1987

USDA - ARS

HOP RESEARCH

1 9 8 7

Annual Research Summary

HOP BREEDING, GENETICS, CHEMISTRY

US Department of Agriculture

Oregon State University

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USDA-ARS

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These are prelimiary data.
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MISCELLANEOUS

HOP GROWERS OF AMERICA, INC.
"STATISTICAL UPDATE"

PRESENTED .....
JANUARY 21, 1988
32ND ANNUAL HGA CONVENTION
LONG BEACH, CALIFORNIA

T A B L E O F C O N T E N T S

preliminary data: Dec. 1987.

1987 CROP STATISTICS RELEASED --

The 1987 crop by variety and state as prepared by USDA-WASS

WASHINGTON

VARIETY/CROP YEAR

1987 CROP	ACRES	YIELD	PRODUCTION
CASCADE	1,650	1,920	3,168,000
CHINOOK	800	1,690	1,352,000
CLUSTER	9,900	1,960	19,382,000
EROICA	730	2,020	1,475,000
FUGGLES	-------	-------	----------
GALENA	4,050	1,870	7,574,000
NUGGET	1,400	1,870	2,618,000
OLYMPIC	230	2,180	501,000
PERLE	200	1,130	226,000
TETTNANG	650	830	540,000
WILLAMETTE	-------	-------	----------
OTHER	490	1,150	562,000
TOTAL	20,100	1,860	37,398,000
1986 CROP	17,400	2,040	35,496,000
1985 CROP	19,500	1,870	36,465,000

IDAHO

VARIETY/CROP YEAR

1987 CROP	ACRES	YIELD	PRODUCTION
CASCADE	-------	-------	----------
CHINOOK	180	1,530	275,400
CLUSTER	510	1,890	963,900
EROICA	440	1,770	778,800
FUGGLES	-------	-------	----------
GALENA	480	2,040	979,200
NUGGET	-------	-------	----------
OLYMPIC	-------	-------	----------
PERLE	-------	-------	----------
TETTNANG	-------	-------	----------
WILLAMETTE	50	740	37,000
OTHER	540	1,510	815,700
TOTAL	2,200	1,750	3,850,000
1986 CROP	2,500	2,040	5,100,000
1985 CROP	3,100	1,630	5,053,000

OREGON

VARIETY/CROP YEAR

1987 CROP	ACRES	YIELD	PRODUCTION
CASCADE	-------	-------	----------
CHINOOK	-------	-------	----------
CLUSTER	-------	-------	----------
EROICA	-------	-------	----------
FUGGLES	920	630	581,600
GALENA	210	1,310	275,000
NUGGET	1,450	2,030	2,940,000
OLYMPIC	-------	-------	----------
PERLE	210	740	155,000
TETTNANG	-------	-------	----------
WILLAMETTE	2,695	1,520	4,090,000
OTHER	515	1,470	758,400
TOTAL	6,000	1,470	8,800,000
1986 CROP	5,100	1,660	8,466,000
1985 CROP	5,500	1,490	8,195,000

UNITED STATES TOTAL

VARIETY/CROP YEAR

1987 CROP	ACRES	YIELD	PRODUCTION
CASCADE	1,650	1,920	3,168,000
CHINOOK	980	1,661	1,627,400
CLUSTER	10,410	1,954	20,345,900
EROICA	1,170	1,926	2,253,800
FUGGLES	920	632	581,600
GALENA	4,740	1,862	8,828,200
NUGGET	2,850	1,950	5,558,000
OLYMPIC	230	2,178	501,000
PERLE	410	929	381,000
TETTNANG	650	831	540,000
WILLAMETTE	2,745	1,503	4,127,000
OTHER	1,545	1,383	2,136,100
TOTAL	28,300	1,768	50,048,000
1986 CROP	25,000	1,962	49,062,000
1985 CROP	28,100	1,769	49,713,000

1/ Estimates by variety begin with 1987 crop.
2/California included in Washington totals to avoid disclosure

Report released January 20, 1988
USDA-Washington Agricultural Statistics Service

1 acre = 0.4047 ha
yield above listed in pound per acre
convert to kg/ha by multiplying by 1.1208
production listed as pounds (o.4536 kg)

COMPLETE 1987 STATISTICAL UPDATE AVAILABLE TO MEMBERS OF HOP GROWERS OF AMERICA VISIT THE OFFICE AT 7 WEST MEAD - YAKIMA OR TELEPHONE (509) 248-7043

final data: Jan. 1988.

U.S. HOP STATISTICS
TOTAL PRODUCTION

Actual Bales		CA.	ID.	OR.	WA.	Total
Year:	1987	*	18,880	43,705	186,279	248,864
	1986	*	25,298	43,612	179,554	248,464
	1985	*	25,287	41,635	184,243	251,165

Actual Pounds						
Year:	1987	*	3,703,600	8,355,371	36,883,242	48,942,213
	1986	*	5,000,000	8,466,000	35,552,000	49,018,000
	1985	*	4,981,539	8,118,825	36,545,454	49,645,818

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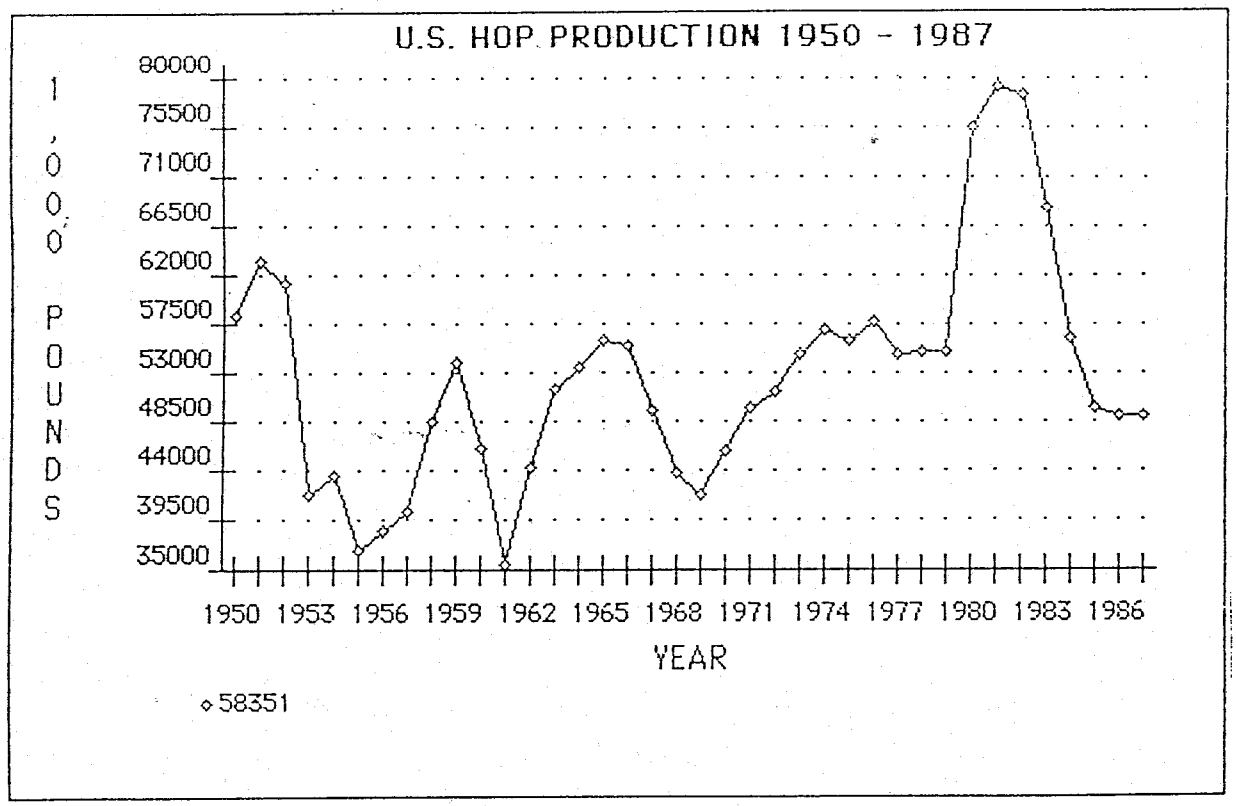
* Included in Washington totals.

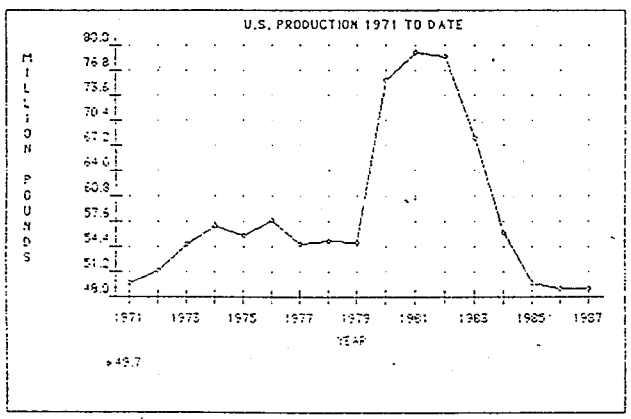


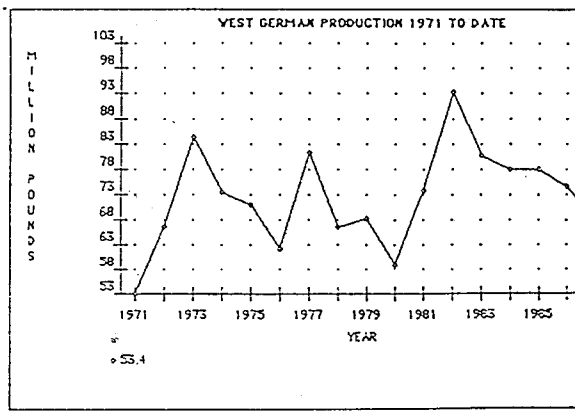
Prepared January 1988
Hop Growers of America, Inc.
Source: USDA, FGIS, HAC, State Commissions

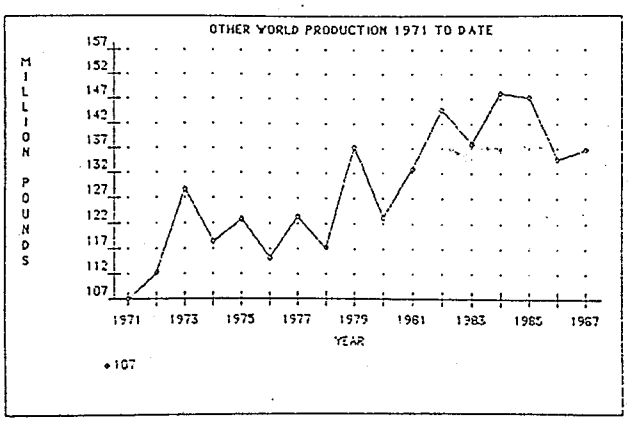
U.S./WORLD PRODUCTION - 1971 TO DATE

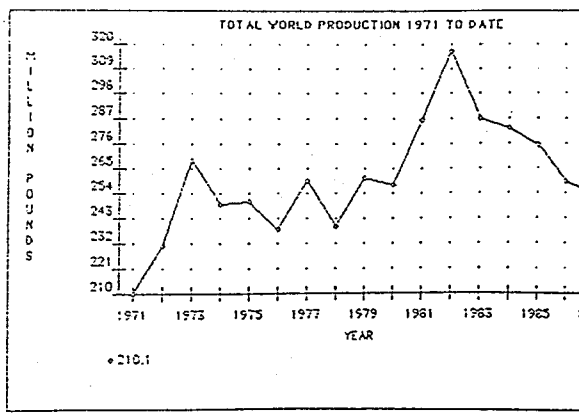
	U.S. PRODUCTION	W. GERMANY PRODUCTION	OTHER WORLD PRODUCTION	TOTAL WORLD PRODUCTION
	(Million Pounds)			
1971	49.7 (25%)	53.4 (25%)	107.0 (51%)	210.1 (100%)
1972	51.3 (22%)	66.9 (28%)	112.4 (50%)	230.6 (100%)
1973	54.8 (20%)	84.9 (32%)	128.8 (48%)	268.5 (100%)
1974	57.0 (23%)	73.9 (30%)	118.4 (47%)	249.3 (100%)
1975	55.9 (22%)	71.5 (29%)	122.9 (49%)	250.2 (100%)
1976	57.8 (25%)	62.6 (26%)	115.0 (49%)	238.1 (100%)
1977	54.8 (21%)	81.6 (32%)	123.5 (47%)	259.5 (100%)
1978	55.1 (23%)	66.9 (28%)	117.4 (49%)	239.4 (100%)
1979	54.9 (21%)	68.8 (27%)	137.2 (53%)	260.9 (100%)
1980	75.6 (29%)	59.3 (23%)	123.0 (48%)	257.9 (100%)
1981	79.1 (28%)	74.3 (26%)	132.7 (46%)	286.1 (100%)
1982	78.6 (25%)	93.7 (29%)	144.9 (46%)	317.2 (100%)
1983	68.1 (24%)	81.2 (28%)	137.9 (48%)	287.2 (100%)
1984	56.2 (20%)	78.3 (28%)	148.2 (52%)	282.7 (100%)
1985	49.7 (18%)	78.5 (28%)	147.4 (54%)	275.5 (100%)
1986	49.0 (19%)	75.2 (29%)	134.7 (52%)	258.9 (100%)
* 1987	48.9 (19%)	68.2 (27%)	136.8 (54%)	253.9 (100%)

*Figures for 1987 are estimates.





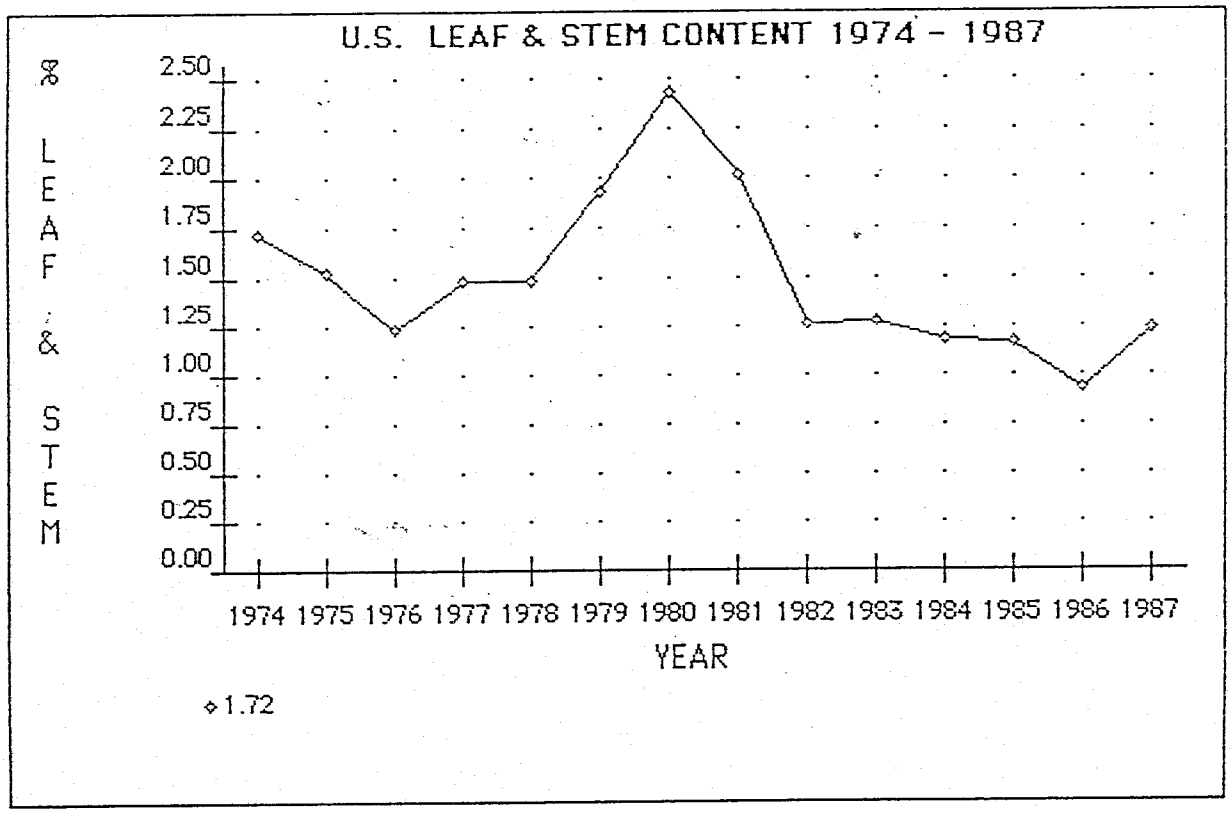




Prepared: January 1988
Hop Growers of America, Inc.
Source: FAS, USDA, HGA

U.S. HOP STATISTICS
LEAF & STEM CONTENT (%)

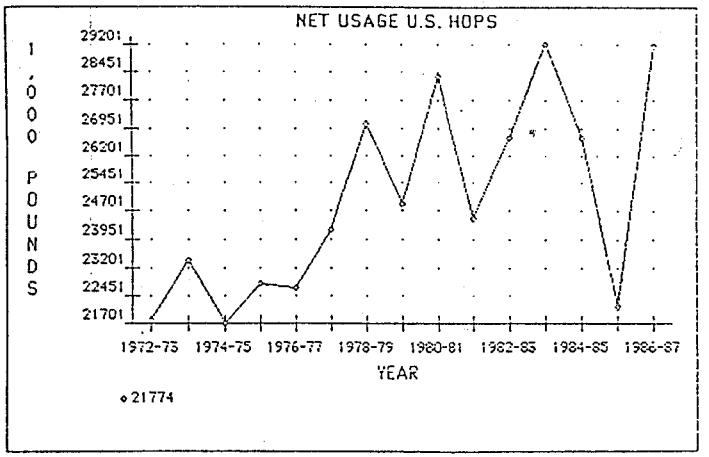
Crop Year	WA.	OR.	ID.	CA.	U.S. Averag
1974	1.95	1.57	1.02	.56	1.72
1975	1.75	1.24	.97	.65	1.53
1976	1.23	1.43	1.16	.88	1.24
1977	1.46	1.91	1.15	.90	1.49
1978	1.38	2.19	1.34	1.07	1.48
1979	1.92	2.32	1.38	1.83	1.93
1980	2.57	2.19	1.84	1.66	2.43
1981	1.93	2.49	1.60	2.73	2.01
1982	1.13	1.80	1.24	1.24	1.26
1983	1.25	1.44	1.20	1.20	1.28
1984	1.07	1.77	1.27	1.26	1.18
1985	1.25	1.56	1.16	0.06	1.16
1986	0.95	0.92	0.73	0.46	0.93
1987	1.14	1.55	1.28	0.45	1.23

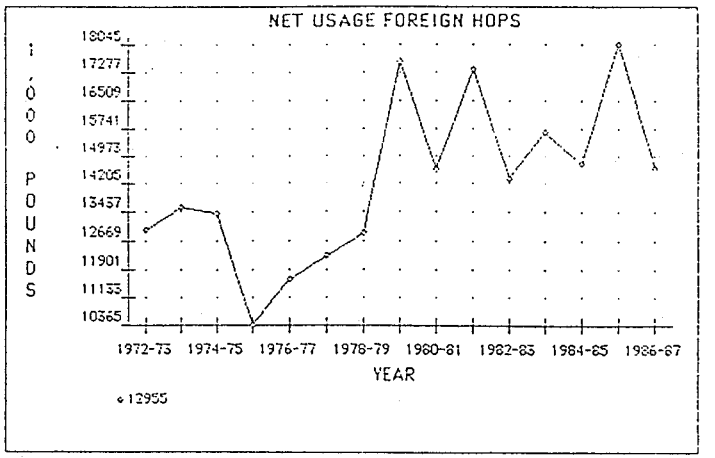


Prepared January 1988
Hop Growers of America, Inc.
Source: Federal-State Inspection Service

	DISPOSITION OF PRODUCTION					U.S. BREWERY USAGE	
	Exports (+)	Net Domestic Usage of U.S. Hops 2/ (+)	Plus or (Minus) Unaccountable Difference (+)	Increase or (Decrease) in Domestic Stocks (=)	Salable Product 1/	Net Usage U.S. Hops	Net Usage Foreign Hops
	(1,000 lbs.)					(1,000 lbs.)	
1972-73	27,969 (55%)	21,774 (43%)	11 3/	1,410 (2%)	51,164 (100%)	21,774 (63%)	12,955 (37%)
1973-74	25,479 (48%)	23,394 (43%)	2,505 (4%)	2,730 (5%)	54,108 (100%)	23,394 (63%)	13,584 (37%)
1974-75	25,215 (45%)	21,701 (38%)	1,749 (3%)	7,700 (14%)	56,365 (100%)	21,701 (62%)	13,411 (38%)
1975-76	27,933 (51%)	22,767 (41%)	(1,460)(-3%)	6,110 (11%)	55,350 (100%)	22,767 (69%)	10,365 (31%)
1976-77	28,959 (51%)	22,678 (40%)	3,816 (7%)	1,310 (2%)	56,763 (100%)	22,678 (66%)	11,666 (34%)
1977-78	25,132 (46%)	24,196 (44%)	6,502 (12%)	(1,140)(-2%)	54,690 (100%)	24,196 (66%)	12,280 (34%)
1978-79	32,543 (59%)	27,070 (50%)	2,760 (5%)	(7,620)(-14%)	54,753 (100%)	27,070 (68%)	12,883 (32%)
1979-80	36,737 (67%)4/	24,870 (45%)	(2,380)(-4%)	(4,470)(-8%)	54,757 (100%)	24,870 (59%)	17,595 (41%)
1980-81	41,965 (57%)	28,346 (38%)	2,580 (3%)	1,520 (2%)	74,411 (100%)	28,346 (66%)	14,601 (34%)
1981-82	43,725 (55%)	24,493 (31%)	(1,892)(-2%)	12,600 (16%)	78,926 (100%)	24,493 (59%)	17,346 (41%)
1982-83	34,742 (44%)	26,689 (34%)	2,673 (4%)	14,050 (18%)	78,154 (100%)	26,689 (65%)	14,349 (35%)
1983-84	32,181 (47%)	25,700 (38%)	3,098 (4%)	7,016 (11%)	67,995 (100%)	29,195 (65%)	15,677 (35%)
1984-85	31,352 (56%)	26,691 (48%)	(4,354)(-8%)	2,364 (4%)	56,053 (100%)	26,691 (64%)	14,774 (36%)
1985-86	26,091 (53%)	22,168 (45%)	866 (2%)	490 (1%)	49,615 (100%)	22,168 (55%)	18,039 (45%)
1986-87	28,362 (58%)	29,159 (60%)	(8,239)(-17%)	(320)(-1%)	48,962 (100%)	29,159 (67%)	14,626 (33%)

1/ Total production less fire loss and reserves not yet sold in normal outlets.
2/ Total usage less imports adjusted for year end inventory changes.
3/ Less than ½ of 1%.
4/ 5 million pounds minus adjustment to reflect more accurate export figure.





Prepared: January 1988
Hop Growers of America, Inc.
Source: FAS, USDA

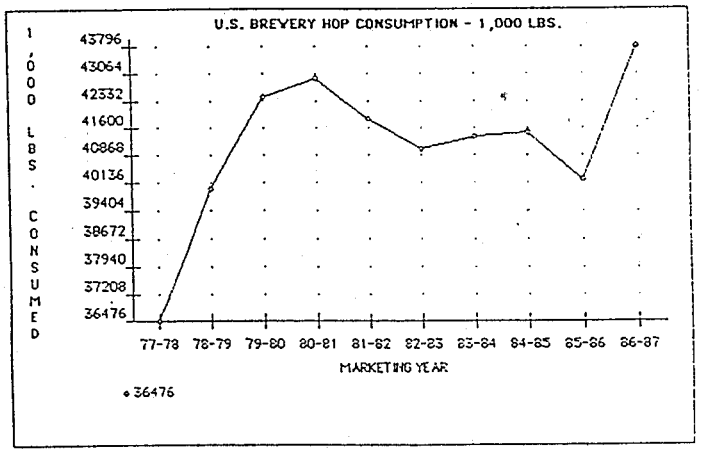
BREAKDOWN OF BREWERY CONSUMPTION AND EXPORTS - (In 1,000 lbs.)

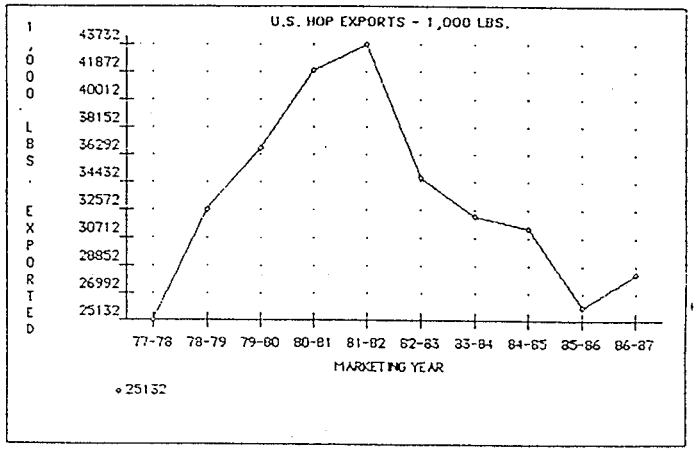
Marketing Year:	EXTRACT CONVERSION FACTOR 1/ Domestic	Export	BREWERY CONSUMPTION As Hops	As Extract (Hop Equivalent)	Total	EXPORTS As Hops	As Extract (Hop Equivalent)	Total
1977-78	2.8-1	3.5-1	29,542	6,934	36,476	13,903	11,229	25,132
1978-79	4.4-1	4.0-1	32,632	7,321	39,953	17,336	15,207	32,543
1979-80	4.4-1	4.0-1	35,582	6,883	42,465	17,045	19,692 2/	36,737 2/
1980-81	3.5-1	4.0-1	35,331	7,616	42,947	19,605	22,360	41,965
1981-82	4.4-1	4.0-1	34,644	7,195	41,839	21,713	22,012	43,725
1982-83	5.0-1	4.0-1	34,476	6,562	41,038	16,817	17,925	34,742
1983-84	5.1-1	4.0-1	35,078	6,294 3/	41,372 3/	10,740	21,441	32,181
1984-85	4.7-1	4.0-1	35,451	6,014	41,465	10,068	21,284	31,352
1985-86	5.6-1	4.0-1	34,617	5,590	40,207	7,803	18,288	26,091
1986-87	6.6-1	4.0-1	36,220	7,567	43,787	8,960	19,400	28,360

1/ Domestic Conversion Factor is based on actual pounds of hops used in production of extract as reported by Treasury Department. Export Conversion Factor is based on USDA Hop Market News Service.

2/ 5 million pounds minus adjustment to reflect more accurate export extract figure.

3/ Includes 3.5 million pounds minus adjustment to reflect more accurate domestic extract comsumption figure.





Prepared December 1987
Hop Growers of America, Inc.
Source: USDA

SUMMARY OF UNITED STATES EXPORTS BY COUNTRIES AND REGIONS OF DESTINATION - IN 1,000 POUNDS

	1986-87				1985-86			
	Cones	Pellets	Extract	Total 4/	Cones	Pellets	Extract	Total 4/
Canada	858	591	139	2,005	505	906	165	2,071
Mexico	99	300	1,539	6,555	360	-	1,167	5,028
NORTH AMERICA	957	891	1,678	8,560	865	906	1,332	7,099
Costa Rica	-	-	22	88	-	-	9	36
El Salvador	29	11	-	40	22	11	-	33
Guatemala	-	15	-	15	96	7	9	139
Honduras	-	-	-	-	14	-	14	70
Panama.	-	-	46	184	-	-	8	32
CENTRAL AMERICA	29	26	68	327	132	18	40	310
Bahamas	-	-	7	28	-	-	-	-
Barbados	-	-	4	16	-	7	-	7
Dominican Republic	46	37	24	179	73	40	21	197
Haiti	-	-	2	8	-	-	-	-
Jamaica	35	44	2	79	8	80	17	84
Leeward & Windward	-	-	2	8	-	-	1	4
Trinidad-Tobago	-	4	11	48	4	9	1	17
CARIBBEAN	81	85	50	366	85	64	40	309
Argentina	4	309	99	709	20	298	103	700
Bolivia	-	42	7	70	1	-	3	13
Brazil	2,004	1,213	699	6,013	944	1,882	493	4,848
Chile	20	4	70	304	-	27	55	247
Colombia	536	474	337	2,358	64	348	1,250	5,411
Ecuador	29	-	137	577	106	-	98	498
French West Indies	-	-	4	16	-	-	-	-
Guyana	-	-	-	-	1	-	-	1
Netherlands Antilles	-	-	4	16	-	-	-	-
Paraguay	-	-	13	52	-	-	13	52
Peru	-	-	212	848	-	-	164	656
Uruguay	11	9	18	92	13	-	9	49
Venezuela	-	15	218	887	315	-	43	487
SOUTH AMERICA	2,604	2,066	1,818	11,942	1,514	2,524	2,231	12,962
Belgium-Luxembourg	128	-	4	144	33	-	11	77
France	-	-	-	-	*	*	*	*
Ireland	220	-	59	456	*	*	*	*
Italy	37	-	-	37	-	-	-	-
Netherlands	-	-	249	996	2	-	208	834
U.K.-N. Ireland	269	13	66	546	99	-	1	103
W. Germany, Fed. Rep. OF	62	11	181	797	456	-	141	1,020
EUROPEAN COMMUNITY	716	24	559	2,976	590	-	361	2,034
Finland	-	-	-	-	*	-	-	*
Spain	-	-	-	-	-	-	55	220
Switzerland	-	-	31	124	-	-	-	-
OTHER EUROPEAN	-	-	31	124	*	0	55	220
Bulgaria	-	-	-	-	9	-	-	9
Czechoslovakia	-	-	-	-	-	-	-	-
U.S.S.R.	-	-	-	-	-	-	-	-
EASTERN EUROPE	-	-	-	-	9	0	0	9
Belize	-	-	-	-	-	-	3	12
Cameroon	-	-	68	272	-	-	-	-
Ghana	-	-	29	116	-	-	-	-
Ivory Coast	-	-	4	16	-	-	4	16
Mauritius	-	-	2	8	-	-	-	-
Nigeria	-	-	245	980	-	-	245	980
Rwanda	-	-	-	-	-	-	16	64
South Africa	117	79	-	196	39	121	-	160
Zaire	-	-	7	28	-	-	10	40
AFRICA	117	79	355	1,616	39	121	278	1,272
Australia	-	64	-	64	-	16	-	16
Bangladesh	-	7	-	28	-	2	-	2
Hong Kong	-	-	66	271	25	-	45	205
Indonesia	-	-	13	52	-	-	-	-
Japan	392	677	-	1,069	59	624	-	683
Rep. of Korea	33	-	11	77	-	11	27	119
Malaysia	-	-	48	192	-	-	55	220
Pakistan	-	22	2	30	-	31	-	31
Philippines	44	40	128	596	119	46	41	329
Seychelles	-	-	2	8	-	-	*	*
Singapore	-	-	20	80	-	-	73	292
Thailand	4	-	2	12	-	-	-	-
ASIA OCEANIA	473	810	292	2,458	203	730	241	1,897
GRAND TOTAL	4,978	3,962	4,850	28,360	3,438	4,365	4,572	26,089

*Less Than 500 Pounds
4/ Natural hop equivalent (hops and pellets plus extract converted at 4 to 1).
Note: Totals may not agree with addition of individual items because of rounding.

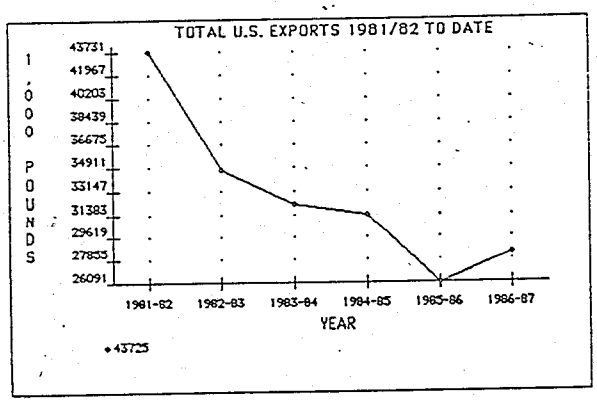
Prepared: January 1988
Hop Growers of America, Inc.
Source: USDA

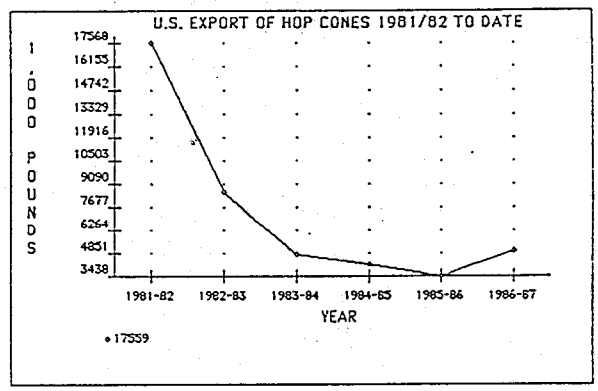
U.S. EXPORTS OF HOPS, PELLETS & HOP EXTRACT (1,000lbs.)

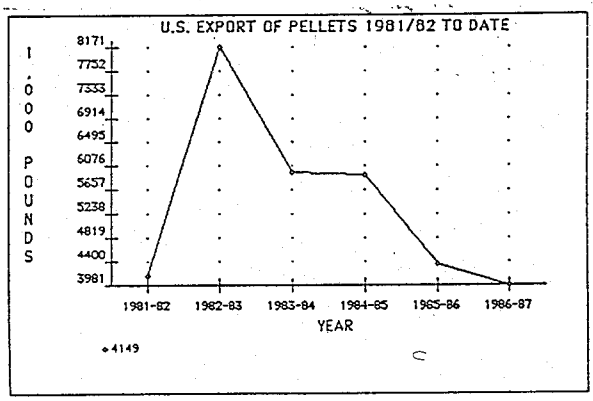
Mktg. Year	Brazil	Mexico	USSR	Canada	Colomb.	Japan	E.E.C. Ireland	E.E.C. W. Ger.	E.E.C. Other	Africa	Other World	Total
HOPS												
1981-82	1,516	815	2,564	4,728	0	844	81	5,102	755	81	1,073	17,559
1982-83	1,129	506	1,184	2,515	0	176	22	1,882	221	197	720	8,652
1983-84	770	126	166	1,045	10	462	0	1,298	138	96	685	4,786
1984-85	2,090	498	0	888	0	101	0	305	0	77	203	4,162
1985-86	994	360	0	505	64	59	0	456	134	39	827	3,438
1986-87	2,004	99	0	858	536	392	220	62	434	117	- 255	4,977
PELLETS												
1981-82	2,486	508	0	15	74	392	12	44	50	25	543	4,149
1982-83	3,958	524	0	1,119	650	615	0	312	76	42	869	8,165
1983-84	1,602	882	0	1,711	15	524	25	180	137	56	822	5,954
1984-85	1,978	594	0	1,637	212	558	0	0	0	431	496	5,906
1985-86	1,882	0	0	906	348	624	0	0	0	121	484	4,365
1986-87	1,213	300	0	591	474	677	0	11	13	79	623	3,981
HOPS (Including Pellets)												
1978-79	4,270	999	5,745	2,193	0	851	451	77	345	411	1,994	17,336
1979-80	4,608	980	1,997	2,577	0	861	506	2,873	376	591	1,676	17,045
1980-81	3,291	681	2,509	4,714	0	1,122	248	3,156	1,025	687	2,173	19,605
1981-82	4,002	1,323	2,564	4,744	73	1,236	93	5,145	805	112	1,616	21,713
1982-83	5,087	1,130	1,184	3,634	650	791	22	2,194	297	239	1,589	16,817
1983-84	2,372	1,008	166	2,756	25	986	25	1,478	275	142	1,507	10,740
1984-85	4,068	1,092	0	2,525	212	659	0	305	0	508	699	10,068
1985-86	2,876	360	0	1,411	412	683	0	456	233	160	1,212	7,803
1986-87	3,217	399	0	1,449	1,010	1,069	220	73	447	196	878	8,958
EXTRACT-HOP EQUIVALENT (Actual X 4)												
1979-80	2,524	3,332*	448	56	5,028	0	364	276	1,472	988	5,204	19,692*
1980-81	2,808	5,120	0	0	2,656	0	532	2,384	2,016	1,472	5,372	22,360
1981-82	1,358	4,330	0	265	4,497	0	653	838	2,531	1,825	5,714	22,012
1982-83	716	3,852	0	908	2,664	0	468	1,192	2,132	860	5,133	17,925
1983-84	756	3,708	0	1,128	6,364	0	312	1,816	2,280	1,248	3,828	21,441
1984-85	1,012	7,036	0	708	2,388	0	516	600	2,745	1,152	5,127	21,284
1985-86	1,972	4,668	0	660	5,000	0	0	564	880	1,112	3,432	18,288
1986-87	2,796	6,156	0	556	1,348	0	236	724	1,276	1,420	4,892	19,404
TOTAL (Including Hop Equivalent of Extract)												
1979-80	7,132	4,312*	2,445	2,445	5,028	861	870	3,149	1,848	1,579	6,880	36,737*
1980-81	6,099	5,801	2,509	4,714	2,656	1,122	780	5,540	3,041	2,151	7,552	41,965
1981-82	5,359	5,653	2,564	5,009	4,570	1,237	746	5,984	3,336	1,937	7,330	43,725
1982-83	5,803	4,982	1,184	4,542	3,314	792	490	3,386	2,429	1,091	6,729	34,742
1983-84	3,128	4,716	166	3,884	6,389	986	337	3,294	2,555	1,390	5,335	32,181
1984-85	5,080	8,128	0	3,233	2,600	659	516	905	2,745	1,660	5,826	31,352
1985-86	4,848	5,028	0	2,071	5,412	683	0	1,020	1,113	1,272	4,644	26,091
1986-87	6,013	6,555	0	2,005	2,358	1,069	456	797	1,723	1,516	5,770	28,362

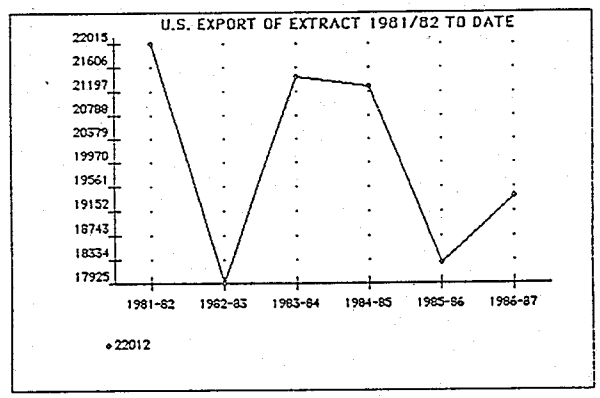
Note: Totals may not agree with addition of individual items because of rounding.

* 5 million pounds plus adjustment to reflect more accurate export figure.









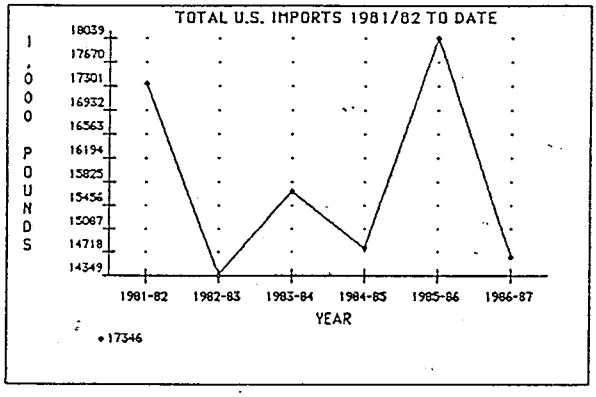
Prepared December 1987
Hop Growers of America, Inc.

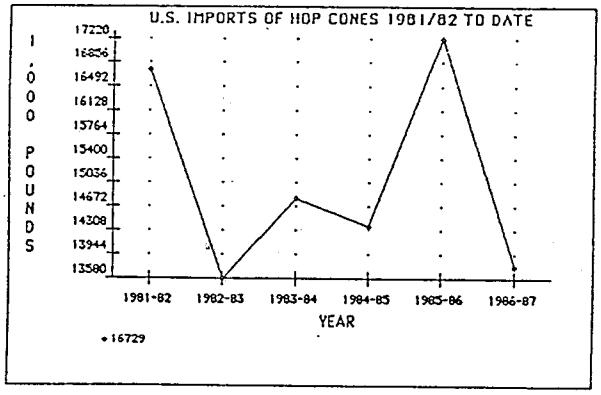
U.S. IMPORTS OF HOPS, PELLETS, & HOP EXTRACT (1,000 lbs.)

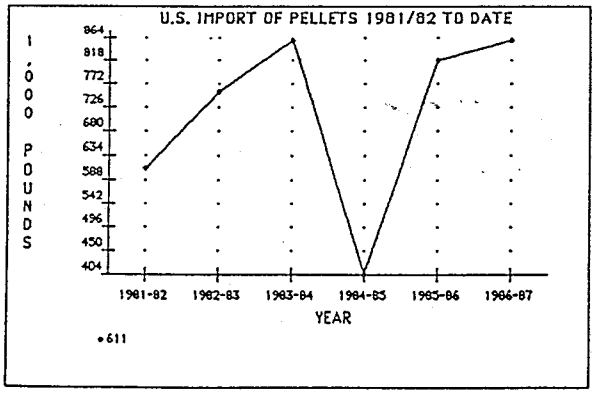
Mktg. Year	Canada	W. Germany	Czech.	Poland	Yugoslavia	France	Belgium	Australia	Others	Total
					HOPS					
1981-82	23	11,468	2,864	1,658	124	320	22	242	31	16,729
1982-83	93	9,776	1,887	1,280	2	400	27	77	131	13,580
1983-84	203	10,552	3,003	640	0	240	35	0	127	14,800
1984-85	139	11,535	1,602	520	0	360	25	81	104	14,366
1985-86	67	13,422	2,713	440	60	320	25	160	5	17,212
1986-87	115	7,330	5,071	957	0	280	0	0	11	13,766
					PELLETS					
1981-82	0	360	0	0	251	0	0	0	0	611
1982-83	0	612	22	0	123	0	0	0	0	757
1983-84	1	848	10	0	0	0	0	0	1	860
1984-85	0	360	4	0	0	0	0	0	40	404
1985-86	8	587	28	0	190	0	0	0	0	818
1986-87	0	445	287	0	0	0	24	0	104	860
					HOPS AND PELLETS					
1979-80	130	11,232	1,441	924	2,006	520	19	196	196	16,664
1980-81	153	8,293	2,501	1,053	1,451	484	24	156	381	14,595
1981-82	23	11,828	2,864	1,658	375	320	22	242	12	17,344
1982-83	93	10,388	1,909	1,280	125	400	27	77	38	14,337
1983-84	204	11,400	3,013	640	0	240	35	0	128	15,660
1984-85	139	11,895	1,606	520	0	360	25	81	144	14,770
1985-86	75	14,009	2,741	440	250	320	25	160	109	18,030
1986-87	115	7,775	5,358	957	0	280	24	0	115	14,626
					EXTRACT-HOP EQUIVALENT (Actual X 4)					
1979-80 4.0-1	0	0	0	0	0	0	0	0	2	2
1980-81 4.0-1	0	0	0	0	0	0	0	0	4	4
1981-82 4.0-1	0	*	0	0	0	0	0	0	*	2
1982-83 4.0-1	0	4	0	0	0	0	0	0	8	12
1983-84 4.0-1	0	10	0	0	0	0	0	0	2	12
1984-85 4.0-1	0	2	0	0	0	0	0	0	1	3
1985-86 4.0-1	0	0	0	0	0	0	0	0	9	9
1986-87 4.0-1	0	0	0	0	0	0	0	0	0	0
					TOTAL (Including Hop Equivalent of Extract)					
1979-80	130	11,232	1,441	924	2,006	520	19	196	198	16,666
1980-81	153	8,294	2,501	1,053	1,451	484	24	156	381	14,501
1981-82	23	11,829	2,864	1,658	375	320	22	242	13	17,346
1982-83	93	10,389	1,909	1,280	125	400	27	77	40	14,349
1983-84	204	11,410	3,013	640	0	240	35	0	130	15,672
1984-85	139	11,897	1,606	520	0	360	25	81	145	14,774
1985-86	75	14,009	2,741	440	250	320	25	160	118	18,039
1986-87	115	7,775	5,358	957	0	280	24	0	115	14,626

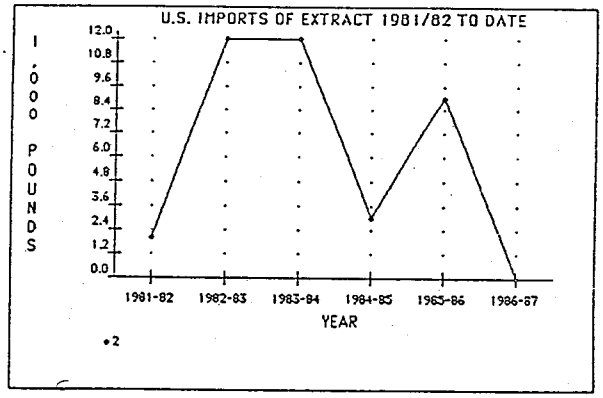
Note: Total may not agree with addition of individual items because of rounding.

* Less than 500 lbs.









Prepared December 1987
Hop Growers of America, Inc.
Source: FAS, USDA

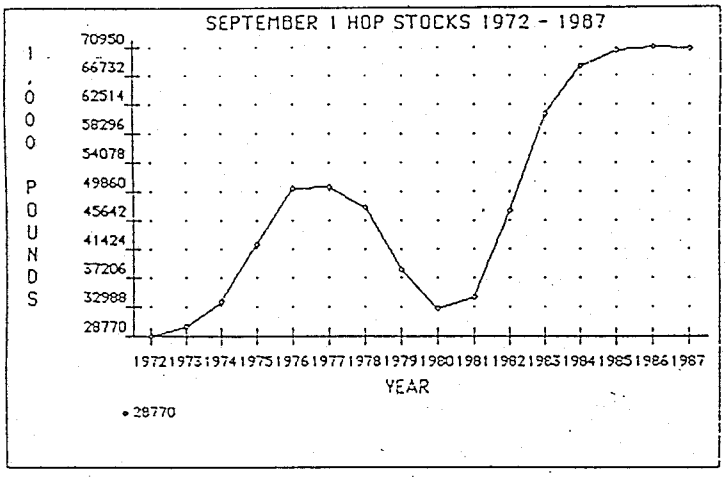
HOP STOCKS

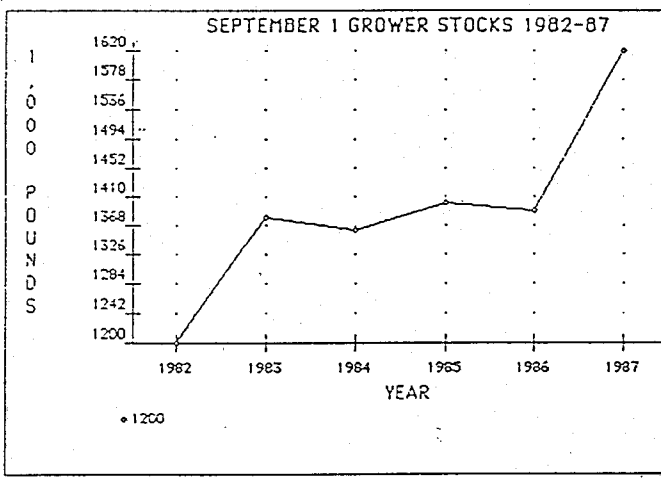
September 1 U.S. Hop Stocks (1,000 lbs.)

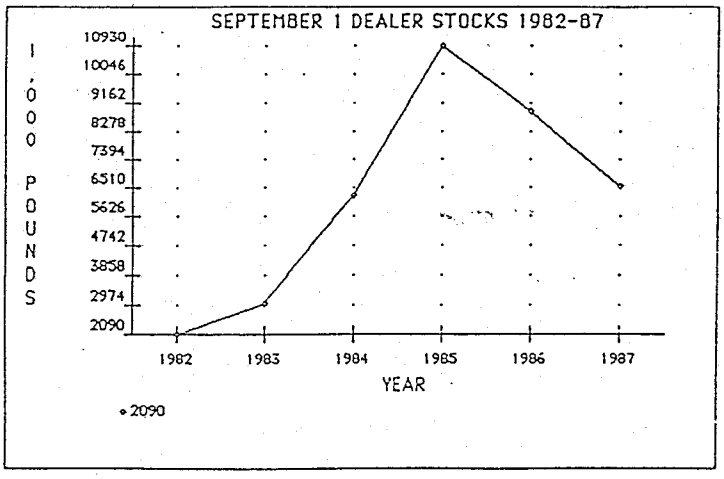
Stocks	1982	1983	1984	1985	1986	1987
Growers	1,200	1,380	1,360	1,400	1,390	1,620
Dealers	2,090	3,000	6,256	10,930	8,930	6,580
Brewers	43,740	56,700	60,480	58,130	60,630	62,430
TOTAL	47,030	61,080	68,096	70,460	70,950	70,630

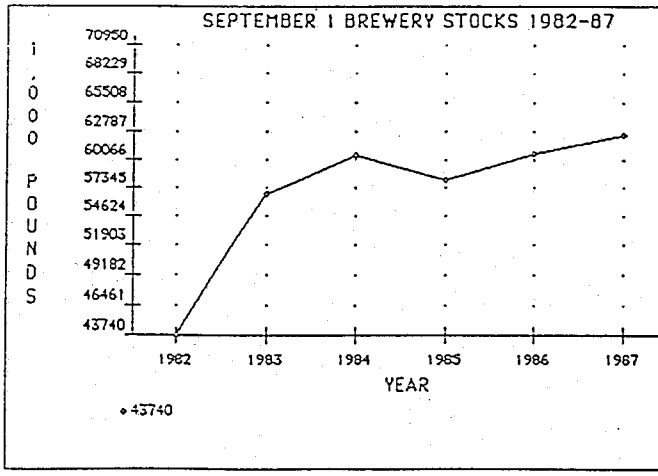
Total Stocks 1972-1987 (1,000 lbs.)

1972	28,770	1980	32,800
1973	30,280	1981	34,430
1974	33,720	1982	47,030
1975	42,170	1983	61,080
1976	50,400	1984	68,096
1977	50,480	1985	70,460
1978	47,540	1986	70,950
1979	38,290	1987	70,630







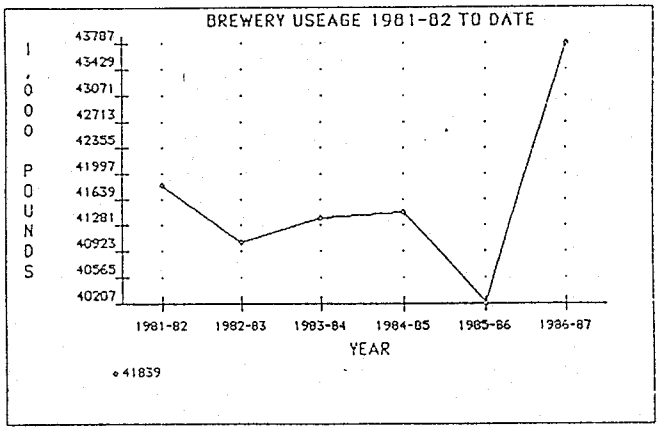


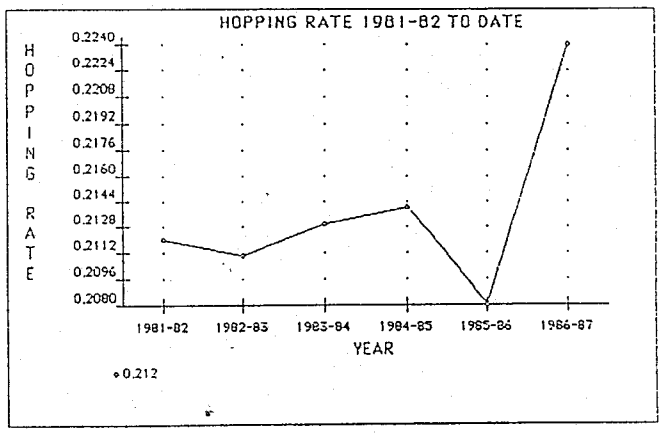
Prepared December 1987
Hop Growers of America, Inc.

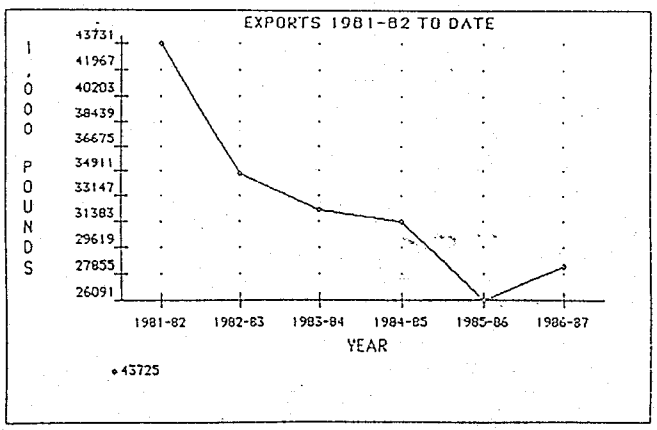
SUPPLY AND DISPOSITION 1981-82 TO DATE (In 1,000 lbs.)

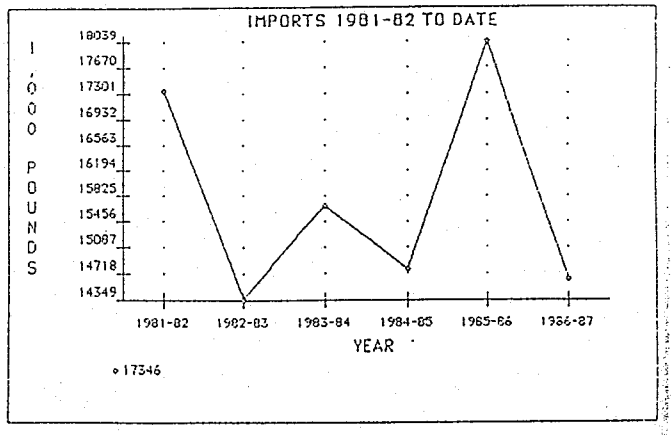
SUPPLY	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88
Carryin Stocks 1/	34,430	47,030	61,080	68,096	70,460	70,950	70,630
Salable Prod. 2/	78,926	78,154	67,995	56,053	49,615	48,962	48,942
Imports	17,346	14,349	15,672	14,774	18,039	14,626	
TOTAL	130,702	139,533	144,748	138,923	138,114	134,538	
DISPOSITION							
Brewery Usage	41,839	41,038	41,372 3/	41,465	40,207	43,787	
Exported	43,725	34,742	32,181	31,352	26,091	28,360	
Carryout Stocks 1/	47,030	61,080	68,096	70,460	70,950	70,630	
Balancing Item	(1,892)	2,673	3,098 3/	(4,354)	866	(8,239)	
TOTAL	130,702	139,533	144,748	138,923	138,114	134,538	
Hopping Rate	.212	.211	.213 3/	.214	.208	.224	

1/ Brewer, dealer and grower stocks as of Sept. 1
2/ Production less fire loss and reserve hops not sold in normal outlets
3/ Includes 3.5 million pounds minus adjustment to reflect more accurate domestic extract consumption figure.





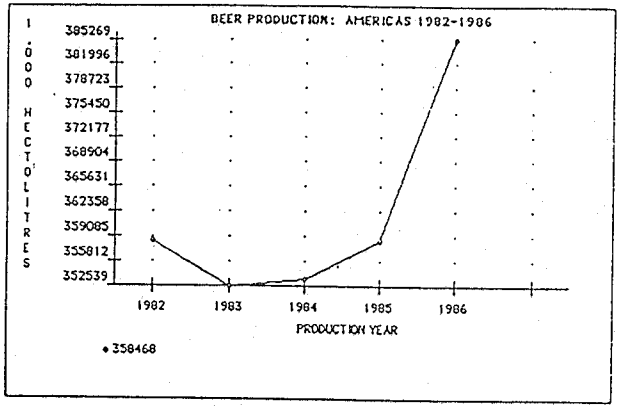


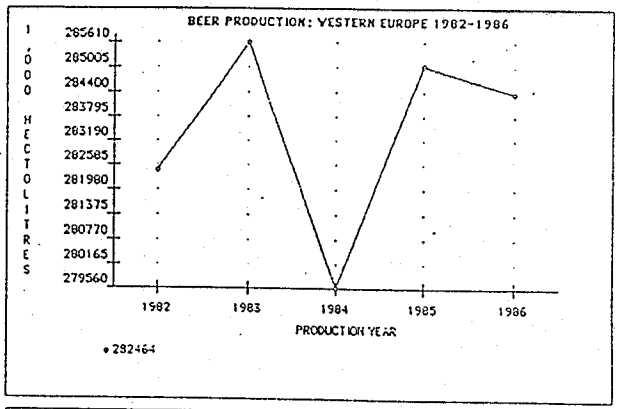


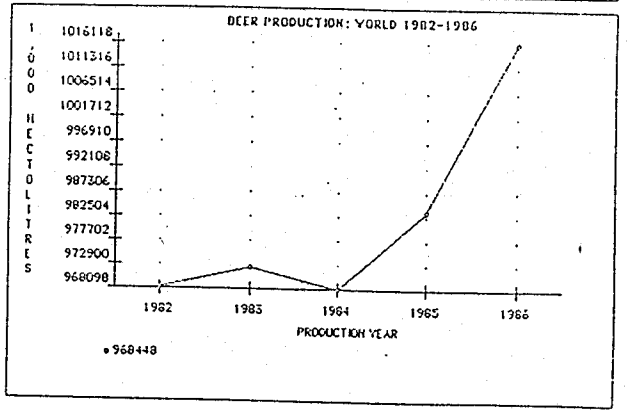
Prepared December 1987
Hop Growers Of America, Inc.
Source: USDA

WORLD BEER PRODUCTION 1982-1986

	1982	1983	1984	1985	1986	%Change 86 v.s. 85
	1,000 Hectolitres					
AMERICAS						
United States	228,050	230,331	226,490	226,825	230,543	+ 1.64
Brazil	29,500	29,000	28,350	30,250	43,760	+44.66
Mexico	27,583	23,611	25,082	27,392	29,287	+ 6.91
Canada	23,667	22,599	23,012	22,126	22,815	+ 3.11
Colombia (est.)	13,438	11,760	14,500	15,800	16,600	+ 5.06
Venezuela	12,000	11,769	11,820	10,300	11,200	+ 8.73
Other	24,230	23,469	24,173	25,923	31,056	+ 7.98
Sub Total:	358,468	352,539	353,427	358,616	385,263	+ 7.43
WESTERN EUROPE						
West Germany	94,816	94,980	92,286	93,294	94,100	+ .86
United Kingdom	59,780	61,700	61,470	62,500	59,166	- 5.30
France	22,410	22,086	20,388	20,802	24,126	+15.90
Spain	21,499	22,082	21,632	23,353	20,655	-11.50
Netherlands	16,180	17,327	17,048	17,529	17,988	+ 2.60
Belgium	15,000	14,620	14,976	14,500	13,715	- 5.40
Other	52,779	52,814	51,550	53,063	54,618	+ 2.90
Sub Total:	282,464	285,609	279,550	285,041	284,368	- 2.30
EASTERN EUROPE						
USSR (estimated)	68,000	68,000	66,100	60,000	55,000	- 8.33
East Germany (est.)	25,000	25,500	26,000	25,500	24,300	- 4.70
Czechoslovakia	24,921	24,956	23,780	22,354	22,783	+ 1.91
Yugoslavia	13,402	12,378	13,600	10,505	10,500	- .04
Romania (est.)	11,500	11,500	11,500	11,500	11,000	- 4.34
Poland	10,300	10,076	9,550	10,801	11,380	+ 5.36
Other	13,925	13,412	13,512	14,372	18,322	+27.48
Sub Total:	167,048	165,822	164,152	155,032	153,285	- 1.12
FAR EAST						
Japan	47,335	49,323	46,689	47,461	49,980	+ 5.30
China (est.)	12,300	16,600	20,000	32,000	40,000	+25.00
Phillipines	7,700	8,700	9,230	8,100	8,300	+ 2.46
South Korea	5,988	7,070	7,500	7,907	8,065	+ 1.99
Taiwan	2,825	2,999	3,071	3,353	3,537	+ 5.48
Other	11,076	9,531	9,930	9,832	8,690	-11.61
Sub Total:	87,224	94,223	96,720	108,653	118,572	+ 9.12
AFRICA						
South Africa	12,000	12,000	13,000	13,500	14,500	+ 7.40
Nigeria	10,350	10,000	9,200	10,000	6,840	-31.60
Cameroon	3,370	4,180	4,729	4,900	5,400	+10.20
Zaire (est.)	2,780	2,949	3,027	3,000	3,200	+ 6.66
Kenya	2,500	2,300	2,400	2,700	3,200	+18.51
Other	14,642	13,762	14,336	15,380	14,864	- 3.35
Sub Total:	45,672	45,191	46,492	49,480	48,004	- 2.98
NEAR EAST						
Turkey	3,200	3,300	2,625	2,200	2,200	0.00
Other	1,732	1,601	1,472	1,461	1,443	- 0.49
OCEANIA						
Australia	19,682	19,350	18,949	18,503	18,170	- 1.79
New Zealand	3,801	3,800	3,839	3,940	3,924	- .40
Other	869	811	861	862	882	+ 3.89
Sub Total:	24,372	23,961	23,649	23,305	22,976	- 1.41
WORLD TOTALS	968,448	972,286	968,099	983,624	1,016,111	+ 3.30







Prepared September 1987
Hop Growers of America, Inc.
Source: Barth Report, July 1987

Conversion: 1,000 Hectolitres = 26,418 gallons

INTERNATIONAL HOP GROWERS CONGRESS
August 4-7, 1987 Poznan, Poland

ECONOMIC COMMITTEE - SUMMARY OF REPORTS

COUNTRY	HOP ACREAGE 1986 ACRES			HOP PRODUCTION 1986 POUNDS			ALPHA 1986		1987 ESTIMATES	
	Aroma	Alpha	Total	Aroma	Alpha	Total	Ton	ø	Production-Million lbs.	Acres
AUSTRALIA	59.30	1,806.30	1,865.60	5,511.55	4,150,197.15	4,155,708.70	180.7	9.60	4.137	1,865.61
BELGIUM	318.76	1,107.01	1,425.77	496,811.12	1,743,854.42	2,240,665.54	59.6	5.90	1.468	988.40
BULGARIA	1,314.57	1,062.53	2,377.10	748,468.49	706,250.02	1,454,718.51	42.0	- - -	1.704	2,396.87
WEST GERMANY	27,183.47	21,369.21	48,552.68	38,414,290.95	36,883,843.75	75,298,134.70	1,199.0	5.84	71.650	47,712.54
CZECHOSLOVAKIA	29,528.45	- - - -	29,528.45	23,148,510.00	- - - -	23,148,510.00	441.0	4.20	23.149	29,404.90
EAST GERMANY	432.43	5,423.85	5,856.28	443,128.62	7,949,859.72	8,392,988.34	255.1	6.70	7.936	5,831.56
ENGLAND	4,534.28	5,922.99	10,457.27	4,966,237.24	6,212,949.85	11,179,187.10	- - - -	- - -	13.228	9,945.78
SPAIN	76.60	4,158.69	4,235.29	13,007.26	4,397,224.82	4,410,232.10	189.9	- - -	4.189	4,027.73
FRANCE	595.51	887.09	1,482.60	721,461.90	1,692,266.31	2,413,728.21	48.1	4.40	1.725	1,371.41
HUNGARY	543.62	721.53	1,265.15	374,124.01	1,040,470.41	1,414,594.42	39.5	6.80	1.488	1,297.27
YUGOSLAVIA	8,082.64	- - - -	8,082.64	10,053,067.20	- - - -	10,053,067.20	267.0	5.85	11.078	7,803.41
POLAND	5,720.37	291.58	6,011.95	5,687,919.60	264,554.40	5,952,474.00	142.9	- - -	5.787	6,041.59
UNITED STATES	5,922.99	19,011.87	24,934.86	9,531,013.19	39,486,948.82	49,017,962.01	2,157.0	9.70	48.943	28,433.80
IHGC TOTAL	84,312.99	61,762.65	146,075.64	94,603,551.13	104,528,419.67	199,131,970.83	5,021.8	- - -	196,482.0	147,120.87

Prepared October 1987

RECAP OF IHGC REPORTS - EXECUTIVE COMMITTEE MEETING
36TH IHGC - HOBART, TASMANIA - FEBRUARY 10, 1988

COUNTRY	'87 ACREAGE	'87 PRODUCTION Pounds	ESTIMATED '88 ACREAGE	%Aroma	%Alpha
Australia	1,888	4,186,535	2,620	4	96
Belgium (1)	988	1,317,439	988	29	71
Bulgaria	2,347	1,545,425	2,347	51	49
Czechoslovakia	29,405	26,273,321	29,528	100	0
East Germany (1)	5,832	7,682,560	5,832	6	94
France	1,381	1,537,929	1,334	60	40
Hungary	1,273	1,467,272	1,223	32	68
Poland	6,042	5,738,353	6,017	95	5
Spain	4,028	4,076,085	3,954	99	1
United Kingdom	9,842	11,441,874	9,983	42	58
USA	28,300	50,048,058	29,301	30	70
West Germany (2)	47,713	68,342,600	47,690	60	40
Yugoslavia	7,900	11,937,909	7,850	100	0
TOTAL	146,939	195,595,36	148,667	62	38

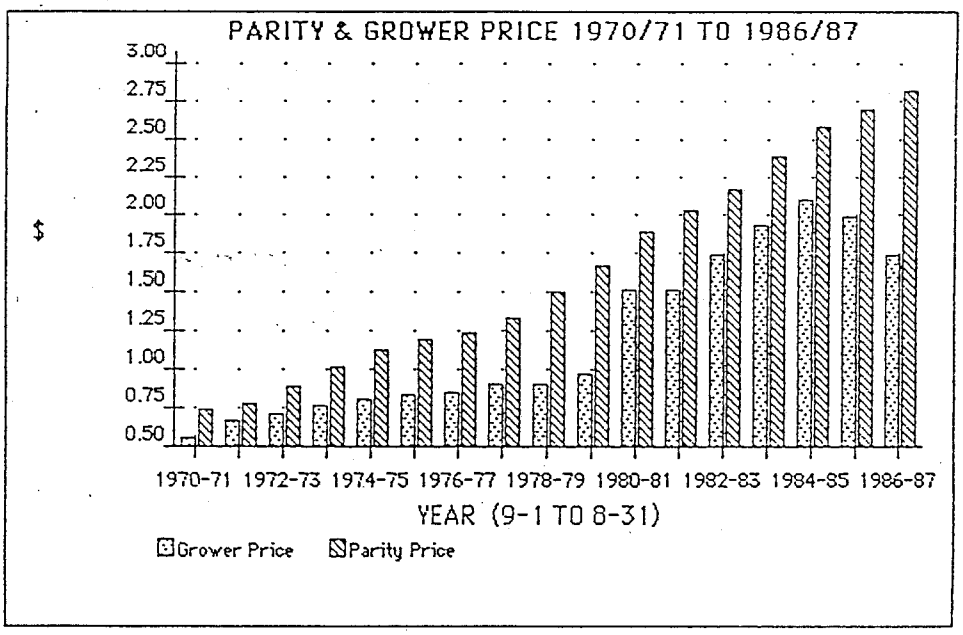
(1) Did not report- figures reflect estimates made August 1987 at Poznan, Poland for 1987
(2) Did not estimate 1988 acreage- figures reflect estimates made August 1987 at Poznan, Poland for 1987

U.S. HOP STATISTICS

PARITY AND GROWER PRICES

Crop Year	Parity Price	Grower Price
(9/1-8/31)	(¢ per lb.)	
1970-71	$ .74	$ .56
1971-72	.78	.66
1972-73	.89	.71
1973-74	1.02	.76
1974-75	1.13	.80
1975-76	1.19	.83
1976-77	1.24	.85
1977-78	1.33	.90
1978-79	1.50	.90
1979-80	1.67	.97
1980-81	1.89	1.51
1981-82	2.03	1.51
1982-83	2.17	1.74
1983-84	2.39	1.93
1984-85	2.59	2.10
1985-86	2.70	1.98
1986-87	2.82	1.74

Month	Parity Price
(1986-87 $ per lb.)	
Sept.	$2.75
Oct.	2.74
Nov.	2.74
Dec.	2.74
Jan.	2.81
Feb.	2.81
March	2.81
April	2.87
May	2.87
June	2.87
July	2.92
Aug.	2.92

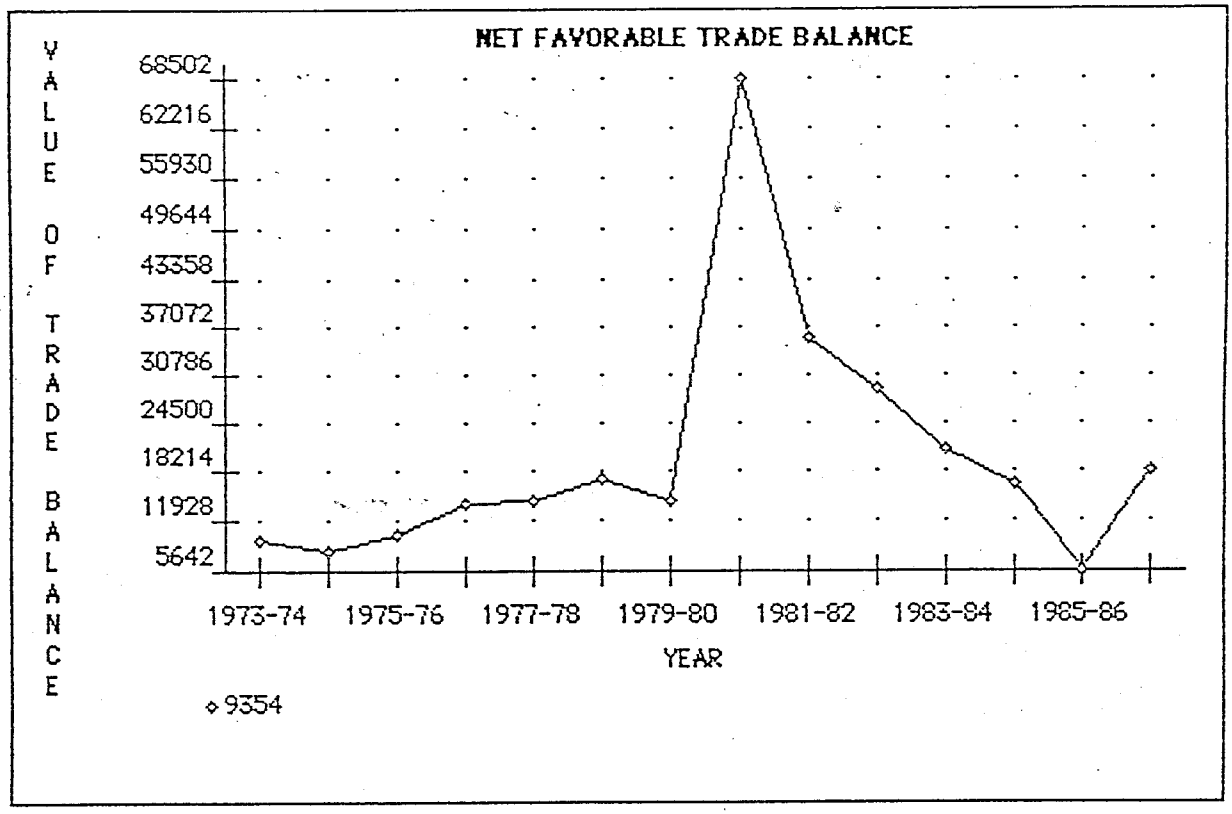


Prepared January 1988
Hop Growers of America, Inc.
Source: SRS, USDA

U.S. HOP STATISTICS

VALUE OF IMPORTS AND EXPORTS

Year	Value		Net Favorable Trade Balance
	Imports	Exports	
	$1,000		
1973-74	17,192	26,546	9,354
1974-75	17,718	25,920	8,202
1975-76	16,616	26,625	10,009
1976-77	15,522	29,591	14,069
1977-78	12,754	27,008	14,254
1978-79	16,969	34,147	17,178
1979-80	37,065	51,365	14,300
1980-81	34,240	102,669	68,429
1981-82	36,944	72,456	35,512
1982-83	33,842	62,755	28,913
1983-84	37,280	58,191	20,911
1984-85	37,611	54,150	16,539
1985-86	47,909	53,551	5,642
1986-87	36,416	54,795	18,379



Prepared January 1988
Hop Growers of America, Inc.
Source: USDA

HOPS U.S.A.

The Official Publication of Hop Growers of America

July, 1995
Number 482

U.S.D.A. Releases 1995 Hop Acreage Survey

Total U.S. hop acreage strung for harvest in 1995 is estimated at 43,431 acres, a 2.4% increase from a year ago and slightly up from 1993 levels.

The Galena remains the industry's number one bitter hop with 9,038 acres, up 90 acres compared to a year ago. The Nugget solidified it's hold on the number two position, as acreage jumped by 1,182 acres to a level of 8,173. On the aroma side, Mt. Hood's acreage dropped by 564 acres, a 27% decline compared to 1993. Willamette's acreage decreased 3% while acreage dedicated to the Tettnang variety rose 14%.

Washington's hop acreage strung for harvest this year is estimated at 30,812 acres, 1.4% more than 1994 harvested acreage, but still 1.6% below the state's all-time high of 31,300 acres in 1981. Galena, Cluster and Nugget are responsible for 61% of all strung acreage in Washington. Nugget had the largest increase at 13.4% to a level of 5,148 acres.

Oregon has 8,641 acres strung for harvest in 1995, 8% more than 1994. The gap between the state's number one and number two hop varieties closed considerably, as Willamette acreage dropped 9% and Nugget acreage increased 23%.

Idaho accounts for 3,978 acres, 1.5% less than last year. Cluster makes up 20% of the state's acreage, followed closely by the Galena at 16%. Galena acreage increased by 34 acres or 5.5% compared to 1994 figures. The complete U.S. hop acreage survey is offered on page 3.

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Domestic Hop Usage Up 5.4% Through February 28th

For the first five months of the 1994-95 marketing year, hop usage by U.S. brewers totaled 16.7 million lbs., a 5.4% increase over the same period a year ago.

The 5 month total represents an increase in hop usage after two years of decline, but brewer's hop consumption still lags behind the 1991-92 pace of 17.2 million pounds.

As the table below indicates, the bulk of the hops are still used in raw or pellet form.

U.S. Brewers' Hop Usage • Sept 1 - Feb 28

	Raw hops, pellets	Extract	Total hop usage
1991-92	13,426	3,747	17,173
1992-93	12,460	3,812	16,272
1993-94	11,582	4,247	15,829
1994-95	12,713	3,964	16,678

Source: U.S. Dept. of the Treasury

Suntory To Brew Beer In The U.S. For Shipment To Japan

Suntory Limited, Japan's fourth largest brewery, has reached agreement with Pabst Brewing Company to brew Suntory beer in the U.S. for sales in Japan.

Company officials said Suntory will sell the U.S. brewed product in 355 milliliter cans for 190 yen (US $2.25) which is 30 yen cheaper than beer made in Japan. The beer will be marketed under the name Suntory Surfside.

Suntory claims that lower production and marketing costs in the U.S. allows the company to undercut the price of domestically produced beer.

The Japanese brewery will only sell Surfside for the next two months, but expects total sales of 1.2 million cases during that time.

BELGIUM'S INTERBREW BIDS ON LABATT BREWERY

Staving off a hostile takeover by a Canadian leveraged buyout firm, it appears the Labatt's brewery will soon be sold to Belgium's Interbrew for $2.7 billion.

Last month the Onex Corporation, a professional arbitrage trader, made a $2.3 billion bid to buyout Labatts and it's holdings, which includes ownership of major league baseball's Toronto Blue Jays.

The buyout was considered hostile by Labatt officials, who said the bid understated the true value of the company's assets.

Onex's bid was backed by Argentine brewer Quilmes Industrial SA and several Canadian pension funds and securities firms. If successful, the consortium planned to retain Labatt's highly profitable North American beer operations, but sell off many of it's subsidiaries.

Labatt officials countered by soliciting bids from other interested parties. At one point the list of potential investors included Anheuser-Busch, Miller Brewing and Denmark's Carlsberg S.A.

However, Interbrew has recently stepped forward and offered $2.7 billion for ownership of the brewery. If the merger does occur, Interbrew will become the world's third largest brewing conglomerate.

In response to Interbrew's offer, Onex officials said the price tag was too high and removed themselves from the bidding process. The Belgian brewer's offer now requires a two-thirds approval from Labatt's shareholders, who will vote on the issue in the next two months.

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1995 NEW ZEALAND HOP CROP TOTALS 1.67 MILLION LBS.

The New Zealand Hop Marketing Board reports a 1995 crop of 1.67 million pounds for the country's hop growers. The crop, which was harvested in March, was down 1.5% compared to 1994 figures.

New Zealand's hop industry has 3 varieties that make up nearly 80% of the country's annual crop -- Super Alpha, Pacific Gem and Hallertau Aroma. Alpha acid content for most of the varieties was reported to be slightly above last year's crop. A preliminary crop summary is offered below.

1995 New Zealand Hop Crop

Variety	Production (1,000 lbs.) 1994	1995	1995 Alpha *
Super Alpha	563	556	13.2%
Sticklebract	112	111	13.2%
Green Bullet	206	220	13.4%
Pacific Gem	451	453	15.5%
Hallertau Aroma	355	319	9.4%
Southern Cross	n/a	4	14.6%
Other	2	5	-
Total	1,689	1,668	

Source: New Zealand Hop Marketing Board
* Figures represent average alpha acid content in bales

HRC'S SUMMER MEETING SCHEDULED FOR YAKIMA • AUGUST 8 - 10

Members of the Hop Research Council will be in Yakima on August 8-10 to conduct their annual summer meetings.

The meetings' tentative agenda includes brewer evaluations of experimental hop varieties and reports from industry scientists on hop chemistry, pathology and entomology projects. HRC members will also review budget requests for 1996 research projects during this meeting.

The meetings are to be followed by a tour of the Yakima valley, including visits to the area's hop farms for inspection of the 1995 crop. The tour is sponsored by the Washington Hop Commission.

Meetings are scheduled for the Yakima Holiday Inn at 9 North Ninth Street in Yakima. If you're interested in attending, please call the hotel for room reservations (509-452-6511).

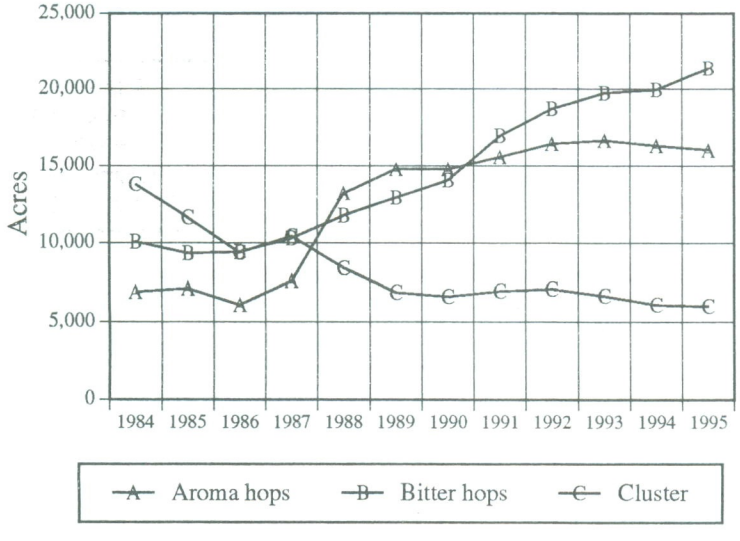
1995 U.S. HOP ACREAGE SURVEY

Variety	IDAHO 1994	IDAHO 1995	OREGON 1994	OREGON 1995	WASHINGTON 1994	WASHINGTON 1995	UNITED STATES 1994	UNITED STATES 1995
Banner	138	103	*	*	*	*	138	103
Cascade	*	*	*	*	1,334	1,121	1,334	1,121
Chinook	351	349	*	60	2,305	2,272	2,656	2,681
Cluster	821	789	*	*	5,308	5,237	6,129	6,026
Eroica	*	*	*	*	446	445	446	445
Fuggles	*	*	470	547	*	*	470	547
Galena	616	650	80	*	8,252	8,388	8,948	9,038
Liberty	*	*	*	*	119	133	119	133
Mt. Hood	*	*	265	287	1,805	1,219	2,070	1,506
N. Brewer	*	*	*	*	57	58	57	58
Nugget	*	*	2,450	3,025	4,541	5,148	6,991	8,173
Olympic	*	*	*	*	225	244	225	244
Perle	*	*	175	154	382	251	557	405
Tettnang	*	*	655	976	2,160	2,242	2,815	3,218
Willamette	*	*	3,570	3,260	2,776	2,889	6,346	6,149
Other	2,111	2,087	335	332	665	1,165	3,111	3,584
U.S. Totals	**4,037**	**3,978**	**8,000**	**8,641**	**30,375**	**30,812**	**42,412**	**43,431**

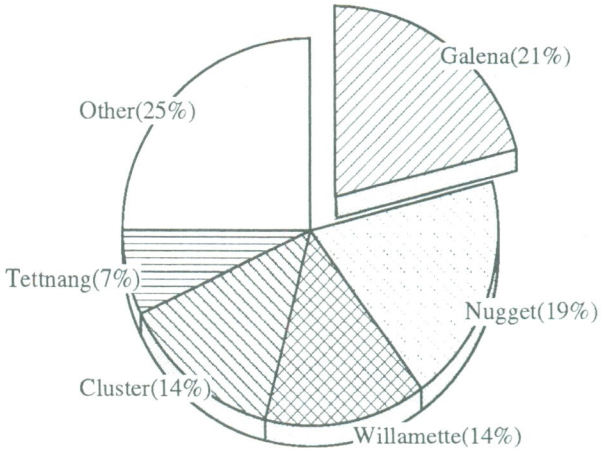
SOURCE: U.S. Department of Agriculture. Prepared by Hop Growers of America, Inc.

* Denotes zero acreage or acreage included in "Other Varieties" to avoid disclosure of individual operations.

U.S. Hop Acreage 1984 - 1995



1995 Top U.S. Varieties



U.S HOP ACREAGE BY VARIETY 1986 - 1995

(Acres Harvested)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 *
Alpha Varieties										
Galena	4,396	4,740	5,570	6,424	6,788	8,244	8,968	9,184	8,948	9,038
Nugget	2,951	2,850	3,270	3,519	4,220	4,650	5,906	6,510	6,991	8,173
Chinook	231	980	1,220	1,489	1,746	2,577	2,630	2,745	2,656	2,681
Eroica	1,470	1,170	1,070	822	756	641	373	446	446	445
Olympic	218	230	270	279	280	337	291	261	225	244
Other	199	309	334	363	265	529	552	597	679	775
SubTotal	9,465	10,279	11,734	12,896	14,055	16,978	18,720	19,743	19,945	21,356
Cluster 1/	9,419	10,410	8,440	6,864	6,614	6,964	7,079	6,677	6,129	6,026
Total - Alpha	18,884	20,689	20,174	19,760	20,669	23,942	25,799	26,420	26,074	27,382
Aroma Varieties										
Willamette	2,114	2,745	5,880	6,299	6,463	6,173	6,227	6,325	6,346	6,149
Tettnang	-	650	2,670	2,941	2,980	2,831	2,702	2,735	2,815	3,218
Mt. Hood	-	-	-	-	560	867	1,519	2,068	2,070	1,506
Cascade	2,241	1,650	920	1,297	1,270	1,240	1,261	1,365	1,334	1,121
Fuggle	967	920	850	801	608	487	570	465	470	547
Perle	-	410	910	1,064	932	935	1,010	942	557	405
Liberty	-	-	-	-	-	-	-	-	119	133
Banner	-	-	340	466	468	511	525	319	138	103
Aquila	-	-	320	466	451	449	447	72	-	-
Other	794	1,236	1,336	1,454	1,062	2,118	2,206	2,389	2,489	2,867
Total - Aroma	6,116	7,611	13,226	14,788	14,794	15,611	16,467	16,680	16,338	16,049
US TOTALS	**25,000**	**28,300**	**33,400**	**34,548**	**35,463**	**39,553**	**42,266**	**43,100**	**42,412**	**43,431**

Source: U.S.D.A., U.S. Hop Administrative Committee reports. Prepared by Hop Growers of America, Inc.

* 1995 figures represent acreage strung for harvest.

1/ 1985-1986 Cluster acreage totals include the variety Talisman.

HOP GROWERS
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ALS 1007

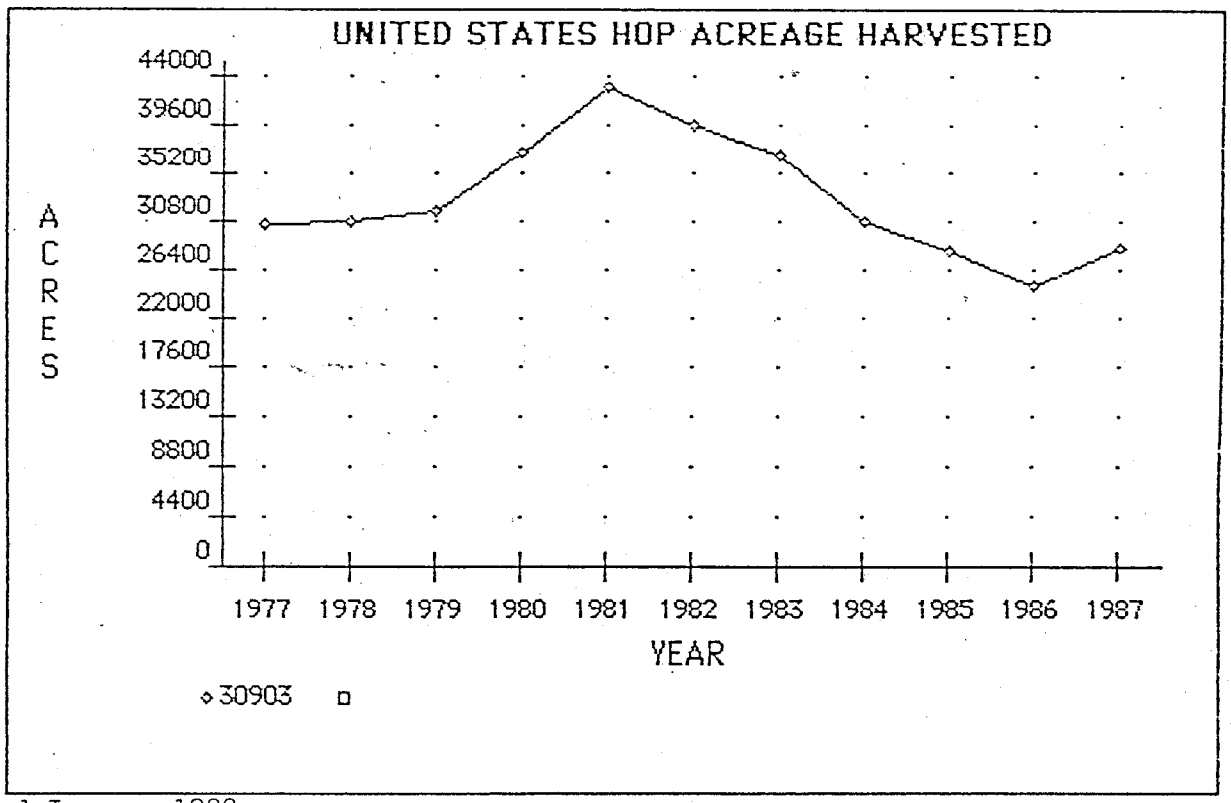
OSU
Gail Nickerson
Departmen of ~~Agriculture~~
Corvallis, OR 97331
USA

U.S. HOP STATISTICS

U.S. Hop Acreage Harvested, 1976-1987

	Strung For Harvest (Rounded)	Actual Strung For Harvest	Unharvested Down	Unharvested Standing	Unharvested Total	Actual Harvested	Harvested (Rounded By State)
1976	31,000	31,003	0	100	100	30,903	30,900
1977	30,600	30,601	0	59	59	30,542	30,500
1978	31,000	30,948	0	86	86	30,862	39,900
1979	31,800	31,854	0	48	48	31,806	31,800
1980	37,100	37,071	0	18	18	37,053	37,100
1981	43,100	43,053	0	0	0	43,053	43,100
1982	41,700	41,696	807 1/	1285 2/	2092	39,604	39,600
1983	37,200	37,188	83 3/	266 4/	349	36,839	36,900
1984	31,300	31,345	97 1/	400 5/	497	30,848	30,800
1985	28,500	28,498	0	354 6/	354	28,144	28,100
1986	25,000	24,935	0	0	0	24,935	25,000
1987	28,300	28,300	0	0	0	28,300	28,300

1/ All in Washington.
2/ 1,097 in WA., 154 in OR., 34 in ID.
3/ 34 in WA. and 29 in OR.
4/ 250 in WA. and 16 in CA.
5/ 313 in WA. and 87 in ID.
6/ 119 in WA. and 235 in OR.

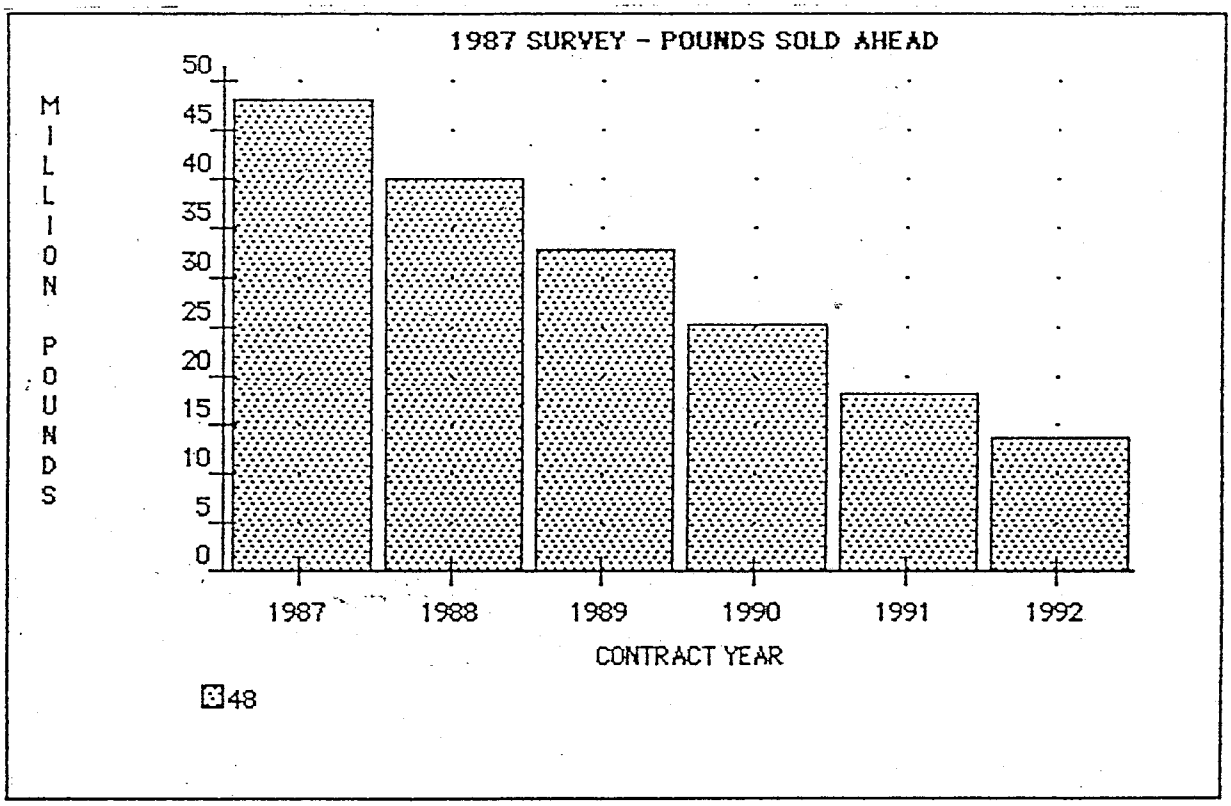


U.S. HOP STATISTICS

HGA Survey of Quantities of Hops Sold Ahead with Prior Years' Comparisons

	1983 Survey	1984 Survey	1985 Survey	1986 Survey	1987 * Survey	% of 1986 Crop
	---------- Million Pounds ----------					
1987	11.1	24.6	41.9	37.5	48.0	98
1988	2.4	13.4	29.4	25.7	40.0	82
1989	0	5.1	16.9	13.2	32.7	67
1990	0	1.8	12.8	7.2	25.4	52
1991	0	0	0	1.4	18.0	37
1992	-	-	-	-	13.7	28

* Response form only 58% of growers



Prepared: January 1988
Hop Growers of America, Inc.
Source: 1987 HGA Sold Ahead Survey

HOP GROWERS OF AMERICA INC: Expenditures for 1987

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
INCOME													
Washington	$5377.83	$5377.83	$5377.83	$5377.83	$5377.83	$5377.83	$5377.83	$5377.83	$5377.83	$5377.83	$5377.83	$5377.83	$64,533.96
Oregon	$15264.52	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$15,264.52
Idaho	$8654.30	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$8,654.30
California	$100.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$100.00
Interest Income	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00	$1,200.00
TOTAL	$29696.65	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$89,952.78
+ 1/1/88 checking balance	$1487.14	---	---	---	---	---	---	---	---	---	---	---	$1,487.14
TOTAL	$31183.79	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$5477.83	$91,439.92
EXPENSES													
Salaries	$2666.66	$2666.66	$2666.66	$2666.66	$2666.66	$2666.66	$2666.66	$2666.66	$2666.66	$2666.66	$2666.66	$2666.66	$31,999.92
Wage Taxes	$320.00	$320.00	$320.00	$320.00	$320.00	$320.00	$320.00	$320.00	$320.00	$320.00	$320.00	$320.00	$3,840.00
Benefits	$325.00	$325.00	$325.00	$325.00	$325.00	$325.00	$325.00	$325.00	$325.00	$325.00	$325.00	$325.00	$3,900.00
Promotion	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4000.00	$4,000.00
Rent	$500.00	$500.00	$500.00	$500.00	$500.00	$500.00	$500.00	$500.00	$500.00	$500.00	$500.00	$500.00	$6,000.00
Phone	$166.66	$166.66	$166.66	$166.66	$166.66	$166.66	$166.66	$166.66	$166.66	$166.66	$166.66	$166.66	$1,999.92
Postage	$125.00	$125.00	$125.00	$125.00	$125.00	$125.00	$125.00	$125.00	$125.00	$125.00	$125.00	$125.00	$1,500.00
Domestic Travel	$100.00	$3350.00	$100.00	$100.00	$100.00	$2100.00	$100.00	$100.00	$100.00	$2100.00	$100.00	$100.00	$8,450.00
Foreign Travel	$0.00	$7500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2500.00	$10,000.00
Dues/Subscriptions	$70.00	$0.00	$220.00	$90.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$847.00	$0.00	$1,227.00
Office Supplies	$83.33	$83.33	$83.33	$83.33	$83.33	$83.33	$83.33	$83.33	$83.33	$83.33	$83.33	$83.33	$999.96
Insurance	$80.00	$45.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2914.00	$0.00	$0.00	$205.00	$0.00	$3,244.00
For. Reporter/USDA *	$155.00	$5155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$6,860.00
Equipment	$1928.31	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$155.00	$3,633.31
Equipment Maintenence	$0.00	$0.00	$125.00	$0.00	$0.00	$125.00	$0.00	$0.00	$125.00	$0.00	$0.00	$125.00	$500.00
Professional	$0.00	$0.00	$0.00	$0.00	$500.00	$0.00	$0.00	$0.00	$500.00	$0.00	$0.00	$500.00	$1,500.00
Miscellaneous	$0.00	$0.00	$125.00	$125.00	$0.00	$0.00	$0.00	$125.00	$0.00	$0.00	$125.00	$0.00	$500.00
Translations	$0.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$100.00
Sold Ahead Survey	$0.00	$0.00	$0.00	$1000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,000.00
State Filing Fees	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$100.00	$100.00
Utilities	$100.00	$100.00	$100.00	$90.00	$90.00	$100.00	$100.00	$100.00	$90.00	$90.00	$100.00	$100.00	$1,160.00
Fieldmen	$0.00	$0.00	$0.00	$0.00	$2000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,000.00
TOTAL	$6,619.96	$20,501.65	$5,176.65	$5,911.65	$7,196.65	$6,831.65	$4,706.65	$7,745.65	$5,321.65	$6,696.65	$5,883.65	$11,921.65	$94,514.11

1988 CASH FLOW PROJECTION

* USDA contract for statistical information ($2000-/year)

IDAHO	ACRES	YIELD	POUNDS
CHINOOK	180	1,530	275,400
CLUSTER	510	1,890	963,900
EROICA	440	1,770	778,800
GALENA	480	2,040	979,200
WILLAMETTE	50	740	37,000
OTHER	540	1,510	815,400
TOTAL	2,200	1,750	3,850,000
OREGON	ACRES	YIELD	POUNDS
FUGGLE	920	630	581,600
NUGGET	1,450	2,030	2,940,000
GALENA	210	1,310	275,000
PERLE	210	740	155,000
WILLAMETTE	2,695	1,520	4,090,000
OTHER	515	1,470	758,400
TOTAL	6,000	1,470	8,800,000
WASHINGTON	ACRES	YIELD	POUNDS
CASCADE	1,650	1,920	3,168,000
CHINOOK	800	1,690	1,352,000
CLUSTER	9,900	1,960	19,382,000
EROICA	730	2,020	1,475,000
GALENA	4,050	1,870	7,574,000
NUGGET	1,400	1,870	2,618,000
OLYMPIC	230	2,180	501,000
PERLE	200	1,130	226,000
TETTNANGER	650	830	540,000
OTHER	490	1,150	562,000
TOTAL	20,100	1,860	37,398,000
ALL STATES	28,300	1,693	50,048,000

1987 Crop Breadkown
Released January 14, 1988
Source: SAS, USDA

United States Department of Agriculture
Agricultural Research Service
Pacific West Area
DEPT. OF CROP SCIENCE
OREGON STATE UNIVERSITY
CORVALLIS, OREGON 97331

To: Interested parties Feb. 14, 1988.

From: Al Haunold
USDA,ARS, Corvallis, OR.

Subject: 1987 US Hop Production as calculated from bale counts
Information received from Bill Elkins, Hop Growers of America Inc.

State	Total pounds	zentners
IDAHO	3,719 360	33,742
OREGON	8,552 475	77,588
WASHINGTON	36,883 242	334,603
Total	49,155 077	445,933

The December 1987 issue of Hopfenrundschau, page 407 carried the following figures:

1987 preharvest estimate: 48,942 120 lbs ; 444,000 zentner
1987 postharvest (Nov.) estimate: 47,950 050 lbs; 435,000 zentner

The latest German production figures (Dec. 15, 1987, Hopfenr. page 413) are: 65,079 461 lbs or 590,397 zentners

ACREAGE BY STATE (STRUNG FOR HARVEST) 1/15/87

	Wash.	Oregon	Idaho	Calif.	Total	Change from prior Year
			-Acres-			
1981-	31,337	7,148	3,395	1,170	43,050	16%
1982-	30,039	7,431	3,752	492	41,714	(3%)
1983-	26,768	6,334	3,579	507	37,188	(11%)
1984-	23,087	4,923	3,186	130	31,326	(16%)
1985-	19,660	5,701	3,147	1/	28,498	(9%)
1986-	17,371	5,089	2,475	1/	24,935	(9%)
Net Change	(2,279)	(612)	(672)	1/	(3,563)	

1/ Included with Washington. Less than 100.
Note: 1986 acreage is down 42% or 18,115 acres, from 1981.

	1986 BABY ACREAGE					% Babies
New Planting 1986	2,111	490	—	—	2,601	1983 - 8%
Replantings 1986	328	97	10	—	435	1984 - 13%
Total Babies	2,439	587	10	—	3,036	1985 - 18%
% Total Acreage	14%	12%	—	—	12%	1986 - 12%

1985 ACREAGE - BY STATE AND VARIETY (STRUNG FOR HARVEST)

Bitter Type					
Medium Alpha					
Clusters - Early	8,622	25	55	—	8,702
Clusters - Late	2,100	—	587	—	2,687
Talisman - Late	32	—	306	—	338
Medium-High Alpha					
English	316	149	—	—	465
Super Alpha					
Galena	3,849	195	863	—	4,907
Nugget	1,059	1,113	20	—	2,192
Eroica	853	45	828	—	1,726
Chinook	95	—	33	—	128
Olympic	196	2	—	—	198
Others 1/	245	—	—	—	245
Aroma Type					
Willamettes 2/	4	2,447	—	—	2,451
Fuggles	72	1,414	—	—	1,486
Cascade	1,979	249	181	—	2,409
Others 3/	228	62	274	—	564
Total	19,650	5,701	3,147	4/	28,498

1986 ACREAGE - BY STATE AND VARIETY (STRUNG FOR HARVEST)

Bitter Type					
Medium Alpha					
Clusters - Early	7,000	8	55	—	7,063
Clusters - Late	1,500	80	553	—	2,133
Talisman - Late	—	—	222	—	222
Med.-High Alpha - English	154	39	—	—	193
Super Alpha					
Galena	3,553	237	606	—	4,396
Nugget	1,600	1,331	21	—	2,952
Eroica	777	173	520	—	1,470
Chinook	190	—	41	—	231
Olympic	216	2	—	—	218
Others 1/	125	8	2	—	135
Aroma Type					
Willamettes 2/	43	2,071	—	—	2,114
Fuggles	96	871	—	—	967
Cascade	1,846	214	181	—	2,241
Others 3/	271	55	274	—	600 3/
Total	17,371	5,089	2,475	4/	24,935

1/ Incl.mostly experimental Super Alpha varieties.
2/ Incl. minor quantity of Columbias in Oregon.
3/ Incl. Hallertau M.F., Tettnang, Perle & other flavor-types.
4/ Less than 100 acres. Included with Washington.

SOURCE: HAC records.

U. S. Hop Statistics - Robert H. Eaton

Table 2-A
1/15/87

ACREAGE OF HOPS BY VARIETY
(Strung for harvest)

Year	Bitter Type: Med. Alpha (6.5-8%) Clusters 1/	Bitter Type: Med. Alpha (6.5-8%) Talisman 1/	Bitter Type: Med.High Alpha (8-10%) English 2/	Bitter Type: Med.High Alpha (8-10%) Comets 2/	Bitter Type: SuperAlpha (10-14%) Galena, Eroica, Nugg., Olympic & Chinook 3/	Bitter Type: Other (mostly Exp. Super Alpha) 3A/	Aroma Type 4/: Fuggles	Aroma Type 4/: Willamette 9/	Aroma Type 4/: Cascade	Aroma Type 4/: Other Tett., Heller. Exp., etc.	HAC Strung for Harv. 5/	USDA 5/ Harvstd.
1965											32,700	32,700
66											32,200	32,200
67											30,421	29,800
68	24,389	6/	1,385				2,602			—	28,376	28,400
69	23,251	6/	1,670				2,099			—	27,020	27,000
1970	22,738	1,138	1,722	—	—	6/	2,152	—	—	—	27,750	27,700
71	22,703	1,350	1,864	—	—	278	2,748	—	7/	78	29,021	28,900
72	22,715	1,455	1,885	—	—	460	2,769	—	351	164	29,799	29,700
73	23,312	1,437	1,886	8/	—	640	2,752	—	1,260	187	31,474	31,400
74	22,797	1,369	1,908	8/	—	608	2,542	7/	3,144	189	32,557	32,400
75	21,535	1,203	1,897	420	—	383	2,522	7/	4,314	194	32,468	32,100
76	19,949	872	2,602	589	—	176	2,324	7/	4,287	204	31,003	30,900
77	19,259	872	2,986	590	—	190	2,152	7/	4,240	318	30,607	30,500
78	18,962	893	4,152	599	34	-0-	2,112	159	3,805	233	30,949	30,900
79	18,282	818	5,122	607	167	31	2,119	157	4,151	386	31,854	31,800
1980	20,404	803	6,654	691	435	16	2,108	296	5,137	527	37,071	37,100
81	22,777	784	7,334	635	1,766	90	2,105	631	6,349	582	43,053	43,100
82	20,288	739	6,089	406	4,102	178	2,099	1,121	6,111	563	41,696	39,600
83	17,226	647	4,576	197	5,415	439	1,882	1,443	4,803	560	37,188	36,900
84	13,419	645	2,569	-0-	7,431	176	1,632	2,129	2,778	547	31,326	30,800
85	11,389	338	465	-0-	9,151	245	1,486	2,451	2,409	564	28,498	25,000
86	9,196	222	193	-0-	9,267 10/	135	967	2,114	2,241	600	24,935	

1/ Associated with excellent Alpha Acid storage characteristics.
2/ Associated with poor Alpha Acid storage characteristics. (English are mostly Bullions with some Brewers Gold.)
3/ Associated with medium to good Alpha Acid storage characteristics.
3A/ 1979 to date mostly experimental Super Alpha. Prior years included Comets & Washington Talisman.
4/ Associated with low to medium Alpha Acid content and fair to good Alpha Acid storage characteristics.
5/ Difference between HAC & USDA totals reflect fact that USDA figures are harvested acreage while HAC figures are the total strung for harvest and are also the result of USDA rounding individual state totals to nearest 100 acres before adding.
6/ Included with Clusters.
7/ Included with "Other" Aroma Type.
8/ Included with "Other" Bitter Type.
9/ Included a few Columbias in earlier years.
10/ Made up of 4,396 Galena, 2,952 Nugget, 1,470 Eroica, 231 Chinook and 218 Olympic.

NOTE: Breakdown by variety not available prior to 1968.

SOURCE: Annual July or August Statistical Reports.

Hopfenrundschau 38(23): 407. 1987.

Hopfenernte 1987 in EWG und Welt

1987 world hop production

Nach den bisher vorliegenden Zahlen, Informationen und Schätzungen hat der Verband deutscher Hopfenpflanzer e. V. für die Hopfenfläche und Hopfenernte 1987 nachfolgende Statistik erarbeitet. Diese Zahlen erheben nicht den Anspruch, vollständig und fehlerfrei zu sein. Die ebenfalls angefügten statistischen Zahlen verschiedener Institutionen und Handelsfirmen beweisen, daß nirgendwo eine bis zu den letzten Tausend Zentner Hopfen umfassende Welthopfenstatistik besteht.

Hopfenflächen und Hopfenernten 1986 und 1987 – Welt

Land	Fläche in ha		Ernte in Ztr.		
	1986	1987	1986	1987[1)]	1987[2)]
Australien	755	755	37 700	37 530	37 530
Belgien	577	400	20 327	13 315	12 700
Bulgarien	962	970	13 197	15 460	15 460
BR Deutschland	19 649	19 309	683 094	650 000	620 000
CSSR	11 950	11 900	210 000	250 000	244 000
DDR	2 370	2 360	76 140	72 000	70 000
England	4 232	4 025	101 416	120 000	100 000
Frankreich	600	555	21 897	15 650	14 700
Ungarn	512	525	12 833	13 500	13 500
Jugoslawien	3 271	3 158	91 200	100 500	104 000
Polen	2 433	2 445	54 000	52 500	52 000
Spanien	1 714	1 630	40 009	48 000	52 000
USA	10 091	11 507	444 684	444 000	435 000
IHB insgesamt	59 116	59 539	1 806 497	1 832 455	1 770 890
Portugal	163	158	6 589	6 500	6 500
Rumänien	2 000	2 200	34 000	34 000	34 000
UdSSR	15 000	15 000	214 000	220 000	220 000
VR China	5 190	5 190	191 340	190 000	190 000
Japan	1 011	1 000	37 680	36 000	36 000
Andere[3)]	2 020	2 113	59 894	61 045	62 610
Welt insgesamt	84 500	85 200	2 350 000	2 380 000	2 320 000

[1)] Schätzung vor Ernte 1987
[2)] Schätzung November 1987
[3)] Andere sind: Kanada, Neuseeland, Korea-Nord, Korea-Süd, Südafrika, Indien, Türkei und Argentinien

EWG-Hopfenflächen und Hopfenernten 1986 und 1987

Land	Fläche in ha		Ernte in Ztr.		
	1986	1987	1986	1987[1)]	1987[2)]
Belgien	577	400	20 327	13 315	12 700
BR Deutschland	19 649	19 309	683 094	650 000	620 000
Frankreich	600	555	21 897	15 650	14 700
England	4 232	4 025	101 416	120 000	100 000
Irland	34	34	286	286	286
Spanien	1 714	1 630	40 009	48 000	52 000
Portugal	163	158	6 589	6 500	6 500
EWG insgesamt	26 969	26 111	873 618	853 751	806 186

1) Schätzung vor Ernte 1987
2) Schätzung November 1987

Vergleich der Statistiken verschiedener Handelshäuser und Institutionen

Bericht von	Welt-Fläche in ha		Welt-Ernte ein Ztr.	
	1986	1987	1986	1987
EG-Kommission	84 009	–	2 272 455	–
Barth & Sohn	84 220	–	2 249 322	–
Steiner	87 250	86 434	2 343 802	2 435 016
Horst-Company	85 667	85 795	2 303 409	2 272 350
Lupofresh	84 100	84 700	2 362 500	2 430 200
Verband deutscher Hopfenpflanzer	84 500	85 200	2 350 000	2 320 000

VERBAND DEUTSCHER HOPFENPFLANZER e. V.
Wolnzach, 27. November 1987

HOPS U.S.A.

The Official Publication of Hop Growers of America

January 11, 1988 Number 397

WORLD HOP PRODUCTION HITS 5 YEAR LOW

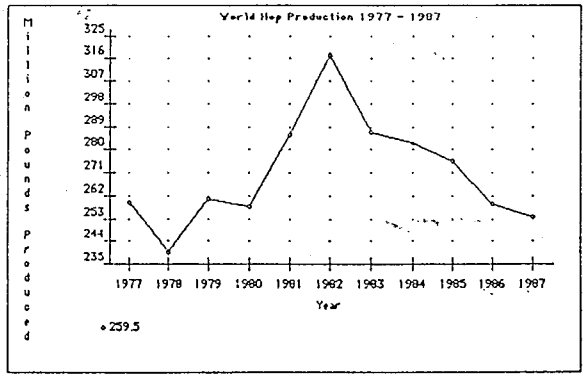
Worldwide hop production for 1987 totaled an estimated 253,900,000 pounds, the lowest production figure since 1982. Of the 253.9 million pounds produced, the United States accounted for 19% with 49 million pounds, and West Germany had 27% with 68.2 million pounds.

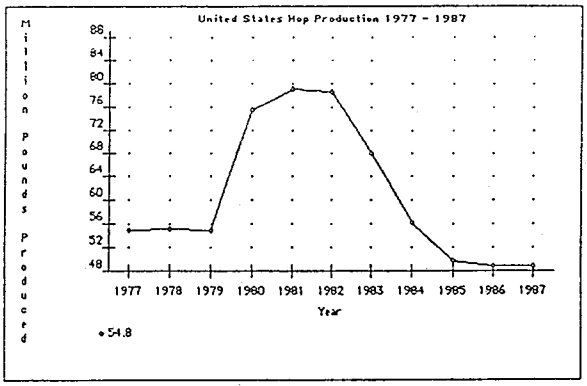
While U.S. production shows little change from 1985 and 1986, the West German production slipped from a 1985 total of 78.5 million pounds, and a 1986 total of 75.2 million pounds.

The total world production for 1987 was an estimated 63.3 million pounds less than the record harvest occurring in 1982.

1987 saw an overall gain in world acreage of 1730 acres. Gainers included the United States (+3,500 acres) and Rumania (+494 acres). Losers of note include West Germany (-820 acres), Czechoslovakia (-123 acres), and England (-511 acres).

HGA's Foreign Reporter indicates that further reductions are likely as West German growers have indicated a willingness to "dig out hops", and have even gone as far as to ask the EEC for a grant, but have been turned down. They are now making the same request of the Bavarian State.





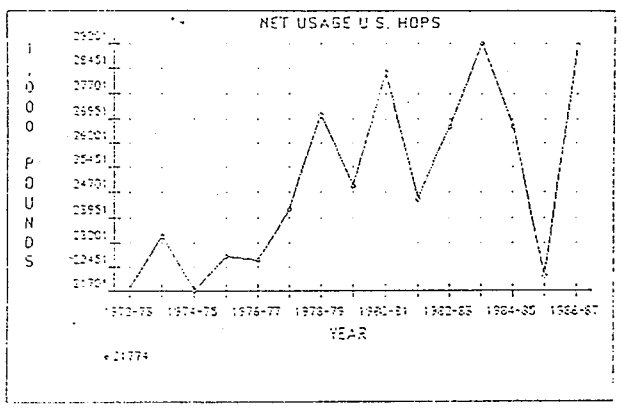
U.S. BREWERS USE OF DOMESTIC HOPS RISES

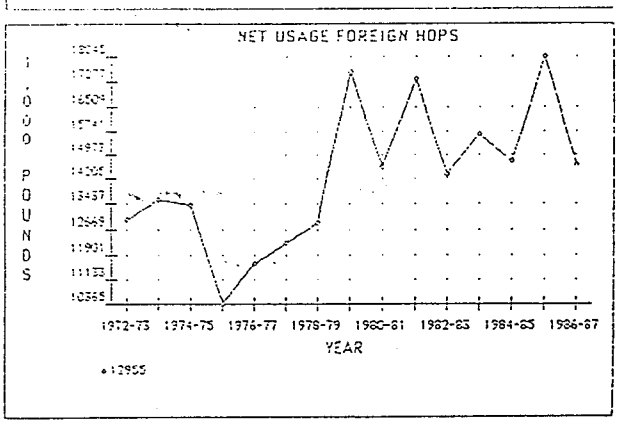
Total usage of U.S. grown hops by U.S. Brewers rose during the 1986-87 marketing year by 6,991,000 pounds to 29,159,000 for the twelve month period September 1, 1986 to August 31, 1987.

U.S. hops accounted for 67% of the total used by U.S. brewers for 1986/87 compared to 55% for the same accounting period 1985/86. The 67% usage is the highest percentage recorded since the 1978/79 marketing year.

Net usage of imported hops fell from a 1985/86 level of 18,039,000 pounds to 14,626,00 during 1986/87, a decline of 19%.

Total hops used by U.S. Brewers rose 3,580,000 pounds to 43,787,000, with the hopping rate rising from .208 to .224 for 1986/87.





Hopfenrundschau 39: Oct. 1, 1988. page 328

Leading Breweries of the World: 1987.

Die führenden Brauereien der Welt 1987

Brauereigruppe	Ausstoß in Mio. hl	Mill. bbl
Anheuser-Busch, USA	89,2	76.2
Miller Brewery, USA	46,0	39.3
Heineken, Niederlande	43,0	36.8
Kirin, Japan	30,3	25.9
Bond Corp., Australien	28,3	24.2
Stroh Brewing, USA	25,2	21.5
Elders IXL, Australien	20,7	17.7
BSN, Frankreich	18,5	15.8
Coors, USA	18,3	15.6
Brahma, Brasilien	18,0	15.4

Hopfen R. 39: 176. 1988

Die 20 größten US-Brauereien 1987 The 20 largest US Brewers

Unternehmen	Absatz in Mio hl	Veränderungen in % change in %
1. Anheuser-Busch Inc.	89,04	+ 5,2
2. Miller Brewing Co.	45,98	− 1,4
3. The Stroh Brewery Co.	25,17	− 5,3
4. G. Heileman Brewing Co.	19,01	+ 1,2
5. Adolph Coors Co.	18,32	+ 2,8
6. Pabst Brewing Co.	7,14	− 15,0
7. Genesee Brewing Co.	3,11	− 11,7
8. Falstaff Brewing Co.***	2,31 (1986)	–
9. Latrobe Brewing Co.	0,601	+ 10,3
10. Hudepohl-Schoenling	0,585	–
11. Eastern Brewing Co.	0,468	0,0
12. F. X. Matt Brewing Co.	0,409 (1986)	–
13. The Lion Inc. – Gibbons	0,252	+ 7,5
14. Jos, Huber Brewing Co.	0,231	− 0,4
15. D. G. Yuengling & Sohn	0,154	+ 1,3
16. Jones Brewing Co.	0,107	− 8,9
17. Jacob Leinenkugel	0,081	+ 12,9
18. Anchor Brewing Co.	0,048 (1986)	–
19. Stevens Point Brewery	0,047	–
20. Spoetzl Brewery, Inc.	0,042	+ 1,6

Quelle: Modern Brewery Age, Nr. 2, 1988

sales in Mil. hl
1 hl = o.8547 bbl

1987 U.S. BEER PRODUCTION SLIPS .3 %

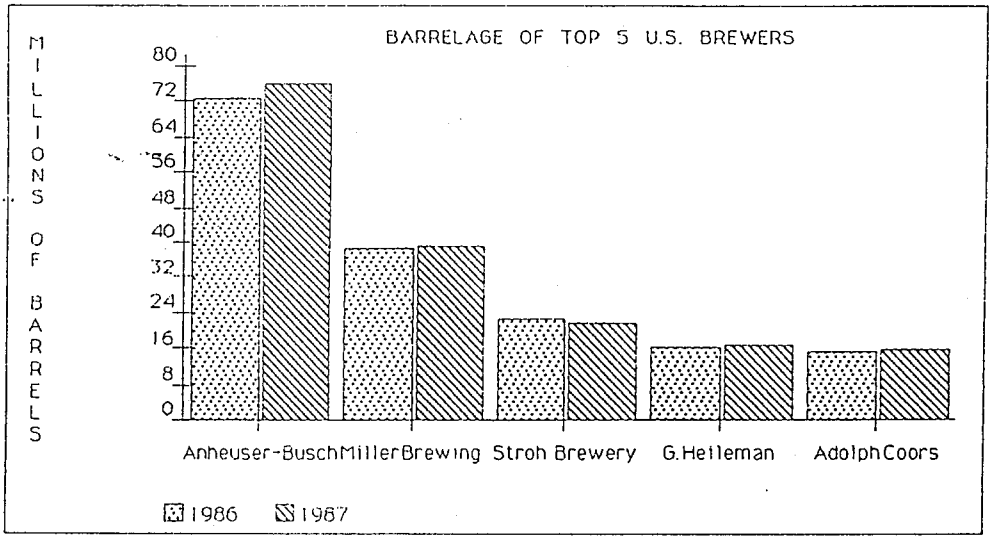
Preliminary reports indicate 1987 United States beer production fell 0.3 % to 181,000,000 31 gallon barrels from a 1986 level of 181,596,702 barrels. This compares to a 1.64 % gain for U.S. brewers 1986 v.s. 1985.

Brewery statistics for 1987 showed growth of 5.2 % for Anheuser-Busch, 1.4 % for Miller Brewing, 1.2 % for G. Heileman, and 2.8 % for Adolph Coors. Of the top five U.S. brewers, only Stroh Brewery posted a decline, slipping 5.3 %.

In 1987 Anheuser-Busch accounted for 40 % of the U.S. market with Miller Brewing holding 20.7 %, Stroh Brewery 11.4 %, G. Heileman 8.5 %, Adolph Coors 8.2 %, Pabst 3.3 %, and all others 7.9 %.

1987 United States per capita beer consumption dipped to 23.8 gallons from a 1986 level of 24.0 gallons, but still higher than the 1985 mark of 23.7 gallons.

Industry analysts have predicted that U.S. production will remain flat, or experience slight growth, into the early 1990's.



1 hectoliter (hl) = 26.42 gallons

WORLD BEER PRODUCTION 1982 - 1987

	1982	1983	1984	1985	1986	1987	% Change 87 vs. 86
	1,000 Hectolitres						
AMERICAS							
United States	228,050	230,331	226,490	226,825	230,543	229,297	– 0.55
Brazil	29,500	29,000	28,350	30,250	43,760	47,500	+ 8.54
Mexico	27,583	23,611	25,082	27,392	29,287	31,537	+ 7.68
Canada	23,667	22,599	23,012	22,126	22,815	23,114	+ 1.31
Colombia (est.)	13,438	11,760	14,500	15,800	16,600	17,600	+ 6.02
Venezuela	12,000	11,769	11,820	10,300	11,200	12,100	+ 8.03
Other	24,230	23,469	24,173	25,923	31,056	32,624	+ 5.04
SUB TOTAL	358,468	352,539	353,427	358,616	385,263	393,772	+ 2.20
WESTERN EUROPE							
West Germany	94,816	94,980	92,286	93,294	94,100	92,744	– 1.45
United Kingdom	59,780	61,700	61,470	62,500	59,166	59,897	+ 1.23
France	22,410	22,086	20,288	20,802	24,126	19,894	– 17.55
Spain	21,499	22,082	21,832	23,353	20,655	25,000	+ 21.03
Netherlands	16,180	17,327	17,048	17,529	17,988	17,547	– 2.46
Belgium	15,000	14,620	14,976	14,500	13,715	13,990	+ 2.00
Other	52,779	52,814	51,660	53,063	54,618	56,381	+ 3.22
SUB TOTAL	282,464	285,609	279,560	285,041	284,368	285,453	+ 0.38
EASTERN EUROPE							
USSR (estimated)	68,000	68,000	66,100	60,000	55,000	50,000	– 9.10
East Germany (est.)	25,000	25,500	26,000	25,500	24,300	25,000	+ 2.88
Czechoslovakia	24,921	24,956	23,780	22,354	22,783	22,228	– 2.44
Yugoslavia	13,402	12,378	13,600	10,505	10,500	11,790	+ 12.28
Romania (est.)	11,500	11,500	11,500	11,500	11,000	10,000	– 9.10
Poland	10,300	10,076	9,660	10,801	11,380	11,644	+ 2.31
Other	13,925	13,412	13,512	14,372	18,322	16,600	– 9.40
SUB TOTAL	167,048	165,822	164,152	155,032	153,285	147,262	– 3.93
FAR EAST							
Japan	47,335	49,323	46,689	47,461	49,980	53,500	+ 7.04
China (est.)	12,300	16,600	20,000	32,000	40,000	50,000	+ 25.00
Phillipines	7,700	8,700	9,230	8,100	8,300	10,200	+ 22.89
South Korea	5,988	7,070	7,800	7,907	8,065	8,800	+ 9.11
Taiwan	2,825	2,999	3,071	3,353	3,537	3,864	+ 9.24
Other	11,076	9,531	9,930	9,832	8,690	9,445	+ 8.68
SUB TOTAL	87,224	94,223	96,720	108,653	118,572	135,809	+ 14.53
AFRICA							
South Africa	12,000	12,000	13,000	13,500	14,500	18,000	+ 24.13
Nigeria	10,380	10,000	9,000	10,000	6,840	7,000	+ 2.33
Cameroon	3,370	4,180	4,729	4,900	5,400	5,500	+ 1.85
Zaire (est.)	2,780	2,949	3,027	3,000	3,200	4,310	+ 34.68
Kenya	2,500	2,300	2,400	2,700	3,200	3,500	+ 9.37
Other	14,642	13,762	14,336	15,380	14,864	15,833	+ 6.51
SUB TOTAL	45,672	45,191	46,492	49,480	48,004	54,143	+ 12.78
NEAR EAST							
Turkey	3,200	3,300	2,625	2,200	2,200	2,500	+ 13.63
Other	1,732	1,601	1,473	1,461	1,443	1,445	+ 0.01
SUB TOTAL	4,932	4,901	4,098	3,661	3,643	3,945	+ 8.28
OCEANIA							
Australia	19,682	19,350	18,949	18,503	18,170	18,765	+ 3.27
New Zealand	3,801	3,800	3,839	3,940	3,924	4,087	+ 4.15
Other	889	811	861	862	882	927	+ 5.10
SUB TOTAL	24,372	23,961	23,649	23,305	22,976	23,779	+ 3.49
WORLD TOTALS	**968,448**	**972,286**	**968,098**	**983,624**	**1,016,111**	**1,044,163**	**+ 2.76**

Prepared October 1988
Hop Growers of America, Inc.
Source: Barth Report, July 1988

Conversion: 1,000 Hectolitres equals 26,418 gallons

Weltbiererzeugung 1986/87

Hopfenrundschau 39: pp 330-331. 1988.

World Beer production in 1986/87
in 1000 hectoliters (1 hl = 0,8547 bbl)

Europa

Angaben in 1000 hl

Land	1987	1986
Bundesrepublik Deutschland	92 744	94 100
Großbritannien	59 897	59 166
UdSSR *	50 000	55 000
DDR *	25 000	24 300
Spanien	25 000	24 126
Tschechoslowakei	22 228	22 783
Frankreich	19 894	20 655
Niederlande	17 547	17 988
Belgien	13 990	13 715 [1]
Polen	11 644	11 380
Italien	11 122	11 082
Rumänien *	10 000	11 000
Jugoslawien	11 790	10 500
Ungarn	9 500	9 222
Bulgarien	7 000 *	9 000 [2]
Österreich	8 932	8 948
Dänemark	8 200	7 500 [3]
Irland	5 369	5 456
Schweiz (Braujahr 1. 10.–30. 9.)	4 115	4 112
Schweden	4 010	4 100
Portugal	4 977	3 945
Finnland	3 423	3 285
Griechenland	3 200 *	3 150
Norwegen	2 167	2 135
Luxemburg	662	732
Malta	164	135
Albanien *	100	100
Island	40	38
Gesamt	432 715	437 659

[1] nachträglich korrigiert auf 14 500; für 1987 liegen noch keine offiziellen Daten vor
[2] nachträglich korrigiert auf 6 000
[3] nachträglich korrigiert auf 8 200

Amerika

Angaben in 1000 hl

Land	1987	1986
USA	229 297	230 545
Brasilien	47 500*	43 760
Mexiko	31 537	29 287
Kanada	23 114	22 815
Kolumbien	17 600	16 600
Venezuela	12 100	11 200
Peru	7 500	6 800
Argentinien	5 800	5 900
Kuba *	3 600	4 000 [2]
Ecuador	2 000	2 386
Chile	2 546	2 200
Dominikanische Republik	972	1 200
Paraguay	1 200	900
Panama	1 360	880
Bolivien	1 180	800
Costa Rica	800	800
Uruguay	600	750
Guatemala	970	710
Jamaika	800	650
El Salvador	670	650
Nicaragua	350	550
Honduras	601	540
Trinidad	470	350
Puerto Rico	376	300
Niederländische Antillen	150	132
Surinam	123	112
Guyana	150	100
Barbados	90	80
Martinique	65	63
San Lucia	57	60 [1]
Guadeloupe	32	30
Belize	25	25
Grenada	25	25
Haiti	47	25
St. Kitts	27	25
Bahamas	21	–
St. Vincent	17	13
Gesamt	393 772	385 263

[1] nachträglich korrigiert auf 47
[2] nachträglich korrigiert auf 2 930

Afrika

Angaben in 1000 hl

Land	1987	1986
Südafrika	18 000	14 500
Nigeria	7 000	6 840
Kamerun	5 500	5 400
Zaire *	4 310	3 200 [3]
Kenia	3 500	3 200
Elfenbeinküste	1 350	1 320
Simbabwe	1 300	1 050
Gabun	1 000	1 000 [2]
Burundi	931	884
Tansania	588	850
Volksrepublik Kongo *	850	850
Äthiopien	964	842
Sambia	800	800
Ruanda	642	641
Algerien *	750	600
Angola *	550	530
Burkina Faso (Obervolta) *	500	500
Ägypten	400	472
Marokko	500	400
Togo	452	400
Namibia	411	350
Tunesien	256	325
Zentralafrikanische Republik	294	306
Benin	219	274
Madagaskar	240	260
Mosambique	213	229
Lesotho	205	200
Mauritius	257	200
Botswana	248	194
Swaziland	216	171
Malawi	160	160
Senegal	153	160
Ghana	526	151 [1]
Tschad	103	115
Liberia	138	110
Réunion	117	100
Niger *	100	90

Land	Angaben in 1000 hl 1987	1986
Mali *	80	80
Uganda *	135	55
Seychellen	49	42
Sierra Leone	47	36
Guinea Bissau	19	20
Gambia	17	12
Gesamt	54 143	48 004

[1] nachträglich korrigiert auf 650
[2] nachträglich korrigiert auf 880
[3] nachträglich korrigiert auf 4 205

Fernost Land	Angaben in 1000 hl 1987	1986
Japan	53 500	49 980
Volksrepublik China *	50 000	40 000
Philippinen	10 200	8 300
Korean. Republik	8 800	8 065
Taiwan	3 864	3 537
Vietnam *	2 000	2 000
Indien	2 000	1 800
Hongkong	1 360	1 250
Dem. Volksrepublik Korea *	1 000	1 000
Thailand	960	800
Malaysia	507	650
Indonesien	843	402 [1]
Singapur	385	391
Iran **	100	100
Mongolei *	100	100
Sri Lanka	75	72
Burma *	40	50
Nepal	45	45
Laos *	10	10
Pakistan	10	10
Bangladesh *	5	5
Kambodscha *	5	5
Gesamt	135 809	118 572

** alkoholfrei
[1] nachträglich korrigiert auf 718

Nahost Land	Angaben in 1000 hl 1987	1986
Türkei	2 500	2 000
Irak	500 *	517
Israel	420	412
Zypern	270	260
Libanon	130	130
Syrien *	90	90
Jordanien	35	34
Gesamt	3 945	3 443

Australien/Ozeanien Land	Angaben in 1000 hl 1987	1986
Australien	18 765	18 170
Neuseeland	4 087	3 924
Papua-Neuguinea	520	494
Fidschi *	170	165
Tahiti	120	118
Neucaledonien	63	55
Samoa	54	50
Gesamt	23 779	22 976

* geschätzt

Welt insgesamt	**1 044 163**	**1 015 917**

Ausstoß-Entwicklung

Der Bierausstoß entwickelte sich in den Kontinenten wie folgt (in 1000 hl)

	1987 % rel.	1986 % rel.	1987 total	1986 total	+/− total
Europa	− 1,1	−0,6	432 715	437 659	− 4 944
Amerika	+ 2,2	+7,5	393 772	385 263	+ 8 509
Afrika	+12,8	−3,0	54 143	48 004	+ 6 139
Asien (Fernost)	+14,5	+9,1	135 809	118 572	+17 237
Nahost	+14,6	−6,0	3 945	3 443	+ 502
Austr./Oze.	+ 3,5	−1,6	23 779	22 976	+ 803
Gesamt	+ 2,8	+3,3	1 044 163	1 015 917	+28 246

Quelle: Fa. Joh. Barth & Sohn Nürnberg

Table 1. Hop germplasm distributed in 1987.

Recipient	Date sent	Variety or or Selection	Amt.	Reasons and Remarks
Bergman, E. L. Pennsylv. State U. University Park, PA 16802	Apr. 24	Cascade, 56013	5	Horticulture Club
		Nugget, 21193	5	"
Borda, A. Iregui Bogota, Colombia	Dec. 16	Willamette, 21041	6	experimental plots
		Nugget, 21193	6	"
		Perle, 21227	6	"
Choi, Dr. Jong Yol Kangweon Natl. Univ. Chuncheon, Korea	Feb. 26	Tettnanger, 21015	5	experimental plots
		Spalter, 21186	5	"
		Hersbrucker G, 21185	5	"
		Hallertauer m.f., 21014	5	"
		Saazer, 21077	5	"
Coleman, Robert T. Gervais, OR 97137	April 9	USDA 21457	150	potted plants, off-stat. trial
Crosby, Kevin Woodburn, OR.97071	March 27	USDA 21102M	200	potted plants, tripl. ♂ pollinator
		USDA 21106M	30	rhizomes, tripl. ♂ pollinator
		21175M	30	"
		21176M	30	"
		21177M	30	"
		21104M	30	"
Giebinck, Bruce Dept. Entomology Univ. of Wisconsin Madison, WI	Feb. 26	Cascade, 56013	5	insect research
Goschie, Herman 7365 Meridian Rd. Silverton, OR. 97381	Apr. 22	USDA 21102M	30	potted plants, pollinators
		- " -	80	rhizomes, pollinators
		21191M	50	potted pl., "
		21189M	20	potted pl., "
		- " -	50	rhizomes, "
		21192M	50	potted pl., "
		21190M	30	potted pl., "
		- " -	50	rhizomes, "
		21177M	50	potted pl., "
		21178M	50	potted pl., "
		21175M	50	rhizomes, "
"	Oct. 5	Tettnanger B	700	potted plants, off station test
Haas, J. I. c/o P. Vandeneynde Salem, OR	March 19	Hallertauer m.f., 21014	5	exptl. planting
		Progress, 66051	5	"
		Alliance, 66050	5	"
		Wye Saxon, 21282	5	"
Heatherbell, Dr. David Or. State Univ. Food Sci. for Univ. CA, Davis	March 9	Cascade, 56013	5	for brewing dept. UC Davis
Idaho Hop Commission Dan Dixon Caldwell, ID	March 21	USDA 21455	1550	off station planting
		21456	1250	"
		21457	2075	"
		21458	2300	"
		21459	2150	"
Kenny, Dr. S. T. WA.State Univ. IAREC, Prosser, WA	July 14	USDA 21490	50	potted plants, propagation
		21491	75	potted plants, propagation
Manning, David USDA-ARS Germplasm Beltsville, MD 20705	March 9	Galena, 21182	5	for Hungary
		Eroica, 21183	5	"
		Nugget, 21193	5	"
		Olympic, 21225	5	"
Nickerson, G. B. Ag Chem. Oreg. St. U. Corvallis, OR 97331	April 10	Nugget, 21193	10	hobby gardening
Rooney, Peter M. Sloughhouse, CA 95683	April 9	Willamette, 21041	50	exptl. planting
		Chinook, 21226	10	"

Table 1. Concluded.

Recipient	Date sent	Variety or or Selection	Amt.	Reasons and Remarks
Segal, John B. Marmaroneck, NY 10543	April 13	USDA 21457	30	rooted softwood cuttings exptl. planting
Serres, Paul Woodburn, OR.97071	April 10	USDA 21102	40	potted plants, tripl. pollinators
		21177	40	"
		21178	40	"
		21189	40	"
		21190	40	"
		21191	40	"
		21192	40	"
- " -	Sept. 25	USDA 21491	2600	potted plants, off-station test
Signorotti, George Sloughhouse, CA 95683	Apr. 9	USDA 21455	30	off-station testing
		21456	30	"
		21457	30	"
		21458	30	"
		21459	30	"
Silva, Ing. Jairo CENARGEN. Brasilia DF, Brazil	Nov. 20	Brewer's Gold, 19001	5	exptl. planting via USDA
		Eroica, 21183	5	" Germpl. Repository
		Fuggle, 48209	5	"
		Hüller Bitterer, 21097	5	"
		N. Mexico 2-4, 60020	5	"
		Southern Brewer, 21187	5	"
		Willamette, 21041	5	"
Skotland, Dr. C. B. IAREC, Prosser, WA 99350	Jan. 21	v.f. Cascade 21092; loc 14:09	2	virus testing
		loc 14:10	2	"
		loc 14:11	2	"
		loc 14:12	2	"
		USDA 19058M; loc 18:53	2	"
		loc 18:54	2	"
		USDA 21119M; loc 21:57	2	"
		loc 21:58	2	"
- " -	Feb. 27	Sel. 8301-01 to 75	75	rhizomes, virus assay
		Sel. 8302-01 to 18	18	rhizomes, virus assay
- " -	March 19	Sel. 8303-01 to 143	143	rhizomes, virus assay
		Sel. 8309-01 to 39	39	rhizomes, virus assay
- " -	April 8	Hersbrucker-G, 21185	20	virus testing & cleanup
		Saazer 21077	20	" "
		Lubelski-Pulawi, 21113	20	" "
		Nadwislanska, 21114	20	" "
	Nov. 2	Sel. 8301-01 to 75	75	rhizomes, re-test viruses
		Sel. 8302-01 to 18	18	" "
	Nov. 16	Sel. 8303-01 to 143	143	" "
		Sel. 8309-01 to 39	39	" "
Stauffer, Robert Hubbard, OR. 97032	April 10	USDA 21189M 21190M 21191M 21192M	40	potted plants, tripl. pollinators
		USDA 21459	60	potted plants, off-station test
Stevens, C. Chicago, IL 60611	April 8	Nugget, 21193	20	hobby gardening (sent via Coors)
Weathers, Don Salem, OR 97303	Sept. 11	Tettnanger A	1000	off-station planting
White, George A. USDA-ARS, Germplasm Center, Beltsville, MD 20705	Jan. 22	USDA 64032M	5	for Dr. Singh. Natl. Genetic Resources New Delhi, India
		64033M	5	
		64037M	5	
		Pride of Ringwood, 66052	5	
Wills, Dave Philomath, OR 97370	March 16	Chinook, 21226	8	propagation
		Nugget, 21193	20	"

Table 2. Hop cones and other samples distributed in 1987.

Recipient	Date sent	Variety or or Selection	Amt.	Remarks
Becker, Hank, USDA-ARS Information Staff Beltsville, MD 20705	May 7	Willamette, 21041	500 g	loose cones, for demonstrating at press meeting in New York City
Coors Brewing Co. Dr. Darwin Davidson Golden, CO 80401	Nov. 30	USDA 21373	750 g	loose cones, pilot brewing
Dorschner, Dr. Keith Univ. ID Res. Ext. Ctr. Parma, ID 83660	Jan. 23	Willamette, 21041	450 g	loose cones, exptl. brewing
		Nugget, 21193	450 g	" "
J. I. Haas Co. Gene Probasco Yakima, WA 98901	March 17	USDA 21455	200 g	loose cones, hand evaluation
		21456	200 g	" "
		21457	200 g	" "
		21458	200 g	" "
		21459	200 g	" "
Knapp, Dr. Steve Dept. of Crop Science OR. State Univ. Corvallis, OR 97331	Jan. 23	Willamette, 21041	450 g	exptl. brewing
Kremheller, Dr. H. Th. Hop Res. Inst. Hüll West Germany	Sept. 16	Late Cluster, 21011	30 cones	green cones for viroid studies
		Bullion, 21056	"	" "
		Cascade, 21092	"	" "
		Chinook, 21226	"	" "
		Nugget, 21193	"	" "
		Eroica, 21220	"	" "
		Fuggle H, 48209	"	" "
Miller Brewing Co. Art Rehberger Milwaukee, WI	Nov. 30	USDA 21373	900 g	pilot brewing
Stroh Brewing Co. Dr. M. Meilgaard Detroit, MI 48207	Jan. 30	Selection 8309-37	100 g	aroma and hand evaluation
		8408-96	"	"
		-22	"	"
		8405-26	"	"
		8406-04	"	"
		-38	"	"
- " -	Nov. 30	USDA 21373	250 g	hand evaluation, pilot brewing
Wagner, Dr. Tone Hop Res. Institute Zalec, Yugoslavia	Feb. 10	Hop paper string	3 pc	experimental evaluation

Table 3. Germplasm received at Corvallis, in 1987.

Supplier	Date	Amount	Variety	Remarks
Haas, J.I. (Gene Probasco) Yakima, WA 98901	Feb. 6	150	I43-11 (USDA 21287), Banner, potted softwood cuttings for propagation	OR. 4 A off-stn. test
- " -	May 20	3100	I33-06 (USDA 21222), Aguila, potted softwood cuttings, planted at J.I.H. Mitoma Farm	OR 4 A off-stn. test
Kenney, S. T., IAREC P. O. Box 30 Prosser, WA 99350	July 14	5	Zenith, USDA 21499 potted plants	variety collection
- " -	July 14	5	Yeoman, USDA 21498 potted plants	-"-
Schmuetz, Dr. W. Univ. Hohenheim D 7000 Stuttgart W. Germany	April 30	8	Tettnanger A, clone No. 4 virus free Ac. No. 21496	variety testing
- " -	April 30	8	Tettnanger B, clone No. 14 virus free, Ac. No. 21497	variety testing

Table 4. New Accessions numbers assigned in 1987.

Accession No.	Location	Source	Name or Pedigree	Remarks
21496	Greenhouse	West Germany	Tettnanger A, clone No. 4	virusfree, good yield potential, good Tettnanger aroma
21497	Greenhouse	West Germany	Tettnanger B, clone No. 14	virusfree, 115% yield of regular Tettnanger or clone No. 4 above
21498	Main Yard	Prosser, WA	Yeoman	new variety from Wye College; Ref. Wye College Rep. 1983, p. 39; good storage, early, high alpha (11%), wilt resistant, resistant to downy and powdery mildew
21499	Main Yard	Prosser, WA	Zenith	new variety from Wye College. Ref. Ann. Rep. 1983, p. 39, medium alpha (9%), high yield, resistant to downy and powdery mildew, susceptible to verticillium wilt
21500	205:12-16	Sel. 7504-26	56013 x 19058M Cascade x EG - XS	v. good yield, late, alpha 10-12, beta 6-7, CoH 22-24, compact cone, occasional male flowers
21501	206:12-16	Sel. 7504-31	-"-	v. good yield, late, alpha 9-11, beta 6-8, CoH 19-25, compact cone
21502	223:12-16	Sel. 7504-111	-"-	v. good yield, late, alpha 7-10, beta 8-10, CoH 33, compact med. small cone
21503	234:12-16	Sel. 7504-137	-"-	exc. yield, late, alpha 8-11, beta 7-8, CoH 34, med. large cone
21504	226:23-27	Sel. 8036-52	64003 x 21268M (LGpSxFu-FuS) x NB - 21108M	phenotype similar to female parent, exc. yield, late, alpha 8-10, beta 3, CoH 24, compact cone
21505	234:23-27	Sel. 8036-99	64003 x 21268M (LGpSxFu-FuS) x NB - 21108M	phenotype similar to female parent; exc. yield, medium late, beta 3-4, CoH 30, small cone
21506	235:23-27	Sel. 7507-62	56013 x 21137M Cascade x 65009 - 64035M	v. good yield, med. late, alpha 9-10, beta 6-8, CoH 37, compact cone, occasional yellow fleck
21507	216:28-32	Sel. W415-90 (Prosser,WA)	6619-04 x 63015M (BG^{2}xFu-FuS) x (BG^{2}xEKG-BavS)	1987 WA off-station, alpha 12-14, beta 4-5, high oil, fair storage, large compact cone, early
21508	218:28-32	Sel. 8037-36	64003 x 21271M (LGpSxFu-FuS) x NB - 21110M	phenotype like female parent, alpha 9-11, beta 3-4, CoH 32, small cone, med. late
21509	220:28-32	Sel. 8037-90	-"-	phenotype like female parent, alpha 7, beta 5, CoH 38, med. large cone, med. late
21510	224:28-32	Sel. 8037-136	-"-	phenotype like female parent, alpha 8-9, beta 4, CoH 30, medium late
21511	238:28-32	Sel. 7610-104	21254 x 21328M [21055x[(BGxEG-XS)xZaS]] x (CometxBu-ZaS)	med. high yield, late, loose cone, alpha 13-15, beta 4, CoH 27-30, red stem
21512	239:28-32	Sel. 7611-25	21254 x 21335M [21055x[(BGxEG-XS)xZaS]] x (NBxBu-ZaS)	med. high yield, med. early, alpha 7-8, very low beta (1-2%), very high ratio α/β
21513	202:12-16	Sel. 7504-04	56013 x 19058M Cascade x EG x XS	v. good yield, medium, alpha 11-13, beta 6-7, CoH 30, sister of 21500 above

Table 5. Diploid x tetraploid crosses from the 1986 season, field planted in 1987 to obtain triploid Tettnanger types. Corvallis, Main Yard. Planted in the '87 Nursery May 18-20

Cross No.	Location of female	Pedigree[1/]	Seed weight	Remarks	No. of seedlings planted
			g		
8601	19:3	61021 x 8309-26M	3.105	pale seed coat, poor germination, select triploids	60
8602	19:1	61021 x 8309-26M	5.310	identical to cross 8601, dark seed coat, v. good germination, select triploids	677
8603	19:4	61021 x 8309-32M	3.356	dark seed coat, v. good germination, select triploids	429

1/61021 = diploid Swiss Tettnagner

8309-26M, a monoecious tetraploid (mostly male) selected from cross 8309 from tetraploid Hallertauer m.f. crossed to 21381M 21397 x (Cas x [(BGxBGxXS) x ZaS])

8309-32M, a monoecious tetraploid (mostly male) also selcted from cross 8309; pedigree identical to above.

Table 6: Hop varieties and selections grown in the Seedless Observation Nursery (Smith Yard), Corvallis, 1987. Prunded: March 27; trained: May 5-8.

Accession or Sel No	Location Row:Hill	Name or pedigree	Vigor[1]	Flowering[2]	Harv. Date	Yield[3]	Quality α	Quality β	Quality ratio	Quality CoH	Quality oil	Remarks
					Sept.	lbs/A	%	%		%	ml/100g	
21368	201:1-5	Yugoslavian 88/150	VG-G	L	1	1135	11.3	4.9	70	36	1.49	triploid, top crop
21369	202: "	- " - 88/87	G	L	1	759	10.6	4.5	66	32	1.04	triploid, top crop
21370	204: "	- " - 88/201	P-G	L	1	683	11.2	4.3	72	32	1.53	triploid
21056	206: "	Bullion 10A	VG	M	1	1621	11.9	5.8	67	36	2.05	
8301-09	207: "	21397 x 19058M	P-G	L		1200e	3.7	5.8	39	30		
-47	208: "	- " -	P	E		1000e	6.1	4.9	55	17		low Cohumulone
-63	209: "	- " -	P	ME	1	742	7.9	5.3	60	32		
21049	214: "	Styrian Golding	P	E	8/28	495	5.1	3.7	58	30	0.70	
8019-03	215: "	19185 x 21266M	G	E	1	845	8.6	6.5	57	38		red styles
8303-16	216: "	21397 x 64035M	P	L		1000e	3.9	2.8	58	27		
8303-17	217: "	- " -	P	ME		1000e	5.8	3.2	65	20		
-20	218: "	- " -	P	M	1	811	7.3	4.6	61	23		low CoH
-29	219: "	- " -	P	L		1200e	2.9	4.0	42	20		weak arms
21227	220: "	Perle	P	L	1	913	10.2	4.1	71	29	0.83	a few ♂ flowers
8303-37	221: "	21397 x 64035M	P-G	L	2	751	4.5	3.3	58	20	0.75	
-39	222: "	- " -	P-G	L	2	1032	3.4	4.9	41	26	0.68	
-42	223: "	- " -	P	L		1200e	4.6	3.6	56	26		
8020-32	224: "	19185 x 21267M	VG	E	10	1305	9.6	4.3	69	42		
8021-11	225: "	19185 x 21268M	VG	ME	2	1433	6.3	4.0	61	29		
8303-43	226: "	21397 x 64035M	G	VL		1000e	6.4	4.0	61	21		top crop, red stem
21041	227: "	Willamette	G-VG	L	2	1553	6.7	4.3	61	33	1.24	
8303-44	228: "	21397 x 64035M	P	L		800e	6.0	3.2	65	24		
21403	229: "	Sticklebract	VG	VL		2000e	11.6	5.0	70	43		
8021-35	230: "	19185 x 21268M	VG	E	2	1263	8.1	2.7	75	39		yellow fleck, discard
21404	231: "	Green Bullet	G-VG	L		1600e	6.9	3.3	68	40		
64007	232: "	19105 x 19058M	VG	ML	2	2278	3.0	8.0	27	30	0.75	
21238	234: "	Blisk	VG	M	4	2312	13.2	4.8	73	34	2.73	triploid
8303-58	235: "	21397 x 64035M	P	L		800e	5.0	3.5	58	18		low CoH
-66	236: "	- " -	P	ME		800e	4.2	4.3	49	23		
21193	237" "	Nugget	VG	L	3	2440	14.6	5.0	75	25	1.17	
21194	238: "	65009 x 64035M	G-P	L		1600e	15.0	6.1	71	26		good picker
21182	239: "	Galena	VG	E		1800e	13.8	10.4	57	38		a few ♂ flowers
21405	240: "	SuperAlpha	G	L		1200e	11.5	6.3	65	35		
21406	241: "	AlphAroma	VG	L		2000e	7.9	2.6	75	24		
8303-68	242: "	21397 x 64035M	P	L		800e	6.0	3.9	61	23		
-77	244: "	- " -	P	M		800e	6.3	3.7	63	24		
-85	245: "	- " -	P	L		1000e	5.0	5.4	48	21		
-88	246: "	- " -	P	L		600e	5.7	5.4	51	22		
-94	248: "	- " -	P	L		600e	3.0	3.4	47	21		
-97	249: "	- " -	P	M		600e	4.2	4.9	46	20		

Table 6: continued

Accession or Sel No	Location Row:Hill	Name or pedigree	Vigor[1]	Flowering[2]	Harv. Date	Yield[3]	Quality α	Quality β	Quality ratio	Quality CoH	Quality oil	Remarks
					Sept.	lbs/A	%	%		%	ml/100g	
8301-01	205:6-10	21397 x 19058M	VG	M	3	1843	6.4	6.2	51	30		red stem
-07	206: "	- " -	VG	M	3	1647	4.8	4.8	50	24		
-24	207: "	- " -	G	L	3	1246	4.4	5.0	47	24		
-36	208: "	- " -	VG	M	3	1621	2.3	6.7	26	35		
-51	209: "	- " -	VG-P	L	3	1023	7.4	6.0	56	31		
-57	211: "	- " -	VG-P	L	3	1741	4.7	3.4	58	27		
8303-49	214: "	21397 x 64035M	G-P	L	3	964	3.8	2.2	63	22		
-122	215: "	- " -	G	E	4	981	8.4	3.2	72	24		
21478	217: "	- " -	P-G	L	4	913	3.4	5.1	40	26	1.23	
8303-86	218: "	- " -	VG-P	M	4	1340	3.7	2.5	59	25		
8303-94	219: "	- " -	VG	L	4	1382	4.3	3.1	58	20		
8304-27	226: "	21397 x 64037M	G-VG	ME	4	998	3.2	5.7	36	23		
-32	227: "	- " -	G-P	ME	4	793	4.3	3.8	53	19		
21287	244: "	Banner	VG	E	8	2346	12.6	8.0	61	36	2.21	a few ♂ flowers, YF1
8304-15	201:12-16	21397 x 64037M	P	ME		400e	4.9	3.7	57	21		
21513	202: "	Cascade x 19058M	G-VG	ME	15	1655	13.1	6.7	66	30		
8304-20	203: "	21397 x 64037M	VP	L		200e	4.6	6.9	40	23		
-21	204: "	- " -	VP	L		200e	3.0	4.4	21	22		
21500	205: "	Cascade x 19058M	VG	M	15	2090	12.9	7.2	64	24		
21501	206: "	- " -	VG	L	15	1869	11.3	7.6	60	21		
8304-23	208:12-16	21397 x 64037M	P	L		800e	2.2	5.2	30	23		top crop
-29	209: "	- " -	P	E		1000e	2.6	3.2	45	20		
-37	212: "	- " -	P	L		800e	4.3	4.6	49	20		
-48	215: "	- " -	P	E		800e	4.8	6.2	44	24		large cones
21228	218: "	Hallertauer m.f.?	P-G	VE	8/20	785	8.1	4.4	65	27	1.05	contains farnesene, Fu-type
8025-57	219: "	19185 x 21344M	VG	ME	15	1519	8.0	3.0	73	28		
8304-54	220: "	21397 x 64037M	P	L		800e	4.8	6.0	45	23		yellow leaves
8026-152	222: "	19185 x 21353M	VG	M	15	1357	9.8	4.7	67	25		
21502	223: "	Cascade x 19058M	VG	L	15	1749	10.2	10.4	49	33		
21382	224: "	- " -	VG	L		2200e	11.5	7.7	60	21		
21251	225: "	21055 x 21109M	VG	VL		2000e	13.1	4.8	73	39		DM/crown, spikes
8304-67	226: "	21397 x 64037M	P	L		600e	6.1	7.4	45	25		
21198	227: "	65009 x 19046M	VG	VL		2400e	10.2	7.1	59	33		
21220	229: "	Eroica	VG	L		2400e	12.7	5.9	68	44		
21261	230: "	65009 x 19046M	VG	VL		2100e	8.9	6.7	57	21		
21285	231: "	BOR-704	VG	ML		2100e	2.4	2.7	47	19		
8304-89	232: "	21397 x 64037M	P	E		800e	3.8	6.6	37	24		large ruffled cones
21409	233: "	65009 x 19046M	G	L		2000e	6.9	5.3	56	23		
21503	234: "	Cascade x 19058M	VG	ML	15	2274	10.3	8.4	55	34		a few ♂ flowers
8304-90	236: "	21397 x 64037M	P	E		1200e	3.5	5.4	39	23		

Table 6: continued

Accession or Sel No	Location Row:Hill	Name or pedigree	Vigor[1]	Flowering[2]	Harv. Date	Yield[3]	Quality α	Quality β	Quality ratio	Quality CoH	Quality oil	Remarks
					Sept.	lbs/A	%	%		%	ml/100g	
8304-120	237:12-16	21397 x 64037M	P	E		1400e	4.3	5.6	44	22		
8305-18	239: "	21397 x 21237M	P	L		800e	6.6	3.9	63	22		top crop
21286	240: "	Kirin II	VG	VL		2600e	3.7	3.8	49	51		ruffled cones
8305-22	241: "	21397 x 21237M	VG-P	L	15	785	4.5	3.1	59	23		
21180	242: "	65009 x 19046M	VG	L	15	1817	10.6	8.8	55	28	1.33	Miller
8306-02	243: "	21397 x 21337M	P	M		600e	6.4	3.0	68	26		
8308-08	202:17-21	21397 x 21362M	VP	L		200e	4.8	5.7	46	26		
21181	204: "	65009 x 19046M	G	L	10	802	10.0	8.2	55	38	0.66	
8030-12	205: "	56013 x 21268M	VG	ME	10	1314	13.1	6.9	65	35		
8308-16	207: "	21397 x 21362M	P-G	L	10	930	6.2	4.3	39	26		
-36	208: "	- " -	P-G	L	10	1400e	5.4	4.6	54	23		
21225	210: "	Olympic	P	ME		1200e	11.1	4.9	69	35		a few ♂ flowers
21199	212: "	65009 x 19182M	G	ME		1800e	9.4	5.3	64	36		
8308-42	213: "	21397 x 21362M	P	L		1200e	5.4	3.4	61	20		
21247	215: "	21055 x 21108M	VG	ME		2200e	14.7	4.6	76	41		
8308-44	217: "	21397 x 21362M	G	L	11	1135	7.3	4.0	64	23		
21248	218: "	21055 x 21108M	VG	ME		2000e	17.1	7.3	70	37		Miller
8308-46	219: "	21397 x 21362M	G-VG	VE	11	790	7.6	5.1	60	27		
8030-174	220: "	56013 x 21268M	VG	E	11	1476	10.0	4.0	72	42		
8031-02	222: "	56013 x 21271M	VG	ME	11	1741	11.1	5.7	66	33		
8308-70	223: "	21397 x 21362M	P	ME		1000e	5.1	3.9	56	24		
21250	226: "	21055 x 21108M	G	ME		1800e	14.4	4.4	77	29		sparse, lg. cones
8309-04	227: "	21397 x 21381M	P	L		800e	4.8	6.1	44	32		
8031-171	231: "	56013 x 21271M	VG	M	11	2082	8.8	2.9	75	35		
8309-05	232: "	21397 x 21381M	P	E		1200e	8.3	7.1	54	22		
-06	233: "	- " -	VG-P	L		1600e	5.4	3.8	59	25		
21494	234: "	56013 x 21136M	VG	L		2400e	8.5	5.4	61	22		exc. pick, compact cone
8309-07	235: "	21397 x 21381M	VG	E	11	1340	10.4	5.7	64	25		
21495	236: "	56013 x 21136M	VG	ME		2000e	10.3	6.5	61	36		
8309-08	237: "	21397 x 21381M	VG	M	11	1160	10.6	5.5	66	23		
8032-46	238: "	56013 x 21274M	VG	L	15	1186	11.0	5.9	65	33	0.76	a few ♂ flowers
8309-10	239: "	21397 x 21381M	G	VE		1600e	5.6	5.8	49	27		
8032-65	240: "	56013 x 21274M	VG	M	15	1399	15.0	8.0	65	49		a few ♂ flowers
8309-24	241: "	21397 x 21381M	G-VG	E	15	1312	7.4	5.7	57	23	2.11	
-29	242: "	- " -	P	L		600e	8.3	5.7	59	22		
8304-91	202:23-27	21397 x 64037M	P	L		400e	7.8	6.0	57	27		
21458	203: "	- " -	P	L	8	406	4.9	5.4	48	24	0.87	
21484	204: "	21397 x 21237M	P	L	9	290	4.4	4.8	48	24	0.78	top crop
8308-15	205: "	21397 x 21362M	P-G	ME		1200e	6.3	4.9	56	25		
-44	207: "	- " -	P-G	L	8	299	6.8	4.4	61	22		

Table 6: concluded:

Accession or Sel No	Location Row:Hill	Name or pedigree	Vigor[1]	Flowering[2]	Harv. Date	Yield[3]	Quality α	Quality β	Quality ratio	Quality CoH	Quality oil	Remarks
					Sept.	lbs/A	%	%		%	ml/100g	
21239	208:23-27	Bobek	P	E		1200e	6.7	4.0	63	28		
8309-34	209: "	21397 x 21381M	P	ME		1200e	6.8	4.5	60	25		
21490	210: "	- " -	P	E	9	895	4.4	7.3	38	21	1.58	Stroh, top crop
21460	211: "	PrRi x [(GC1-XS)x XS]	P-G	L		2000e	5.2	4.1	56	30		
21240	212: "	Buket	P	E		1600e	11.9	5.7	67	23		
21253	213: "	21055 x 21109M	VG	ME		2400e	12.5	6.1	67	40		
21254	214: "	- " -	VG	L		2200e	11.1	3.4	77	27		
21455	215: "	21397 x 19058M	P	L	9	538	7.4	8.1	47	23	2.38	YF1, top crop
8033-34	216: "	56013 x 21353M	VG	L	9	1800	8.7	4.2	67	26		
21456	218: "	21397 x 64035M	P	ME	10	606	4.9	5.4	48	26	1.52	top crop
21256	219: "	21055 x 21110M	VG	E		2500e	14.6	6.1	71	43		
21457	220: "	21397 x 64035M	P	ME	10	580	6.7	4.1	62	26	1.67	top crop
8036-26	222: "	64003 x 21268M	VG	ML	10	1834	5.5	5.1	52	40		
21257	224: "	21055 x 21110M	G	E		1800e	15.1	7.6	66	40		sparse set
21504	226: "	64003 x 21268M	VG	L	10	2312	8.8	2.7	77	25	1.78	
65009	228: "	BG x EG - XS	VG	L		2000e	10.7	7.3	59	37		
8036-83	231: "	64003 x 21268M	VG	ML	10	1382	9.3	4.9	66	38		a few ♂ flowers
-84	232: "	- " -	VG	ME	10	1229	6.5	3.1	68	26		
-87	233: "	- " -	VG	M		1800e	9.3	4.2	69	37		compact cone, sparse
21505	234: "	- " -	VG	ML		2200e	8.2	2.6	76	52		
21506	235:23-27	56013 x 21137M	VG	ME		2200e	8.6	7.7	53	37		compact c., YF2
21486	239: "	- " -	VG	L		2200e	11.1	7.8	59	32		compact cone
21099	240: "	65104 x 6751-98M	P	VE	8/20	1442	10.6	8.0	57	34	2.54	DM/cones
8308-61	205:28-32	21397 x 21362M	P	L		600e	6.2	3.8	62	24		
21459	207: "	- " -	P	L	8	299	4.0	3.4	54	24	0.66	
21202	208: "	YC x 64037M	VG	ML		1900e	6.8	5.6	55	45		
21195	210: "	65009 x 64035M	G	L		1600e	10.1	4.3	70	28		
21507	216: "	6619-04 x 63015M	G	E		1600e	13.4	5.5	50	28		lg. compact cones
21508	218: "	64003 x 21271M	VG	ME	9	1212	9.3	3.0	76	32		
21509	220: "	- " -	VG	ME	9	1348	7.6	4.9	61	38		
21384	223: "	64100 x 64035M	G	E	8	964	9.1	4.8	66	33	1.58	male flowers
21510	224: "	64003 x 21271M	VG	ME	9	1297	8.1	3.3	71	30		
21226	226: "	Chinook	VG	ME		2000e	15.9	4.6	77	33	2.23	large ruffled cones
8309-05	227: "	21397 x 21381M	VG	L	9	1638	7.1	7.2	50	22		
21490	229: "	- " -	G	M	8	1519	5.6	7.7	42	20	1.48	duplicate plot
21373	230: "	65009 x 64035M	G-P	L	9	990	16.0	7.7	68	20	1.78	Miller
7003-154	231: "	65009 x 19046M	VG	L		2000e	6.7	5.4	55	38		
21197	232: "	Swiss Tettnanger	P	E	8/20	708	6.8	4.1	62	28	1.10	Fuggle type
21197	235: "	- " -	P	E	8/20	708	7.1	4.3	62	26	1.30	Fuggle type
21405	236: "	SuperAlpha	G	L		1700e	8.5	4.3	66	36		duplicate plot
21091	237: "	FuT x RV - FuS	P	E		1800e	6.4	5.0	56	29		
21511	238: "	21254 x 21328M	VG	ML		1800e	14.7	4.4	77	30		poor cone type
21512	239: "	21254 x 21335M	VG	ML		1800e	7.1	1.3	84	30		low beta
21197	240: "	Swiss Tettnanger	P	E	8/20	512	7.5	4.3	63	27	0.94	Fuggle type
21246	241: "	21055 x 21108M	VG	L		1700e	4.8	8.8	35	39		

1/ VG, G, P = very good; good; poor
2/ E, ME, M, L = early; medium early; medium; late
3/ green wt. of 5-hill plot x 0.08532; e = estimate

YF= yellow fleck, virus-like symptoms
Miller Brewing Co. Stroh and Coors are interested in genotypes indicated

Table 7: Agronomic and quality data of hops grown in the Seeded Hop Variety World Collection, Corvallis, OR. 1987. Pruned: March 30; trained: May 14-15.

Accession No.	Location Row:Hill	Name	Harv. Date	Yield[1]	Quality					Remarks
					α	β	ratio	CoH	oil	
			Aug.	lbs/A	%	%		%	ml/100 g	
19001	1:1-4	Brewer's Gold	9/10	1200e	11.4	5.6	67	45	2.40	
21185	4: "	Herbrucker-G	9/10	600e	5.4	6.6	45	23	0.97	
21179	6: "	Hersbrucker-E	9/10	400e	2.9	4.8	38	23		
21014	7: "	Hallertauer m.f.	18	498	4.7	3.4	58	19	0.64	
21015	8: "	Tettnanger	18	192						sample lost
21016	9: "	Fuggle-N	18	693	6.1	3.6	65	27		shatter
48209	10: "	Fuggle-H	18	661	5.0	2.6	66	26	0.44	
56001	11: "	Hallertauer	18	327	4.7	4.5	51	20	0.50	
56002	12: "	Bačka	9/10	600e	4.5	4.9	48	20		
61019	17: "	Yugoslavia Golding	18	242	4.4	2.7	62	25	0.71	
61020	18: "	Savinja Golding	18	331	5.0	2.4	67	27	0.93	
61021	19: "	Swiss-Tettnanger	18	43	4.8	4.5	52	23	0.76	v. poor
62013	20: "	Comet	9/10	1600e	13.6	4.3	76	42	2.46	
21187	28: "	Southern Brewer	9/10	1600e	8.7	3.6	71	42		
21227	32: "	Perle	9/3	1200e	9.0	3.4	72	30		
64017	4:5-8	Northern Brewer	19	356	9.1	3.6	72	25	1.04	
21196	7: "	Bullion 6A	9/3	1200e	10.6	5.1	67	35		
21182	8: "	Galena	9/3	1200e	13.1	7.4	64	41	1.30	
66052	10: "	Pride of Ringwood	9/10	1600e	9.2	6.0	61	33	1.12	
66050	12: "	Alliance	18	555	5.8	2.3	71	29	0.66	
21183	13: "	Eroica	9/10	1600e	13.4	4.9	73	43	1.54	
21044	19: "	Wye Northdown	18	284	8.3	4.5	64	24	1.09	
21049	20: "	Styrian Golding	18	501	5.2	2.6	66	28	0.71	
21238	22: "	Blisk	9/3	1600e	11.5	4.5	72	37		triploid
21040	23: "	Columbia	9/10	1700e	9.1	5.3	63	39		triploid
21041	24: "	Willamette	9/10	1600e	8.8	4.5	66	27		triploid
21213	25: "	Aromat	19	85						sample lost
21214	26: "	Sifem	18	170						sample lost
21215	27: "	Nordgaard 1478	18	139	8.7	4.1	68	33	1.15	
21217	29: "	Star	18	405	3.9	2.5	62	23		
21097	30: "	Hüller Bitterer	9/10	1600e	7.6	4.6	62	32		
21197	32: "	Swiss-Tettnanger (?) St-1	18	213	5.1	2.6	66	24	0.60	Fuggle type
21053	3:9-12	Aurora	9/3	1200e	11.7	4.0	74	19		
21080	8: "	Bačka	9/10	600e	5.9	6.6	47	21		
21093	12: "	Northern Brewer	19	412	9.9	3.7	72	23	1.05	
21056	13: "	Bullion 10A	9/3	1800e	11.0	4.6	70	34		
21092	14: "	Cascade	9/10	2000e	7.2	5.7	56	38		
21112	16: "	Wye Target	19	1120	12.0	5.5	69	32	0.86	
21276	23: "	Early Prolific	19	533	5.1	2.5	67	24	0.68	
21280		Pride of Kent	9/3	1600e	9.3	8.0	54	38		early
21281	28: "	Sunshine	9/3	400e	8.2	2.7	75	35	1.62	
21283	30: "	Wye Viking	9/3	363	7.3	4.3	63	23	0.84	
21396	32: "	Tolhurst	9/3	200e	1.4	2.9	33	30		

1/ e = visual estimate

Table 8. First-year production of triploid Hallertauer-derived aroma selections in Oregon. 1987.

Genotype	Pedigree[1]	Grower, location	Plot size	Harvest date	Maturity[2]	Production		Yield	Quality				Brewer rating ('86 crop)[3]		
									α	β	CoH	oil	1	2	3
			acres			lbs	bales	lbs/A	%	%	%	ml/100g	Hand	Hand	Pilot
21455	21397 x 19058M	H. Goschie, Silverton	3.3	Sept. 1	ME	3458	19	1048	6.3	8.8	22	2.08	VG	VG	VG
21456	21397 x 64035M	D. Weathers, Salem	3.4*	Aug. 25	E	2156	12	743	3.5	5.2	26	1.05	fair-VG	VG	mild
21457	- " -	R. Coleman, Gervais	3.5	Aug. 31	ME	3447	19	985	4.8	3.8	25	1.12	VG-fair	VG	VG
21458	21397 x 64037M	P. Serres, Woodburn	3.4**	Aug. 24	ME	3158	15	1089	2.6	5.6	28	0.83	Fair	Fair	Strong
21459	21397 x 21362M	R. Stauffer, Hubbard	3.3	Sept. 11	ML	7112	37	2155	3.8	3.9	26	0.80	Fair-VG	Fair	VG

* heptachlor damage - 370 hills (1/2 acre) discarded; adjusted yield

**slipdown, erratic growth - about 350 plants (1/2 acres) lost; adjusted yield

1/21397 = tetraploid Hallertauer mf
19058M = Early Green x OP
64035M = Zattler Seedling
64037M = Zattler Seedling
21362M = Cas x (BG - 19058M x 64035M)

2/E, ME, ML = early, medium early, medium late

3/Aroma rating, 1986 crop pilot brews or hand evaluation; VG = closest to Hersbrucker control

Table 9 : Additional female Hallertauer-type aroma selections from the '84 Nursery made in 1987 for planting in the Smith Yard. Pruned: March 26; trained: May 14, 1987.

Acc. or Sel. No.	Location Row:Hill	Pedigree	Matur.2/	1986 Yield	1986 α	1986 β	1986 CoH	1987 Yield	1987 α	1987 β	1987 CoH
				lb/A	%	%	%	lb/A	%	%	%
21469	11:13-16	21397 x 19058M	ME	2784	4.8	4.6	22	1000e	5.3	4.5	22
21470	18: "	- " -	ME	2176	4.0	4.2	22	600e	5.6	4.2	19
8301-21	21: "	- " -	E	2090	8.2	5.6	19				
-25	25: "	- " -	E	1685	8.3	5.0	28				
21471	19:17-20	- " -	ME	2112	8.4	5.1	19	800e	9.9	3.4	18
21473	11:21-24	21397 x 64035M	ME	1578	3.7	4.8	21	800e	4.7	5.0	19
21475	17:25-28	- " -	ME	1269	5.0	4.1	22	300e	6.3	5.2	21
21476	23: "	- " -	E	1418	5.0	3.0	20	400e	6.3	4.2	19
21477	4:29-32	- " -	M	1194	3.3	4.5	22	600e	5.3	5.7	21
8303-81	11: "	- " -	M	1493	7.0	3.0	22	300e	8.2	4.5	22
21479	14: "	- " -	L	654	5.7	3.7	22	500e	5.7	5.3	22
21480	21: "	- " -	M	768	5.4	4.2	22	300e	6.4	6.2	24
21481	6:33-36	- " -	E	1479	6.4	3.4	24	800e	7.0	4.7	23
21482	21:41-44	21397 x 64037M	ME	821	3.2	4.8	24	400e	4.0	6.3	21
8304-126	29:65-68	- " -	ME	2016	6.2	4.2	24	800e	3.0	4.8	25
8308-20	36:73-76	21397 x 21362M	ME	1909	9.4	4.1	24	1800e	6.4	4.5	26
8309-12	40:81-84	21397 x 21381M	ME	1984	8.2	3.5	18	1200e	9.3	3.2	22
-22	50: "	- " -	ME	1546	8.0	3.4	18	600e	6.6	3.7	23
-36	34:85-88	- " -	ME	1994	7.3	4.9	24	1600e	7.6	5.8	26
21397	38:85-88	tetrapl. Haller-tauer m.f.	E	341	2.7	2.5	23	200e	2.8	3.6	27

1/19058M = Early Green - OP
64035M = Zattler Seedling
64037M = - " -
21362M = Cas x [(BG-19058M) x 64035M]

2/E, ME, M, L = early, medium early, medium, late

Acc also pp. 27 (WR - Kenny report).

Table 10. Two-year comparison of additional aroma selections, Corvallis, OR., 1986, 1987 seasons.

Geno-type	Location -row:hill	Pedigree[1]	Maturity[2]	Harvest date	1987 Yield	α	β	CoH	Oil	H/C	1986 Yield	α	β	CoH	Oil	H/C	Brewer evaluation[3]
					lbs/A	%	%	%			lbs/A	%	%	%			
21470	2:62-66		ME	Aug. 28	1621	2.8	4.6	23	0.37								
	67-71				1672	3.2	4.8	23									
	72-76				1135	3.5	4.5	21									
	77-82				1365	3.5	4.7	22									
		21397 x 19058M		Avg.	1448	3.3	4.7	22			2176	4.0	4.2	22	0.63	2.36	VG
21471	3:62-66		ME	Aug. 28	1288	5.6	5.8	21	1.19								
	67-71				1313	7.8	5.6	21									
	72-76				1557	6.5	6.1	19									
		- " -		Avg.	1386	6.6	5.8	20			2112	8.4	5.1	19	1.15	2.29	G
21473	5:62-66		ME	Aug. 28	904	3.0	5.5	23	1.16								
	67-71				538	3.2	5.4	24	0.94								
	72-76				738	2.7	5.6	24									
	77-81				776	2.6	5.1	25									
		21397 x 64035M		Avg.	739	2.9	5.4	24			1578	3.7	4.8	21	1.30	3.17	G
21475	7:62-66		M	Sept. 5	861	4.5	5.0	24									
	67-71				819	4.5	5.0	25									
	72-75				885	4.2	4.7	24									
		- " -		Avg.	855	4.4	4.9	24			1269	5.0	4.1	22	1.32	3.32	G
21481	13:62-66		E	Aug. 19	1382	5.2	4.5	24									
	67-71				1057	5.3	4.6	24	0.90								
	72-77				1408	4.2	4.7	23									
	78-82				1527	5.2	4.2	24	0.86								
		- " -		Avg.	1344	5.0	4.5	24			1479	6.4	3.4	24	1.35	3.32	F
21484	16:62-65		ME	Aug. 27	1461	4.0	4.5	26	0.89								
	66-69				1194	4.3	4.5	25	1.09								
	70-74				1365	4.6	4.3	24	0.76								
	75-79				1212	4.7	4.6	26	0.97								
		21397 x 21237M		Avg.	1308	4.4	4.5	25			1344	4.2	3.7	23	0.77	3.34	Exc

1/ 21397 = tetraploid Hallertauer M.f.
19058M = Early Green x OP
64035M = Zattler Seedling
21237M = Saazer x OP

2/ E, ME, M = early; medium early; medium
3/ Exc, VG, G, F = excellent (best); very good; good; fair (1986 cr

21474	6:62-82	21397 x 64035M			1400e	8.2	4.7	23			885	5.6	4.1	21	1.06	3.48	Anh.Busch interested

Table 11: Detailed quality data of the most promising higher-alpha/aroma selections from the 1983 and 1984 Hallertauer tetraploid crosses. (For agronomic data see Tables 3, 4, 5 of the 1986 HRC report, pages 97-99, and

Selection No.	Location Row:Hill	Pedigree[1]	Year	Yield[2]	Quality α	Quality β	Quality Ratio CoH	Quality Oil	Myrcene	Humulene	Farnesene	H/C[3]	Remarks
				lbs/A	%	%	%	ml/100g	%	%	%		
8309-07	35:81-84	21397 x 21381M	1985	1849	8.0	5.4	60	27	1.43	49.0	23.3	0	3.34	vigorous
			1986	2229	9.4	5.8	62	22	1.82	49.5	24.6	0	3.22	
-08	36: "	"	1985	1450	8.4	4.7	64	26	1.79	64.9	9.4		2.01	vigorous
			1986	2830	8.8	4.7	65	23	2.16	45.6	27.6	1.1	3.25	
1490 ① -37*	35:85-88	"	1985	1830	8.6	5.9	59	21	1.38	45.5	27.4	0	3.44	
	229:28-32		1986	2244	10.3	5.8	64	20	2.14	53.9	21.3	0	5.19	seedless Smith Yd
	35:85-88		1986	1237	5.0	5.2	49	19	0.66	34.3	36.0	0	3.43	1987 - OFF Station Strah
21491 ④ 8405-26 *	149:44	21397 x 21337M	1985	VG	8.1	3.5	70	23						
			1986	1834	9.1	3.9	70	21	1.68	38.9	29.9	0	2.38	1987 - OFF Station Strah
8406-04 *	151-38	21397 x 21361M	1985	G	7.0	3.0	70	24						
			1986	1792	8.0	3.0	73	21	1.77	21.2	25.6	2.8	3.31	
-38 *	152-20	"	1985	G	7.3	3.1	70	25						
			1986	2304	8.5	3.5	71	22	1.26	48.9	26.1	2.9	3.14	
8407-35	154-03	21397 x 21380M	1985	G										
			1986	1450	9.2	3.5	73	23	1.94	46.9	24.3	3.3	2.90	
-43	154-11	"	1985	G	8.3	4.8	63	24						
			1986	1408	9.5	4.4	68	24	2.11	48.1	23.3	4.2	2.56	
21492 ③ 8408-22 *	154:35	21397 x 21381M	1985	VG	6.8	4.0	63	27						
			1986	2773	10.5	5.0	68	23	2.33	40.6	32.0	0.8	3.37	
-46	155:07	"	1985	G	7.5	3.8	66	28						
			1986	2133	8.9	4.6	66	24	1.80	49.4	24.6	1.2	3.31	
-74	155:35	"	1985	G	5.8	3.3	64	31						
			1986	2133	9.9	3.0	77	23	2.04	33.9	25.1	0.6	3.38	
21493 ② -96*	156:05	"	1985	G	6.6	3.7	64	25						
			1986	2048	8.7	4.9	64	22	2.01	49.0	23.8	1.1	3.23	

[1] 21397 = tetraploid Hallertauer m.f.
21337M = Saazer - OP
21361M = Cascade x 65009-64035M (BGxEG-XS) x ZaS
21380M = "
21381M = "

[2] G = good, VG = very good (visual estimate)

[3] Humulene/Caryophyllene

* preliminary ranking spring 1987; circled numbers indicate initial choice

Table 12: Three-year data of USDA 21490 and 21491 with higher alpha and essential oils, plus good aroma potential.

Genotype	Location	Pedigree[1]	Year	Maturity	Yield	α	β	CoH	Oil	H/C	Myrcene	Humulene	Remarks	Virus[2]
					lb/A	%	%	%	ml/100g		%	%		
21490 (Sel.8309-37)	35:85-88	21397 x 21381M	1984			5.2	6.3	18					cone analysis	
	35:85-88	- " -	1985	M	1830	8.6	5.9	21	1.38	3.44			bale analysis	0,0,0,0,0
	229:28-32	- " -	1985	M	300	7.9	7.3	21					cone analysis	
	35:85-88	- " -	1986	ME	1237	5.0	5.2	19	0.66	3.43	34.3	36.0	bale analysis	0,0,0,0,0
	229:28-32	- " -	1986	L	2244	10.3	5.8	20	2.14	5.19	53.9	21.3	bale analysis	
	35:85-88	- " -	1987	L	1418	4.4	7.4	22	1.36				bale analysis	+,+,0,0,0
	210:23-27	- " -	1987	L	895	4.4	7.3	21	1.58	3.47	66.0	17.0	bale analysis	
	229:28-32	- " -	1987	L	1519	6.0	7.6	15	1.48	3.43	65.5	16.8	bale analysis	
21491 (Sel.8405-26)	149:44	21397 x 21337M	1985	L		8.1	3.5	23					cone analysis	
	149:44	- " -	1986	M	1834	9.1	3.9	21	1.68				bale analysis	
	149:44	- " -	1987	ME	1237	6.3	4.5	22	0.88	2.73	34.5	35.5	bale analysis	0,0,0,0,0

1/ 21397 = tetraploid Hallertauer m.f.
21337M = Saazer x OP
21381M = Cas x (BG - 19058M x 64035M)

2/ PNRV (cherry), PNRV (apple), HMV, AmHLV, HLV

Table13. Combining high yield and alpha acid potential for germplasm development. Corvallis, 1986-87.

Genotype	Location Row-Hill	Pedigree 2/	Matur.	1986 Yield	1986 α	1986 β	1986 CoH	1986 Oil	1987 Yield	1987 α	1987 β	1987 CoH	1987 Oil
				lb/A	%	%	%	ml/100g	lb/A	%	%	%	ml/100g
64007	232:1-5	19105 x 19058M	L	2628	2.6	6.6	32	1.70	2278	3.0	8.0	30	0.75
21337M 1/	4:59-60	NB x Bu - 64035M	E		42-52	17-21	17-22						
21361M 1/	50;59-60	Cas x (BG-19058Mx64035M)	E		32-42	23-28	12-19						
8411-15	161:24	64007 x 21337M	L	1920	7.9	3.0	20		1834	9.1	4.3	24	0.96
-135	163:40	- " -	L	1663	7.9	3.8	28		2261	8.9	4.2	30	1.45
-150	164:03	- " -	L	1749	9.8	3.4	23		2475	9.7	3.8	25	
-157	:10	- " -	L	1792	7.8	3.5	28		2218	7.2	4.5	30	
8412-19	166:33	64007 x 21361M	ME	2471	9.2	3.5	21		2815	11.2	4.4	23	
-22	:36	- " -	M	2304	7.0	3.1	23		1834	10.8	4.0	26	
-58	167:20	- " -	M	1920	10.0	4.7	23		2389	10.9	5.7	20	
-75	:37	- " -	ME	1621	8.0	3.4	21		2303				1.91
-135	168:45	- " -	L	2133	7.1	3.1	38		2304	8.3	5.0	38	1.31
-150	169:08	- " -	L	2133	7.4	3.7	33		2048	4.9	5.6	35	
-188	:46	- " -	L	1792	10.1	5.6	29		1792	10.8	6.9	27	
-214	170:20	- " -	L	1792	7.1	3.2	21		2389	9.0	4.0	25	
-225	:31	- " -	L	2133	6.9	2.8	26		2261	7.8	3.9	25	
-234	:40	- " -	L	2005	6.6	2.2	37		2432	6.8	3.9	35	0.68

1/ 6-year data

2/ 64007 =(Late Grape S x Fu-FuS)x Early Green-CP

Table 14: Female Hallertauer-type selections from the '85 Nursery grown at Corvallis in 1986 and 1987. Pruned: April 2; trained: May 5-8, 1987.

Acc. or Sel. No.	Location Row:Hill	Pedigree[1]	Matur.[2]	1986 Yield	α	β	Ratio	CoH	1987 Yield	α	β	Ratio	CoH	Remarks
				lb/A	%	%		%	lbs/A	%	%		%	
8401- 04	137:04	21397 x 19172M	ME	1621	8.0	4.7	63	25	1600e	9.5	5.8	62	25	oil 1.72
- 34	34	"							1300e	5.6	5.2	51	30	very vigorous
- 41	41	"	ML	1920e	3.7	2.4	61	20	1900e	3.1	3.8	45	27	
- 65	138:13	"	L	1706e	8.1	3.4	71	19	1800e	7.5	4.9	61	23	
- 68	16	"	ME	1920e	5.6	2.6	68	22	1800e	6.1	4.1	59	27	
- 70	18	"	ME	1066e	8.2	3.9	68	24	1700e	6.5	4.1	61	30	
- 76	24	"	ME	1920e	6.3	3.2	66	22	1900e	3.6	3.5	50	30	
-113	139:09	"	L	1706e	5.6	2.7	67	17	1400e	5.9	3.6	62	28	
-132	28	"	E						2432	6.0	5.7	52	24	vigorous, large cones
-145	41	"	E	1280e	7.4	3.5	68	25	1400e	9.0	4.9	65	20	
-158	140:02	"	M	1066	8.3	3.6	69	22	1600e	10.5	6.0	64	26	
-163	07	"	M	1066	7.2	3.1	70		1400e	8.9	4.0	69	26	large cones
-175	19	"	M						1400e	10.1	4.5	69	26	large cones
-192	36	"	M	1280e	7.3	3.2	70	26	1400e	9.0	4.8	65	26	
-196	40	"	E						2389	5.4	4.9	52	26	large cones, mites
8402- 21	141:10	21397 x 21087M	L	1706e	7.1	2.3	75	19	1800e	6.8	4.3	61	24	small cones
- 36	25	"	M	1493e	6.1	2.7	69	22	1500e	9.6	4.8	67	26	
- 45	34	"	M	1493e	5.8	2.1	73	22	1500e	7.3	3.0	71	26	
- 68	142:05	"	E	1280e	5.1	2.3	69	22	1877	6.8	3.2	68	22	
- 80	17	"	M	1621	7.0	2.6	73	23	1600e	7.4	3.4	69	27	
- 93	30	"	E						2453	6.1	2.7	69	25	
- 99	36	"	ME	1408	7.3	2.7	73	24	1450	7.4	3.0	71	26	oil 1.51
-106	43	"	M	1706	6.5	2.8	70	23/	1400e	8.8	3.6	71	22	
-136	143:21	"	M	1280	7.5	2.4	76	20	1600e	8.4	3.4	71	24	
8403- 03	144:19	21397 x 21088M	E	1920e	6.4	3.2	66	22	2133	5.0	4.0	56	23	
- 07	23	"	E	1920e	6.3	3.3	66	18	2346	5.5	3.4	62	18	very low CoH
- 41	145:05	"	L	2282	6.3	3.8	62	19	1000e	6.7	4.3	61	21	
- 45	09	"	M	2517	8.0	4.0	67	19	1200e	7.0	4.1	63	19	oil 0.98
- 86	50	"	L	1920e	5.3	2.0	73	16	1900e	5.0	3.3	60	15	very low CoH
-111	146:23	"	ME						2048	4.5	3.1	60	26	
-112	24	"	L	1920e	6.1	2.2	73	19	1500e	6.3	3.8	63	20	
-129	41	"	ME						2176	4.2	3.1	58	20	
8404- 03	47	21397 x 21090M	L	1920e	5.4	2.2	71	16	1600e	4.1	4.6	47	18	very low CoH
- 06	50	"	L	1706e	5.6	2.0	74	20	1400e	5.3	4.4	54	20	
- 18	147:10	"	L	2005	6.7	4.5	60	19	1400e	3.2	4.5	41	18	very low CoH
- 23	15	"	M		7.0	3.6	66	19	1800e	4.4	3.9	53	23	
- 63	148:03	"	L	1920e	6.4	3.4	65	16	1600e	7.0	4.6	61	16	very low CoH
- 72	12	"	M	1706e	5.4	1.6	77	18	1800e	7.5	4.3	64	21	
- 79	19	"	M	1920e	6.8	3.2	68	19	1900e	6.4	5.3	55	21	
- 88	28	"	L	1700e	7.2	2.6	74	18	1800e	5.3	6.4	45	21	
- 89	29	"	L	2133e	6.0	2.3	73	18	1600e	7.1	4.3	62	18	very low CoH
-106	46	"	L	1664	7.1	2.5	74	18	2000e	7.7	5.7	58	19	very low CoH
8405- 02	149:20	21397 x 21337M	ME	2474	7.4	3.2	70	23	2000e	4.6	4.4	51	38	small cones
- 10	28	"	E						1621	7.8	4.3	65	27	
- 13	31	"	M						1749	6.6	4.5	60	24	
- 24	42	"	ME	1962	6.0	2.3	72	23	1493	6.2	3.1	66	23	
21491	44	"	ME	1834	9.1	3.9	70	21	1237	6.3	4.5	58	22	5A off station
8405- 27	45	"	ME	1536	7.5	3.3	69	20	1322	6.2	3.9	61	22	
- 31	49	"	M	1365	8.6	3.2	73	21	1600e	7.6	5.2	59	24	
- 38	150:04	"	M	1621	7.0	3.6	66	23	1400e	8.3	4.6	64	25	
- 39	05	"	ME						2474	8.6	5.5	61	26	
- 45	11	"	ME						2474	7.6	3.3	70	26	
- 52	18	"	E						1365	7.9	4.6	63	27	
- 59	25	"	E						2005	6.6	4.0	62	23	
- 84	50	"	E						1621	9.3	3.7	72	20	
-101	151:15	"	E						2261	9.0	4.2	68	20	
-103	17	"	M	1322	6.8	2.5	73	19	1557	8.1	3.2	71	19	very low CoH
-104	18	"	E	1493	8.2	2.8	75	25	1408	9.0	4.1	69	25	

Table 14. Continued

Acc. or Sel. No.	Location Row:Hill	Pedigree[1]	Matur.[2]	1986 Yield	α	β	Ratio	CoH	1987 Yield	α	β	Ratio	CoH	Remarks
				lb/A	%	%		%	lbs/A	%	%		%	
8406- 04	151:38	21397 x 21361M	ME	1792	8.0	3.0	73	21	2176	8.7	2.7	76	21	
- 16	50	"	ME						1408	7.5	5.6	57	24	
- 26	152:08	"	ME	2602	7.3	2.8	72	27	2474	7.6	3.2	70	26	
- 30	12	"	M	1706	6.5	2.0	77	25	1400e	8.0	4.4	64	27	
- 38	20	"	ME	2304	8.5	3.5	71	22	2282	8.5	3.4	72	22	
- 44	26	"	ME	1408	7.2	2.5	74	21	1400e	7.9	4.3	65	23	
- 45	27	"	ME	1749	7.1	2.7	73	25	1877	8.2	2.8	74	25	
- 49	31	"	ME	1365	6.0	2.4	71	20	1800e	9.1	3.1	75	22	
- 54	36	"	L	1962	6.2	2.6	71	22	1600e	5.6	4.7	54	23	compact cone
- 58	40	"	M	1792	7.8	3.2	71	19	1450	6.5	3.8	63	24	compact cone
- 62	44	"	ME	1280	8.1	2.4	77	20	1450	9.5	4.5	68	21	
- 64	46	"	ME	1664	7.1	3.0	70	28	1536	8.0	3.8	68	25	
- 65	47	"	M	1280	7.1	2.7	72	15	1792	7.7	3.9	66	17	very low CoH
- 79	153:09	"	M	1920	7.3	2.4	75	23	1600e	8.0	4.3	65	23	
- 84	14	"	ME	2133e	8.3	2.8	75	21	1962	8.6	3.8	69	22	
- 85	15	"	ME	1706e	7.0	2.6	73	26	1792	8.0	4.1	66	24	
- 88	18	"	E	1706e	8.8	3.9	70	22	1877	9.2	5.1	64	22	
- 90	20	"	M	1920e	8.3	3.1	73	20	2000e	8.3	4.1	67	20	small cones
8407- 01	23	21397 x 21380M	M	1578	6.6	2.6	72	21	1600e	6.2	3.4	65	18	small cone
- 06	26	"	M	1706	10.6	4.1	72	22	1365	8.4	5.1	62	23	large cone
- 08	28	"	M	1834	7.6	2.9	72	28	1400e	7.2	3.9	65	26	
- 15	35	"	M						1856	7.8	4.4	64	27	
- 20	40	"	ME	1578	9.1	3.5	72	22	1493	8.5	4.1	68	25	sparse
- 22	42	"	M	1664	8.5	2.9	75	25	1400e	7.3	4.0	64	24	small cone
- 23	43	"	M	1152	6.9	3.4	67	28	1600e	8.5	4.9	65	23	
- 26	46	"	M	1578	8.1	3.5	70	30	1024	9.5	4.6	67	28	compact cone
- 35	154:03	"	M	1450	9.2	3.5	73	23	1450	9.2	4.1	69	25	
- 37	05	"	M	1920	7.7	3.1	72	26	1664	8.4	3.1	73	30	compact cone
- 38	06	"	M	1493e	7.3	2.9	72	27	1400e	10.8	4.6	70	30	
- 42	10	"	L	1706e	6.9	2.5	74	23	1400e	8.5	4.6	65	24	
- 43	11	"	M	1408	9.5	4.4	68	24	1536	9.9	4.9	67	23	high oil
8408- 01	14	21397 x 21381M	M	1493	8.3	4.4	65	27	1962	10.1	5.2	66	26	large cone
- 04	17	"	ME	2432	10.6	4.8	69	24	2261	10.7	5.5	66	24	oil 1.80
- 06	19	"	M	1493e	8.9	4.3	67	25	1600e	10.1	5.4	65	26	
- 11	24	"	M	1280e	8.6	4.8	64	23	1664	10.3	5.7	65	22	large cone
- 12	25	"	M	1280e	9.1	4.2	69	20	1800e	9.5	5.0	65	23	
- 16	29	"	ME	1493e	10.1	6.3	62	21	1800e	10.9	9.2	53	26	
- 18	31	"	M	2218	10.1	3.5	74	24	1578	6.9	7.0	50	27	oil 1.82
- 19	32	"	M	1493e	10.4	4.9	68	24	1400e	2.0	1.7	55	21	oil 1.69
21492	35	"	ME	2773	10.5	5.0	68	23	2005	7.2	5.7	56	24	oil 1.86
8408- 30	43	"	ME	1408	8.8	4.5	66	14	1792	7.9	5.8	58	24	
- 31	44	"	L	1450	10.4	5.8	64	22	1408	7.5	7.8	49	23	
- 43	155:04	"	M	2133e	8.7	4.4	66	25	2389	8.3	4.0	67	27	compact cone
- 46	07	"	ME	2133	8.9	4.6	66	24	2901	6.9	6.7	51	25	oil 1.80
- 47	08	"	E	1706	9.1	2.6	78	21	1920	6.6	6.7	50	23	
- 51	12	"	M	1621	7.4	3.3	69	22	1600e	9.1	4.2	69	23	
- 61	22	"	ME	1749	10.3	4.2	71	24	2240	10.2	4.6	69	25	oil 1.58
- 63	24	"	M	1365	8.9	4.1	69	23	1600e	10.3	5.2	66	24	oil 1.72
- 66	27	"	ME	2133	8.7	6.6	57	18	2304	9.3	6.7	58	18	oil 1.53; low CoH
- 70	31	"	ME	1280e	8.8	4.1	68	24	2261	9.5	5.2	65	25	
- 72	33	"	M	2133	8.2	3.8	68	21	2000e	9.0	5.1	64	20	oil 1.12
- 74	35	"	ME	2133	9.9	3.0	77	23	2517	8.5	4.4	66	25	
- 79	40	"	M	1621	8.8	5.2	63	20	1600e	9.9	5.5	64	21	
- 80	41	"	M	1493	5.8	4.3	57	20	1800e	7.8	5.9	57	22	compact cone
- 82	43	"	M	1280e	9.4	3.8	71	22	2133	9.8	4.4	69	24	large compact cone
- 89	50	"	M	1493	7.2	3.4	68	22	1800e	8.9	6.0	60	24	
- 92	156:01	"	E	1066	7.6	3.5	69	19	2000e	8.7	4.7	65	22	compact cone
- 93	02	"	M	1066	8.1	3.7	69	25	1800e	9.8	5.9	62	27	compact cone
21493	05	"	M	2048	8.7	4.9	64	22	2517	8.5	5.3	61	22	oil 2.11

Table 14: Concluded.

Acc. or Sel. No.	Location Row:Hill	Pedigree[1]	Matur.[2]	1986 Yield[3]	1986 α	1986 β	1986 Ratio	1986 CoH	1987 Yield[3]	1987 α	1987 β	1987 Ratio	1987 CoH	Remarks
				lb/A	%	%		%	lbs/A	%	%		%	
8408-106	156:15	21397 x 21381M	ME	1920e	8.6	5.2	62	23	2005	4.8	6.8	41	27	
-108	17	"	M	1706e	7.4	3.4	68	25	2000 e	9.9	6.8	59	23	
-114	23	"	ME	1706e	8.8	5.5	61	25	2261	6.3	8.2	44	26	
-115	24	"	M	1493	9.0	4.1	69	17	1800e	8.0	5.7	59	21	
-119	28	"	M	1920e	8.2	3.5	70	18	1700e	6.6	5.9	53	25	
-125	34	"	M	1706e	7.7	4.2	65	19	1600e	7.4	5.3	58	21	compact cone
-126	35	"	ME	1706e	9.7	4.5	68	21	2176	9.5	4.6	67	23	oil 1.87
8409- 18	157:17	21397 x 64033M	ME	2090	8.0	3.6	69	23	1664	8.4	2.9	75	21	oil 1.42
8410- 16	159:01	21397 x 64037M	ME	1280e	7.6	6.0	56	27	2090	7.2	6.0	55	24	
- 26	11	"	L	1706	7.8	5.7	58	25	1962	3.9	6.2	38	21	
- 28	13	"	L	1706	8.8	5.3	62	23	1834	4.4	6.9	39	23	
- 52	37	"	L	1578	6.9	5.1	58	27	2090	4.4	6.0	42	25	
- 57	42	"	L	1834	8.0	5.6	59	24	2048	6.2	4.9	56	22	
- 69	160:02	"	L	1280e	6.8	5.7	54	26	1800e	8.3	6.2	57	22	
- 75	08	"	L	2176	8.2	6.4	56	26	1800e	8.5	5.9	59	22	
- 80	13	"	L	1962	7.3	6.4	53	24	2346	8.1	5.2	61	22	
- 85	18	"	L	1706e	7.6	5.6	58	25	1834	7.6	5.2	59	22	
- 86	19	"	ME	1920	7.1	5.2	58	24	2261	7.2	4.2	63	22	
- 96	29	"	ME	2218	7.9	6.6	54	28	2602	6.2	6.3	50	24	
-102	35	"	ME	1706e	7.8	6.0	56	28	1792	7.0	5.5	56	24	

[1]/21397 = tetraploid Hallertauer m.f.
19172M = Cat's tail x Fu - FuS
21087M = Yugoslavian 3/3
21088M = Yugoslavian 5/9
21090M = Yugoslavian 12/17
21337M = No. Brewer x 64035M
21361M = Cascade x 65009 - 64035M
21380M = - " -
21381M = - " -
64033M = Zattler Seedling
64037M = Zattler Seedling

[2]/E, ME, M, L = early; medium early; medium; late

[3]/ e = visual estimate

Table 15: Female Selections from the '85 Nursery for High-Yield Germplasm Development.
Pruned: April 2; trained: May 5-8. 1987

Acc. or Sel. No.	Location Row:Hill	Pedigree 1/	Matur. 2/	3/ 1986 Yield	α	β	Ratio	CoH	3/ 1987 Yield	α	β	Ratio	CoH	Remarks
				lb/A	%	%		%	lbs/A	%	%		%	
8411- 15	161:24	64007 x 21337M	M	1920e	7.9	3.0	72	20	1834	9.1	4.3	68	24	
- 25	34	"	M						1834	9.0	4.0	69	25	
- 27	36	"	M						2000e	9.3	3.9	71	25	
- 29	38	"	L	1280	6.7	2.5	72	23	1877	9.2	3.2	74	23	
- 40	49	"	E						1920	8.3	3.5	71	24	
- 42	51	"	E	1706e	5.5	2.3	71	21	1493	9.5	3.7	72	27	
- 49	162:06	"	E						2304	8.2	3.4	71	27	
- 64	21	"	E	1493e	7.4	3.9	66	29	1749	8.6	3.6	70	32	
- 75	32	"	E	1280	8.3	2.9	74	21	1877	9.2	2.8	76	23	
-135	163:40	"	E	1663	7.9	3.8	68	28	2261	8.9	4.2	68	30	shatter
-150	164:03	"	E	1749	9.8	3.4	74	23	2474	9.7	3.8	72	25	
-157	10	"	E	1792	7.8	3.5	69	28	2218	7.2	4.5	61	30	
-170	23	"	ME						2000e	7.5	3.6	68	20	
-201	165:02	"	M	1493	4.9	1.6	75	21	1600e	7.8	5.3	59	21	
-204	05	"	E	1024	7.5	3.3	69	20	1493	10.4	4.4	70	21	
-229	30	"	E	1365	6.4	2.9	69	30	1621	10.4	3.6	74	35	
-262	166:11	"	E	1536	6.7	3.3	67	26	1792	9.6	4.8	67	27	shatter
8412- 02	16	64007 x 21361M	ME	1578	9.8	5.2	65	40	2005	10.1	5.6	64	38	
- 10	24	"	ME	1450	9.5	5.9	62	41	1621	9.3	7.2	56	38	
- 12	26	"	M	1706e	7.0	2.4	75	22	2261	8.2	4.1	67	22	compact cone
- 16	30	"	ME	1792	8.7	3.6	71	25	1578	11.4	4.6	71	30	small compact cone
- 19	33	"	ME	2474	9.2	3.5	72	21	2815	11.2	4.4	72	22	med. large compact c.
- 22	36	"	E	2304	7.0	3.1	70	23	1834	10.8	4.0	73	26	excellent set
- 25	39	"	ME	2432	5.3	2.8	65	33	1920	7.2	4.5	62	27	
- 34	48	"	M	2133	5.5	1.9	74	24	1322	9.5	4.7	67	29	
- 46	167:08	"	ME						1800e	10.2	3.9	72	22	
- 51	13	"	ME	1536	8.1	3.1	72	23	1400e	10.2	4.0	72	24	
- 58	20	"	M	1920	10.0	4.7	68	23	2389	10.9	5.7	65	20	
- 75	37	"	ME	1621	8.0	4.3	70	21	2303	10.0	4.3	70	25	
- 77	39	"	M	2133	6.2	2.4	72	24	2000e	8.7	4.6	66	19	
- 79	41	"	M	1706e	8.4	3.7	70	28	1749	10.0	5.2	66	29	yellow fleck
- 88	50	"	M	1493e	6.3	2.5	72	19	1800e	9.3	4.5	68	23	
-101	168:11	"	ME	1962	9.4	4.6	67	19	1450	9.3	5.4	63	20	
-121	31	"	M	1706	7.5	4.3	64	36	1749	10.4	6.2	63	37	
-125	35	"	M	2133e	6.6	3.9	63	27	2346	8.5	5.8	59	28	
-135	45	"	M	2133e	7.1	3.1	70	38	2304	8.3	5.0	62	38	
-138	48	"	M	2346e	7.7	3.1	71	21	2304	9.9	5.4	65	25	
-139	49	"	M	1920e	7.0	2.7	72	20	1664	8.2	3.5	70	21	
-150	169:08	"	M	2133e	7.4	3.7	67	33	2048	4.9	5.6	46	35	exc. picker
-166	24	"	M	1920	7.7	4.8	62	23	2176	8.0	5.5	60	23	
-183	41	"	ME	1493	8.3	4.0	68	24	1920	10.4	4.9	68	27	
-188	46	"	ME	1792	10.1	5.6	64	29	1792	10.8	6.9	61	27	compact cone
-196	170:02	"	E	1706	8.4	4.1	67	34	1900e	10.3	5.2	66	36	compact cone
-199	05	"	M	1706	7.9	3.4	70	18	1900e	9.5	5.1	65	26	compact cone
-207	13	"	M	1706	5.9	1.9	76	21	1800e	9.4	3.7	72	22	compact cone
-214	20	"	ME	1792	7.1	3.2	69	21	2389	9.0	4.0	69	25	
-222	28	"	M	1920e	7.0	3.3	68	23	1800e	7.4	4.9	60	24	exc. picker
-225	31	"	M	2133e	6.9	2.8	71	26	2261	7.8	3.9	66	25	
-234	40	"	M	2005	6.6	2.2	75	37	2432	6.8	3.9	64	35	
64007	17:49-50	19105 x 19058M		2628	2.6	6.6	28	32	2000e	3.2	8.5	27	28	control

1/ 64007 = (LGpS x Fu-FuS) x EG - XS
21337M = No. Brewer x Bu - 64035M
21361M = Cascade x [(BG x EG - XS) x 64035M)]

2/ E, ME, M, L = early; medium early; medium; late

3/ e = visual estimate

2/ E, ME, M,L = early, med.early, medium, late
3/ e = visual estimate

Table 16: Vigorous male selections from the '85 Nursery for planting in a 2-hill Observation Nursery. Pruned: April 2; trained: May 5-8. 1987.

Selection Number	Location Row:Hill	Pedigree[1]	Maturity[2]	Vigor[3]	Remarks
8401- 37M	137:37	21397 x 19172M	M	VG	monoecious, probably triploid
- 93M	138:41	"	E	VG	" " , mostly male
-105M	139:01	"	M	VG	" "
-190M	140:34	"	M	VG	" "
8402- 89M	142:26	21397 x 21087M	E	VG	" "
- 92M	29	"	ME	G-P	" " , mostly male
-102M	39	"	M	VG	" "
-124M	143:09	"	M	VG	" "
-172M	144:05	"	ME	VG	" " , mostly male
8403- 15M	31	21397 x 21088M	L	VG	" "
- 27M	43	"	M	VG	" " , mostly male
- 28M	44	"	M	VG	" "
- 57M	145:21	"	M	VG	" "
- 69M	33	"	ME	VG	" "
- 72M	36	"	ML	VG	" "
-115M	146:27	"	M	VG	" "
8404- 33M	147:25	21397 x 21090M	ME	VG	" "
- 47M	39	"	ML	VG	" "
- 75M	148:15	"	M	VG	" " , mostly male
- 92M	32	"	ME	VG	" " , mostly male
-128M	149:16	"	ME	VG	" "
8405- 43M	150:09	21397 x 21337M	E	G	" "
- 62M	28	"	M	VG	" " , mostly male
8406- 06M	151:40	21397 x 21361M	ME	VG	" "
- 09M	43	"	E	VG	" " , mostly male
- 23M	152:05	"	E	VG	" " , mostly male
- 32M	14	"	E	VG	" "
- 37M	19	"	E	G-P	" "
- 60M	42	"	ME	G	" "
- 73M	153:03	"	E	VG	" " , mostly male
8408- 35M	154:48	21397 x 21381M	E	VG	" " , mostly male
- 54M	155:15	"	ME	VG	" "
-110M	156:19	"	E	VG	" "
-129M	38	"	E	VG	" " , mostly male
8409- 14M	157:13	21397 x 64033M	E	G	" " , mostly male
- 17M	16	"	E	VG	" " , mostly male
- 64M	158:11	"	E	VG	" " , mostly male
- 68M	15	"	M	VG	" "
8410- 88M	160:21	21397 x 64037M	M	VG	" " , mostly male
- 90M	23	"	M	VG	" "
-124M	161:05	"	M	G	
8411- 04M	161:13	64007 x 21337M	E	G	probably diploid
- 21M	30	"	E	G-P	"
- 69M	162:26	"	E	VG	"
- 86M	43	"	E	VG	"
- 93M	50	"	E	VG	"
- 99M	163:04	"	E	VG	"
-104M	:09	"	E	VG	"
-174M	164:27	"	ME	G	"
-203M	165:04	"	E	G-P	"
-215M	16	"	E	P-G	"
-217M	18	"	E	G-P	"
-236M	37	"	E	G	"
-260M	166:09	"	E	VG	"
-263M	12	"	E	G	"
8412- 07M	21	64007 x 21361M	ME	G	" , yellow fleck
- 14M	28	"	E-M	VG	"
- 57M	167:19	"	ML	VG	"
-118M	168:28	"	E	G	"
-119M	29	"	E	G	"
-198M	170:04	"	G	ME	"

[1]/21397 = tetraploid Hallertauer m.f.
64007 = (LGpS x Fu - FuS) x EG - XS

19172M = Cat's Tail x Fu - FuS
21087M = Yugoslavian 3/3
21088M = Yugoslavian 5/9
21090M = Yugoslavian 12/17
21337M = No. Brewer x Bu- 64035M
21361M = Cascade x 65009 - 64035M
21381M = " - "

[2]/E, ME, M, ML, L = early; med. early; medium; med. late; late

[3]/P, G, VG = poor; good; very good

Table 17 : Diploid male selections from the '85 Nursery for high-yield germplasm development to be planted in a 2-hill Observation Nursery. Pruned: April 2; trained May 5-8, 1987.

Selection Number	Location Row:Hill	Pedigree[1]	Maturity[2]	Vigor[3]	Remarks
8411- 04M	161:13	64007 x 21337M	VE	G	
- 21M	30	"	VE	G	
- 69M	162:26	"	E	G	
- 86M	43	"	E	VG	
- 93M	50	"	ME	VG	
- 99M	163:04	"	ME	VG	
-104M	09	"	E	G-VG	
-174M	164:27	"	ME	G-VG	
-203M	165:04	"	E	G-P	
-215M	16	"	VE	G-P	
-217M	18	"	VE	G-P	
-236M	37	"	E	G	
-260M	166:09	"	VE	VG	
-263M	12	"	E	G	
8412- 07M	21	64007 x 21361M	ME	G	Yellow fleck
- 14M	28	"	L	VG	
- 57M	167:19	"	M	VG	
-118M	168:28	"	E	G	
-119M	29	"	E	G-P	
-198M	170:04	"	ME	G	

[1]/64007 = (LGpS x Fu - FuS) x (EG-XS)
21337M = No. Brewer x Bu-64035M
21361M = Cascade x [(BG x EG-XS) x 64035M]

[2]/VE, E, ME, M, L = very early, early, medium early, medium, late

[3]/P, G, V = poor, good, very good

for 1986/85 data: see 1986 USDA Rep. p. 54.

Table 18 : Virus data of Oregon-grown triploid Hallertauer seedling selection and controls: ELISA tests by C. B. Skotland, Prosser, WA.

Accession or Sel. No.	Location Row:Hill	Name or Pedigree	March 1987[1/] PNRV	CAMV	HMV	HLV	AHLV
Cross 8301							
8301-01	1:13-16	21397 x 19058M	-	-	-	+	-
-02	2: "	"	-	-	-	-	-
-03	3: "	"	-	-	-	+	-
-04	4: "	"	-	-	-	-	-
-05	5: "	"	-	-	-	-	-
-06	6: "	"	-	-	-	-	-
-07	7: "	"	-	-	-	+	-
-08	8: "	"	-	-	-	-	-
-09	9: "	"	-	-	-	-	-
-10	10: "	" (21455)	-	-	-	-	+
-11	11: "	" (21469)	-	-	-	-	-
-12	12: "	"	-	-	-	-	-
-13	13: "	"	-	-	-	+	-
-14	14: "	"	-	-	-	+	-
-15	15: "	"	-	-	-	+	-
-16	16: "	"	-	-	-	+	-
-17	17: "	"	-	-	-	+	-
-18	18: "	" (21470)	-	-	-	+	-
-19	19: "	" (21471)	-	-	-	-	-
-20	20: "	"	-	-	-	-	-
-21	21: "	"	-	-	-	+	-
-22	22: "	"	-	-	-	-	-
-23	23: "	"	-	-	-	+	-
-24	24: "	"	-	-	-	+	-
-25	25: "	"	-	-	-	-	-
-26	26: "	"	-	-	-	-	-
-27	27: "	"	-	-	-	-	-
-28	28: "	"	-	-	-	-	-
-29	29: "	"	-	-	-	-	-
-30	30: "	"	-	-	-	+	-
-31	31: "	"	-	-	-	-	-
-32	32: "	"	-	-	-	+	-
-33	33: "	"	-	-	-	-	-
-34	34: "	"	-	-	-	-	-
-35	35: "	"	-	-	-	-	-
-36	36: "	"	-	-	-	-	-
-37	37: "	"	-	-	-	-	-
-38	38: "	"	-	-	-	-	-
-39	39: "	"	-	-	-	-	-
-40	40: "	"	-	-	-	+	-
-41	41: "	"	+	-	-	-	-
-42	42: "	"	-	-	-	-	-
-43	43: "	"	-	-	-	-	-

Table 18: continued

Accession or Sel. No.	Location Row:Hill	Name or Pedigree	March 1987[1/] PNRV	CAMV	HMV	HLV	AHLV
8301-44	1:17-20	21397 x 19058M	-	-	-	+	-
-45	2: "	"	-	-	-	-	-
-46	3: "	"	-	-	-	+	+
-47	4: "	"	-	-	-	+	-
-48	5: "	"	-	-	-	-	-
-49	6: "	"	-	-	-	-	-
-50	7: "	"	-	-	-	-	-
-51	8: "	"	-	-	-	-	-
-52	9: "	"	-	-	-	-	-
-53	10: "	"	-	-	-	-	-
-54	11: "	"	-	-	-	+	-
-55	12: "	"	+	+	-	-	-
-56	13: "	"	-	-	-	-	-
-57	14: "	"	-	-	-	+	-
-58	15: "	"	+	+	-	-	-
-59	16: "	"	-	-	-	-	-
-60	17: "	"	-	-	-	-	-
-61	18: "	"	-	-	-	-	-
-62	19: "	" (21471)	-	-	-	+	-
-63	20: "	"	-	-	-	-	-
-64	21: "	"	-	-	-	-	-
-65	22: "	"	-	-	-	-	-
-66	23: "	"	-	-	-	-	-
-67	24: "	"	-	-	-	-	-
-68	25: "	"	-	-	-	-	-
-69	26: "	"	-	-	-	-	-
-70	27: "	"	-	-	-	-	-
-71	28: "	"	-	-	-	-	-
-72	29: "	"	-	-	-	-	-
-73	30: "	"	-	-	-	-	-
-74	31: "	"	-	-	-	-	-
-75	32: "	"	-	-	-	-	-

Table 18 : continued

Accession or Sel. No.	Location Row:Hill	Name or Pedigree	March 1987[1/] PNRV	CAMV	HMV	HLV	AHLV
Cross 8302							
8302-01	33:17-20	21397 x 64033M	-	-	-	-	-
-02	34: "	"	-	-	-	-	-
-03	35: "	"	-	-	-	-	-
-04	36: "	" (21472)	-	-	-	+	-
-05	37: "	"	-	-	-	+	-
-06	38: "	"	-	-	-	-	-
-07	39: "	"	-	-	-	-	-
-08	40: "	"	-	-	-	-	-
-09	1:21-24	"	-	-	-	-	-
-10	2: "	"	+	+	-	-	-
-11	3: "	"	-	-	-	-	-
-12	4: "	"	-	-	-	-	-
-13	5: "	"	-	-	?	+	-
-14	6: "	"	-	-	-	-	-
-15	7: "	"	-	-	?	+	-
-16	8: "	"	-	-	-	-	-
-17	9: "	"	-	-	-	-	-
-18	10: "	"	-	-	-	-	-

Table 18 : continued

Accession or Sel. No.	Location Row:Hill	Name or Pedigree	March 1987[1/] PNRV	CAMV	HMV	HLV	AHLV
Cross 8303							
8303-01	11:21-24	21397 x 64035M (21473)	-	-	-	-	-
-02	12: "	"	-	-	-	-	-
-03	13: "	"	-	-	-	-	-
-04	14: "	"	-	-	-	-	-
-05	15: "	"	-	-	-	-	-
-06	16: "	" (21474)	-	-	-	-	-
-07	17: "	"	-	-	-	-	-
-08	18: "	"	-	-	-	+	-
-09	19: "	"	-	-	-	-	-
-10	20: "	"	-	-	-	-	-
-11	21: "	"	-	-	-	-	-
-12	22: "	"	-	-	-	-	-
-13	23: "	"	-	-	-	-	-
-14	24: "	"	-	-	-	-	-
-15	25: "	"	-	-	-	-	-
-16	26: "	"	-	-	-	-	-
-17	27: "	"	-	-	-	-	-
-18	28: "	"	-	-	-	-	-
-19	29: "	"	-	-	-	-	-
-20	30: "	"	-	-	-	-	-
-21	31: "	"	-	-	-	-	-
-22	32: "	"	-	-	-	-	-
-23	33: "	"	-	-	-	-	-
-24	34: "	"	-	-	-	-	-
-25	35: "	"	-	-	-	-	-
-26	36: "	"	-	-	-	-	-
-27	37: "	"	-	-	-	-	-
-28	38: "	"	-	-	-	-	-
-29	39: "	"	-	-	-	-	-
-30	40: "	"	-	-	-	-	-
-31	1:25-28	"	-	-	-	-	-
-32	2: "	"	-	-	-	-	-
-33	3: "	"	-	-	-	-	-
-34	4: "	"	-	-	-	-	-
-35	5: "	"	-	-	-	-	-
-36	6: "	"	-	-	-	-	-
-37	7: "	"	-	-	-	-	-
-38	8: "	"	-	-	-	-	-
-39	9: "	"	-	-	-	-	-
-40	10: "	"	-	-	?	+	-
-41	11: "	"	-	-	-	-	-
-42	12: "	"	-	-	-	-	-
-43	13: "	"	-	-	-	-	-
-44	14: "	"	-	-	-	-	-
-45	15: "	"	+	+?	-	-	-

Table 18: continued

Accession or Sel. No.	Location Row:Hill	Name or Pedigree	March 1987 1/ PNRV	CAMV	HMV	HLV	AHLV
8303-46	16:25-28	21397 x 64035M (21456)	-	-	-	-	-
-47	17: "	" (21475)	-	-	-	+	-
-48	18: "	"	-	-	-	-	-
-49	19: "	"	-	-	-	-	-
-50	20: "	"	-	-	-	-	-
-51	21: "	"	-	-	-	-	-
-52	22: "	"	-	-	-	-	-
-53	23: "	" (21476)	-	-	-	-	-
-54	24: "	"	-	-	-	-	-
-55	25: "	"	-	-	-	-	-
-56	26: "	"	-	-	-	-	-
-57	27: "	"	-	-	-	-	-
-58	28: "	"	-	-	-	-	-
-59	29: "	"	-	-	-	-	-
-60	30: "	"	-	-	-	-	-
-61	31: "	"	-	-	-	-	-
-62	32: "	"	-	-	-	-	-
-63	33: "	"	-	-	-	-	-
-64	34: "	"	-	-	-	-	-
-65	35: "	"	-	-	-	-	-
-66	36: "	"	-	-	-	-	-
-67	37: "	"	-	-	-	-	-
-68	38: "	"	-	-	-	-	-
-69	39: "	"	-	-	-	-	-
-70	40: "	"	-	-	-	-	-
-71	1:29-32	"	-	-	-	-	-
-72	2: "	"	-	-	-	-	-
-73	3: "	"	-	-	-	-	-
-74	4: "	" (21477)	-	-	-	-	-
-75	5: "	"	-	-	-	-	-
-76	6: "	" (21478)	-	-	-	-	-
-77	7: "	"	-	-	?	+	-
-78	8: "	"	-	-	-	-	-
-79	9: "	"	-	-	-	-	-
-80	10: "	"	-	-	?	+	-
-81	11: "	"	-	-	-	-	-
-82	12: "	"	-	-	-	-	-
-83	13: "	"	-	-	-	-	-
-84	14: "	" (21479)	-	-	-	-	-
-85	15: "	"	-	-	-	-	-
-86	16: "	"	-	-	-	-	-
-87	17: "	"	-	-	-	-	-
-88	18: "	"	-	-	-	-	-
-89	19: "	"	-	-	-	-	-
-90	20: "	"	-	-	-	-	-

Table 18 : continued

Accession or Sel. No.	Location Row:Hill	Name or Pedigree	March 1987 1/ PNRV	CAMV	HMV	HLV	AHLV
8303- 91	21:29-32	21397 x 64035M (21480)	-	-	-	-	-
- 92	22: "	"	-	-	-	-	-
- 93	23: "	"	-	-	-	-	-
- 94	24: "	"	-	-	-	-	-
- 95	25: "	"	-	-	-	-	-
- 96	26: "	"	-	-	-	-	-
- 97	27: "	"	-	-	-	-	-
- 98	28: "	"	-	-	-	-	-
- 99	29: "	"	-	-	-	-	-
-100	30: "	"	-	-	-	-	-
-101	31: "	"	-	-	-	-	-
-102	32: "	"	-	-	-	-	-
-103	33: "	"	-	-	-	-	-
-104	34: "	"	-	-	-	-	-
-105	35: "	"	-	-	-	-	-
-106	36: "	"	-	-	-	-	-
-107	37: "	"	-	-	-	-	-
-108	38: "	"	plant lost				
-109	39: "	"	-	-	-	+	-
-110	40: "	"	-	-	-	-	-
-111	1:33-36	"	-	-	-	-	-
-112	2: "	"	-	-	-	-	-
-113	3: "	"	-	-	-	-	-
-114	4: "	"	-	-	-	-	-
-115	5: "	"	-	-	-	-	-
-116	6: "	" (21481)	-	-	-	+?	-
-117	7: "	" (21457)	-	-	-	-	-
-118	8: "	"	-	-	-	-	-
-119	9: "	"	-	-	-	-	-
-120	10: "	"	-	-	-	-	-
-121	11: "	"	-	-	-	-	-
-122	12: "	"	-	-	-	-	-
-123	13: "	"	-	-	-	-	-
-124	14: "	"	-	-	-	-	-
-125	15: "	"	-	-	-	-	-
-126	16: "	"	-	-	-	-	-
-127	17: "	"	-	-	-	-	-
-128	18: "	"	-	-	-	-	-
-129	19: "	"	-	-	?	-	-
-130	20: "	"	-	-	-	-	-
-131	21: "	"	-	-	-	+	-
-132	22: "	"	-	-	-	-	-
-133	23: "	"	-	-	-	-	-
-134	24: "	"	-	-	?	+	-
-135	25: "	"	-	-	?	-	-
-136	26: "	"	-	-	-	-	-
-137	27: "	"	-	-	-	-	-
-138	28: "	"	-	-	-	-	-
-139	29: "	"	-	-	-	-	-
-140	30: "	"	-	-	-	-	-
-141	31: "	"	-	-	-	-	-
-142	32: "	"	-	-	-	-	-
-143	33: "	"	-	-	-	-	-

Table 18 : concluded

Accession or Sel. No.	Location Row:Hill	Name or Pedigree	March 1987 1/ PNRV	CAMV	HMV	HLV	AHLV
Cross 8309							
8309-01	29:81-84	21397 x 21362M	?	-	-	-	+
-02	30: "	"	-	-	-	-	-
-03	31: "	"	-	-	-	-	-
-04	32: "	"	-	-	-	-	-
-05	33: "	"	-	-	-	-	-
-06	34: "	"	-	-	-	-	-
-07	35: "	"	-	-	-	-	-
-08	36: "	"	-	-	-	-	-
-09	37: "	"	-	-	-	-	-
-10	38: "	"	+	-	-	-	-
-11	39: "	"	-	-	-	-	-
-12	40: "	"	-	-	-	+	-
-13	41: "	"	-	-	+	-	-
-14	42: "	"	-	-	-	-	-
-15	43: "	"	-	-	-	-	-
-16	44: "	"	+	?	-	-	-
-17	45: "	"	-	-	-	-	-
-18	46: "	"	-	-	-	-	-
-19	47: "	"	-	-	-	-	-
-20	48: "	"	-	-	-	-	-
-21	49: "	"	-	-	-	-	-
-22	50: "	"	-	-	-	-	-
-23	21:85-88	"	-	-	-	-	-
-24	22: "	"	+	+	-	-	-
-25	23: "	"	-	-	-	-	-
-26	24: "	"	-	-	-	-	-
-27	25: "	"	-	-	-	-	-
-28	26: "	"	-	-	-	-	-
-29	27: "	"	-	-	-	+	-
-30	28: "	"	+	?	-	-	-
-31	29: "	"	-	-	-	-	-
-32	30: "	"	-	-	?	+	-
-33	31: "	"	-	-	-	-	-
-34	32: "	"	-	-	-	-	-
-35	33: "	"	-	-	-	-	-
-36	34: "	"	+	+	-	-	-
-37	35: "	" 21490	+	-	-	-	-
-38	36: "	"	-	-	-	-	-
-39	37: "	"	-	-	-	-	-
Parental control							
21397	38:85-88	tetr. Ha. m.f.	+	+	+	?	-

1/ PNRV = prunus necrotic ringspot virus; + positive, - negative,
CAMV = California strain of apple mosaic virus ? questionable
HMV = hop mosaic virus
HLV = hop latent virus
AHLV = American hop latent virus

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
WASHINGTON, D.C.

and

OREGON AGRICULTURAL EXPERIMENT STATION
OREGON STATE UNIVERSITY
CORVALLIS, OR 97331

NOTICE OF RELEASE OF USDA 19058M MALE HOP GERMPLASM

The Agricultural Research Service and the Oregon Agricultural Experiment Station announce the release of the male hop germplasm USDA 19058M. This genotype has exhibited high vigor and quality traits valuable for breeding European-type aroma hops.

USDA 19058M has been used in the USDA hop breeding program for nearly 20 years. The exact origin of USDA 19058M is obscure. It was selected in the early 1950's as an open-pollinated seedling from the English female hop 'Early Green' at Corvallis, OR. USDA 19058M consistently exhibited exceptional vigor, excellent pollen production, and good primary and secondary laterals, traits that are thought to be related to high yield potential. USDA 19058M has been maintained at the USDA Male Hop Germplasm Collection at Oregon State University for over 25 years.

USDA 19058M has excellent spring regrowth early in the season. Its erect shoots are easy to train and readily climb a supporting string to a height of 5.5 m or more. In Western Oregon, pollen shedding occurs in mid- to late July on sidearms that range from 75 to 120 cm in length. The sidearms carry well developed secondary and tertiary laterals which produce ample amounts of pollen over a two- to three-week period. Resin glands from the sepals and anthers are easily collected for analysis. The alpha acids content measured in isolated lupulin glands has ranged from 16 to 36 percent over an 18-year period, with an overall mean of 26.8%. The beta acids content over the same period averaged 45.7% with a range of 32.2 to 55.1%. Cohumulone content of USDA 19058M has always been low, with a mean of 16% and a range of 12-21%. This desirable low cohumulone content has been transmitted successfully to the progeny in test crosses.

The essential oil of USDA 19058M contains no farnesene. The ratio of humulene:caryophyllene is about 2.3:1.

USDA 19058M is resistant to crown infection by hop downy mildew (Pseudoperonospora humuli Miy. et Tak. G. W. Wilson). Early leaf infection of basal shoots in the spring can easily be controlled with systemic fungicides. The genotype also appears to be resistant to Verticillium wilt (Verticillium dahliae Kleb.) in Western Oregon.

USDA 19058M is free of the cherry and apple serotypes of Prunus Necrotic Ringspot Virus (PNRV) as judged from ELISA tests of dormant rhizome buds over a 3-year period despite the presence of PNRV infected hop plants nearby. However, a mild positive reaction to the apple strain of PNRV was observed recently. The genotype has also remained free of Hop Latent Virus

(HLV) and American Hop Latent Virus (AmHLV), but carries Hop Mosaic Virus (HMV). These latter three insect transmitted viruses are prevalent in hop growing areas of the Pacific Northwest, but their effect on hop yields and quality is unknown. The HMV infection in USDA 19058M is latent, and disease symptoms cannot be detected visually. Progeny of a test cross made in 1983 were free of HMV, indicating that this virus is not readily transmitted by crossing.

USDA 19058M has been used successfully in the past as a pollinator in commercial Oregon hop yards for producing a seeded crop. In controlled crosses, USDA 19058M has consistently transmitted a moderately high alpha-and-beta-acids content to its progeny with an alpha:beta ratio near 1, similar to European aroma hops. The cohumulone content of the seedling progeny has also been low, indicating that this trait is highly heritable. Most seedlings of USDA 19058M have been remarkable because of the high degree of vigor, and a high yield potential of the female progeny.

The vigorous growth type, downy mildew resistance, low cohumulone content, and absence of most viruses are valuable attributes of USDA 19058M. Planting stock will be maintained by the USDA, ARS in the Hop Germplasm Collection at Oregon State University, Corvallis, OR 97331.

The date of release is that of the final signature.

Dr. Thayne Dutson,
Director, Oregon Agricultural Esperiment Station

2-9-88
Date

Dr. T. B. Kinney, Jr.
Administrator, Agricultural Research Service

MAR 25 1988
Date

TO: Hop growers and dealers, brewers and interested research personnel

July 8, 1987

FROM: A. Haunold
USDA-ARS, Corvallis, OR.

SUBJECT: Field Notes from a Brief Visit to Oregon Off-Station Experimental Plots.

The early part of 1987 has been unusual in many respects. A very mild winter, an extremely warm early spring and much drier than normal.

It appears that the early maturing varieties, Fuggle, Styrian, Tettnanger and perhaps Perle have suffered the most. Now in early July some plants are fully coned out and it is estimated that harvest could begin up to two weeks earlier than normal.

Experimental I33-06 (USDA Selection No. 21222). 4 acres, babies.
Grown at J. I. Haas Mitoma farm, planted May 5, 1987 from virusfree softwood cuttings supplied by Gene Probasco, J. I. Haas, Yakima, WA.
This is an open-pollinated Brewer's Gold seedling, with late maturity in Oregon as judged from earlier testing. Baby planting has 7.5 foot spacing, 4.2 acres total. Excellent stand, plants are still on the ground, some have slight downy mildew infection. Plot will be staked and trained on 3 foot stakes and hand hoed and hilled. There needs to be some weed control, particularly grasses.

USDA 21490. (Higher alpha, higher oil, triploid Hallertauer seedling selection). Planted at Don Weather's farm, Salem, Oregon, baby field.
Thus far nearly 2 acres are planted and the remainder will be in the ground about July 25. Plants are rather small, excellent stand growing vigorously, will be trained on 3 foot bamboo stakes and hand hoed and hilled.

USDA 21456. First year, mature; triploid Hallertauer seedling selection. Grown at Don Weather's farm, Salem, Oregon. One year old planting, very early maturity, about 75% of the plants are coned out. Harvest is expected around August 10. Estimated production probably 4-5 bales/acre. A plot of adjacent Galena (established): 5-6 b/A, Fuggle about 3 b/A.

USDA 21457. Growing at the Bob Coleman ranch, Gervais, Oregon.
One year old plot, early maturity, triploid Hallertauer seedling selection. About 25% coned out but not as far along as USDA 21456. More even growth, better yield potential (probably about 6 b/A, maybe more). Harvest expected around August 18. Plants have a conspicuous red stem. Some volunteer males should be rogued out before harvest.

USDA 21459. First year, mature. Grown at the Staufer Brothers Ranch, Hubbard, Oregon. Triploid Hallertauer seedling selection, 1 year old Tettnanger type (oil contains significant amounts of farnesene). Excellent development of most plants. All are in full bloom. Harvest expected about August 28; probably 10 b/A or more. This is the best of the five off-station Hallertauer triploid seedling selections.

An additional 106 plants have been planted in 1987 to fill in one empty row at the end of the plot. These, however, will not be harvested in 1987. A nearby Fuggle yard has about a 3 to 3.5 b/A yield potential and is nearly fully coned out.

USDA 21180. About 5 years old. Grown at the Frank Forbert Ranch, Hubbard, Oregon. This is a diploid, medium-high alpha and high-beta selection that the HRC decided to discontinue in Oregon. Miller Brewing Company expressed an interest, and the plot is grown for Miller Brewing Company which pelletizes the hops and tests them in their brewing formula.

Excellent development; plants just starting to bloom, harvest expected around September 10, yield 11-12 b/A. Adjacent Galena (2 year old) 5-6 b/A, irregular growth.

slipdown — poor overhang

USDA 21458. First year, mature. Grown at the Paul Serres Ranch, Woodburn, Oregon. A one year old triploid Hallertauer seedling selection. Generally poor appearance of the whole 4 acre plot. Arms are very weak, long, but break easily. Plants in full bloom now, should mature around August 25 with a yield potential of 5-6 b/A or less depending on arm breakage. Grower stated that this is a very difficult hop to grow, plants do not want to stay on the string, grow straight up and fall away from the string. Some plants also show crinkled leaves similar to spray damage. The grower insists that no unusual sprays were used.

USDA 21491. Baby planting. Grown on the Paul Serres Ranch, Woodburn, Oregon. Only one half of the plants delivered about 10 days ago were planted since grower had to remove existing strawberries before field planting could begin. This planting will not be completed until late 1987 since a commercial propagator (Oki Nursery) had difficulty obtaining sufficient rooted plants. Therefore, additional softwood cuttings are now being started in the OSU greenhouse which will not be ready for field planting until mid-September. This plot will probably be irregular in 1988 with about 2 acres ready for harvest and about 1 acre essentially baby plants next year. Propagation for Prosser, Washington, will have to come from existing mother plants or from additional softwood cuttings in 1988. (Another 80 mother plants of 21491 and about 50 of 21490 were shipped to Prosser in mid-July).

Experimental I4311 (USDA 21287). Baby planting. Grown at the Joe Annen Farm, Mt. Angel, Oregon. An open-pollinated diploid Brewer's Gold seedling selection developed by Dr. Bob Romanko, Parma, Idaho. This plot adjacent to a new Willamette planting with 1 blank row in between consists of 20 rows with 96 plants per row, a total of 2788 plants at 8 foot spacing or 4.2 acres. Plants were increased from virusfree softwood cutting supplied by Gene Probasco, J. I. Haas, Yakima, Washington, in early spring 1987 and field-planted in mid-May 1987. Excellent growth, no missing hills, strong plants. This will be a very nice plot in 1988.

USDA 21181. About 5 years old. A diploid medium-high alpha, late maturing hop which has been tested by HRC for several years in both Oregon and Washington. Anheuser Busch has continued interest in this plot; slightly over one acre is being grown in both states. Most plants are over the wire now, are still growing vigorously and arming out, but about 30-40% have started blooming. The plot was recently treated with Des-I-Cate to remove

bottom growth. Aphids are a problem. Yield potential at this stage looks like 9 b/A. Plants look somewhat less vigorous this year than in past years but yield history at this location has been very good.

USDA 21455. First year, mature. Grown at the Herman Gosche Farm, Silverton, Oregon. Early maturing triploid Hallertauer seedling selection. Very good growth, even, healthy but short to medium short sidearms. About 25% of the plants are coned out; harvest is expected about August 20-22, slightly earlier than USDA 21457 but about a week to 10 days later than 21456. Yield potential at this point is 6-7 b/A or more depending on cone size. Cone development is very even with no significant head formation. Some plants show mild yellow flecks on lower leaves which could be associated with spray damage. Other fields on the same ranch, notably Willamette and Nugget, also showed similar yellow fleck pattern.

Summary of 1987 Hallertauer triploid off-station plots: Oregon

					alpha %	beta %	co-humulone %	oil ml/100g
21455	H. Goschie	harv. Sept. 1	19 bales	3458 lbs	6.3	8.8	22	2.08
21456	D. Weathers	Aug. 26	12	2156	3.6	5.2	28	1.05
	note: 370 hills discarded due to heptachlor damage							
21457	R. Coleman	Aug. 26	19	3447	4.8	3.9	25	1.12
21458	P. Serres	Aug. 24	15	3158	2.6	5.6	28	0.83
	note: hard picking, arms break, poor cleanup, 20% late bloom, 9% leaf/stem							
21459	R. Stauffer	Sept. 11	37	7071	3.8	3.9	26	0.80

All baled hops were delivered to cold storage facilities in Oregon shortly after baling. All experimental hops except USDA 21458 appear to have good commercial potential, were easy to pick and to dry. Hops were shipped to cooperating brewers during the year, some were pelletized by J.I. Haas Inc. Yakima for Miller, Heileman and Molson Breweries, respectively.

Other Oregon off-station trials in 1987:

USDA 21180 (for Miller Brewing Co.)

Frank Fobert farm: harvested: on Sept 7, 1987.

11 bales (2190 lbs)-- 1-acre plot. very nice picking and cleaning/drying.

alpha: 9.7, beta 7.9 (as is)
10.4 9.2 (dry weight basis)

seeds: 5%

Leaf and stem : below 1%

Cohumulone: 28%

Additional plots planted in 1987 but not harvested:

USDA 21490, 21491 (triploid Hallertauer types)

Tettnanger A, B (diploid aroma hops from Germany)

Diploid aroma hop for Hop Research Council:

USDA 21181 at Annen Bros. farm near Mt. Angel:

1.4 acres, 2836 lbs (2026 lbs/acre)

alpha: 8.3 beta 7.0, cohumulone 26%

Brewer evaluation of Hallertauer triploid selections: 1987 crop.

Anheuser Busch Inc.: (information provided by Dr. Paul Hoskins), Feb. 27, 1987.
samples stored in cold storage since October

21455	October 77(fresh):	good	6-months later:	good, mild aroma
21456		fair		good, mild
21457		good		fair, slightly harsh
21458		fair		fair, slightly weak
21459		fair		good, mild

Coors: Dr. Bob Foster , March 12, 1987.
hand evaluation against Hallertauer/Hersbrucker standard

21455	first choice
21457	second
21456	third
21458	
21459	these last two did not do well inhand evaluation tests 21459 was too floral at the expense of harbals

Additional genotypes of interest to Coors:

21484	first choice
21470	very good
21373	(diploid technician hop, high alpha) very good
21475	good
21471	"
21473	"
21478	questionable
21481	questionable

Other brewers interested in triploid aroma hops: (Not HRC members).

Heileman (Hans Reuther)
Miller (wants bale quantities)

from the 1987 HRC report , page 57.

HOP CHEMISTRY

Table 4. Maturity and Harvest Results for Hallertauer Triploids Grown in Oregon. Results on "dry weight basis".

Variety	Harvest Date	Dry Matter (Moisture Content)	Spectrophotometric % Alpha	% Beta	Oil mL/100g	CoHumulone
21455	Aug 5	19.1*	4.2	6.2		24
	13	19.8*	3.8	6.4		23
	17	19.3	4.3	7.1		24
	21	18.6	4.6	7.7		23
	25	19.7	5.7	9.0	2.29	24
	31	19.3	6.2	9.6	2.68	25
(Bale)	Sept 1	(10.0)	6.3	8.8	2.08	22
21456	Jul 30	19.9*	2.6	3.8		
	Aug 5	21.8*	2.2	3.0		26
	10	18.0	3.0	4.8		24
	17	19.7	2.8	3.9		26
	24	19.8	2.8	4.9	1.80	25
(Loose)	25	(11.0)	3.4	5.5	1.32	27
(Bale)		(7.6)	3.6	5.2	1.05	28
21457	Aug 5	21.2*	3.3	2.9		23
	13	21.5*	3.7	3.2		24
	17	18.9	4.5	3.5		24
	24	20.3	4.3	3.8	1.56	24
(Bale)	31	(7.0)	4.8	3.9	1.12	25
21458	Aug 5	20.6*	1.7	3.4		
	13	21.1*	2.5	4.7		23
	17	17.8	2.8	5.4		27
(Loose)	24	(10.9)	2.4	5.2	0.79	25
(Bale)		(12.7)	2.6	5.6	0.83	28
21459	Aug 5	18.3*	2.1	3.0		24
	13	16.7*	2.6	2.7		25
	17	13.2	3.5	3.3		25
	25	17.0	3.4	3.9	0.69	28
	31	17.4	4.5	4.6	0.84	28
	Sept 7	19.7	4.3	4.5	1.17	25
(Bale)	7	(9.0)	3.8	3.9		26

* Microwave oven

Certified Analyses

1987 OREGON HALLERTAUER TRIPLOIDS

Variety	Grower ID	Broker	Bales	% Alpha	% Beta	mL oil/100g	Cohumulone
21455	76-214-E	Steiner	19	6.3	8.8	2.08	22
21456	76-211-A	Steiner	12	3.6	5.2	1.05	28
21457	76-205-B	Barth	19	4.8	3.9	1.12	25
21458	76-252	Barth	15	2.6	5.6	0.83	28
21459	76-235-X	Barth	37	3.8	3.9		26

1987 Hallertauer Triploid Selections

Oil Composition of Commercially Grown Samples

Oil Composition: Area % of Oil

	ID 21455	OR 21455	WA 21455	ID 21456	OR 21456	ID 21457	OR 21457	ID 21458	OR 21458	WA 21458	ID 21459	OR 21459	WA 21459	OR Hall	OR Tett
Myrcene	56.76	48.18	27.91	42.33	36.14	44.73	36.19	45.38	36.85	30.26	38.02	33.25	41.33	36.48	52.30
Limonene	0.20	0.18	0.16	0.17	0.13	0.15	0.13	0.14	0.13	0.13	0.16	0.15	0.17	0.13	0.18
I.S.	0.67	0.71	3.28	1.17	1.00	0.88	1.15	1.45	1.45	1.79	1.91	1.67	1.97	1.92	1.50
Linalool	0.82	0.64	0.49	0.76	0.61	1.11	0.83	0.58	0.50	0.53	0.79	0.74	0.63	0.44	0.33
Undecanone-2	0.29	0.31	0.38	0.71	0.51	0.84	0.57	0.61	0.51	0.62	0.49	0.36	0.36	0.64	0.54
Caryophyllene	8.37	9.95	13.74	9.21	10.48	8.34	10.38	9.06	10.73	11.79	7.25	8.41	7.28	10.32	5.08
Farnesene	0.02	0.01	0.03	0.03	0.00	0.03	0.07	0.03	0.03	0.20	6.01	6.82	5.80	0.09	11.60
Humulene	19.64	26.20	36.24	31.74	36.43	29.37	35.69	31.21	37.01	37.83	25.47	28.96	24.77	36.25	17.21
Cadinene/Muurolene	0.39	0.46	0.67	0.52	0.55	0.53	0.61	0.44	0.56	0.72	2.65	2.51	2.25	0.58	0.47
Cadinene/Muurolene	0.20	0.24	0.36	0.29	0.31	0.29	0.36	0.27	0.35	0.47	2.50	2.37	2.12	0.32	0.16
Cadinene/Selinene	1.17	1.37	1.87	1.44	1.56	1.54	1.71	1.17	1.43	1.60	1.23	1.39	1.30	1.61	0.84
Cadinene/Selinene	0.74	0.85	1.16	0.83	0.92	0.86	0.97	0.64	0.77	0.94	0.73	0.78	0.71	0.93	0.42
Geranyl acetate	0.15	0.15	0.15	0.27	0.21	0.02	0.29	0.17	0.21	0.29	0.23	0.19	0.19	0.27	0.26
Geranyl isobutyrate	0.13	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Geraniol	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Caryophyllene oxide	0.24	0.25	0.69	0.21	0.25	0.13	0.19	0.14	0.22	0.61	0.23	0.23	0.20	0.24	0.04
Humulene monoepoxide I	0.10	0.11	0.35	0.15	0.15	0.10	0.13	0.08	0.13	0.32	0.12	0.17	0.14	0.13	0.11
Humulene monoepoxide II	0.54	0.65	1.93	0.77	0.89	0.49	0.71	0.47	0.73	1.94	0.80	0.80	0.67	0.88	0.17
Humulene monoepoxide III	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Humulol	0.12	0.16	0.22	0.25	0.21	0.51	0.26	0.06	0.08	0.50	0.31	0.38	0.35	0.39	0.34
Eudesmol(s)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Humulenol II	0.09	0.11	0.24	0.13	0.17	0.14	0.10	0.02	0.15	0.19	0.15	0.20	0.16	0.17	0.07
Humulene diepoxide	0.08	0.07	0.33	0.12	0.10	0.08	0.09	0.05	0.06	0.09	0.17	0.20	0.18	0.07	0.04
Humulene triepoxide	0.10	0.14	0.06	0.18	0.22	0.21	0.23	0.20	0.11	0.03	0.27	0.30	0.40	0.09	0.12

1987 Hallertauer Triploid Selections

Oil Composition of Commercially Grown Samples

Oil Content: ng compound/g hops

	ID 21455	OR 21455	WA 21455	ID 21456	OR 21456	ID 21457	OR 21457	ID 21458	OR 21458	WA 21458	ID 21459	OR 21459	WA 21459	OR Hall	OR Tett
Myrcene	8421	6748	850	3608	3625	5060	4015	3123	3145	2640	1989	2484	3428	2297	4043
Limonene	30	25	5	14	13	17	14	10	11	11	8	11	14	8	14
I.S.	100	100	100	100	100	100	128	100	124	156	100	125	163	121	116
Linalool	121	89	15	65	61	125	92	40	42	46	42	56	52	27	26
Undecanone-2	43	43	11	60	51	95	63	42	43	54	26	27	30	40	42
Caryophyllene	1242	1393	418	785	1051	944	1152	623	915	1029	379	628	603	650	393
Farnesene	4	2	1	2	0	4	8	2	2	17	315	510	481	6	897
Humulene	2914	3670	1103	2705	3654	3323	3960	2148	3159	3300	1333	2165	2055	2282	1330
Cadinene/Muurolene	58	64	20	44	55	60	67	31	47	62	139	188	186	36	36
Cadinene/Muurolene	29	34	11	25	31	33	40	18	29	41	131	177	176	20	12
Cadinene/Selinene	174	192	57	122	157	174	190	81	122	139	64	104	108	101	65
Cadinene/Selinene	110	118	35	71	93	97	108	44	66	82	38	58	59	59	33
Geranyl acetate	23	22	5	23	21	2	32	12	18	25	12	14	15	17	20
Geranyl isobutyrate	20	0	0	0	5	0	0	0	0	0	0	0	0	0	0
Geraniol	5	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Caryophyllene oxide	35	34	21	18	25	14	21	9	19	53	12	17	17	15	3
Humulene monoepoxide I	14	15	11	12	15	11	15	5	11	28	6	13	11	8	9
Humulene monoepoxide II	80	91	59	66	89	55	79	32	63	169	42	60	56	55	13
Humulene monoepoxide III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humulol	17	23	7	21	21	58	28	4	7	43	16	28	29	25	26
Eudesmol(s)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humulenol II	13	16	7	11	17	16	11	2	13	16	8	15	13	11	5
Humulene diepoxide	12	9	10	10	10	9	10	3	5	8	9	15	15	4	3
Humulene triepoxide	15	19	2	16	22	23	26	14	9	3	14	22	33	6	9

1987 Hallertauer Triploid Selections

Oil Composition of Commercially Grown Samples

Area % of Oil

	ID 21455	OR 21455	WA 21455	ID 21456	OR 21456	ID 21457	OR 21457	ID 21458	OR 21458	WA 21458	ID 21459	OR 21459	WA 21459	OR Hall	OR Tett
Group 1, Hydrocarbons	84.79	84.35	77.92	83.31	83.05	82.47	82.32	85.68	84.61	80.08	76.75	77.44	79.17	83.14	86.18
Group 2, Oxidation Prod	1.25	1.48	3.82	1.80	1.99	1.66	1.72	1.01	1.48	3.68	2.05	2.28	2.10	1.98	0.90
Group 3, Floral	1.14	0.79	0.64	1.03	0.87	1.13	1.13	0.75	0.71	0.82	1.02	0.93	0.81	0.71	0.68
Group 4, Citrus-Piney	1.53	1.72	2.35	1.81	1.92	1.83	2.07	1.49	1.80	2.26	6.03	5.82	5.25	1.95	1.23
Total Accounted for:	88.72	88.34	84.73	87.94	87.82	87.09	87.23	88.93	88.61	86.83	85.85	86.47	87.33	87.78	88.98

ng/ g hops

	ID 21455	OR 21455	WA 21455	ID 21456	OR 21456	ID 21457	OR 21457	ID 21458	OR 21458	WA 21458	ID 21459	OR 21459	WA 21459	OR Hall	OR Tett
Group 1, Hydrocarbons	12581	11814	2372	7100	8330	9330	9135	5897	7222	6986	4016	5787	6568	5235	6663
Group 2, Oxidation Prod	186	208	116	154	199	187	191	70	127	321	107	170	174	125	69
Group 3, Floral	169	111	19	87	87	127	125	52	60	71	54	70	67	45	52
Group 4, Citrus-Piney	227	241	72	154	192	207	229	103	154	197	316	435	435	123	95
Total Accounted for:	13163	12373	2580	7495	8809	9852	9679	6121	7563	7575	4492	6462	7244	5527	6880

	ID 21455	OR 21455	WA 21455	ID 21456	OR 21456	ID 21457	OR 21457	ID 21458	OR 21458	WA 21458	ID 21459	OR 21459	WA 21459	OR Hall	OR Tett
Humulene/Caryophyllene	2.35	2.63	2.64	3.45	3.48	3.52	3.44	3.45	3.45	3.21	3.51	3.44	3.41	3.51	3.39
Humulene/Farnesene	811.90	1854.29	1392.21	1292.81	0.00	912.81	512.59	938.10	1381.92	192.92	4.24	4.25	4.27	398.95	1.48
Caryophyllene/Farnesene	346.01	704.00	527.92	375.10	0.00	259.31	149.06	272.24	400.45	60.14	1.21	1.23	1.26	113.63	0.44
% Volatiles:	1.48	1.40	0.30	0.85	1.00	1.13	1.11	0.69	0.85	0.87	0.52	0.75	0.83	0.63	0.77

1987 ANALYSES OF 21180 AND 21181

21180 (Fobert 76-212-F)

Date	Dry Matter or (Moisture Content)	Dry Weight Basis % Alpha-Acids	% Beta-Acids	mL oil/100g	CoHumulone
Aug 26	20.8	8.9	8.0		28
31	18.9	9.5	7.8		31
		HARVEST			
Sept 1	(8.15)	10.4	9.2	2.72	28

21181 (Annen)

Date	Dry Matter or (Moisture Content)	Dry Weight Basis % Alpha-Acids	% Beta-Acids	mL oil/100g	CoHumulone
Aug 26	19.1	7.2	6.4		43
31	20.6	7.6	6.5		40
Sept 7	21.3	7.9	6.6		40

1987 Certified Hop Analyses

Variety	Bales/Lot	At 8 % mc Alpha	Beta	Dry Weight Alpha	Beta	HSI	CoH	Lots
Willamette	126	5.1	3.5	5.5	3.8	0.30	33	2
Galena	84	11.6	8.2	12.6	8.9	0.25	35	6
Eroica	233	11.5	4.2	12.5	4.5	0.33	41	2
Nugget	192	13.7	4.8	14.9	5.2	0.28	26	34
Experimental	17	4.2	5.5	4.6	6.0	0.26	25	7
Perle	97	8.4	3.9	9.1	4.3	0.28	27	3

1986 Samples with Beta-Acid content >=7 %

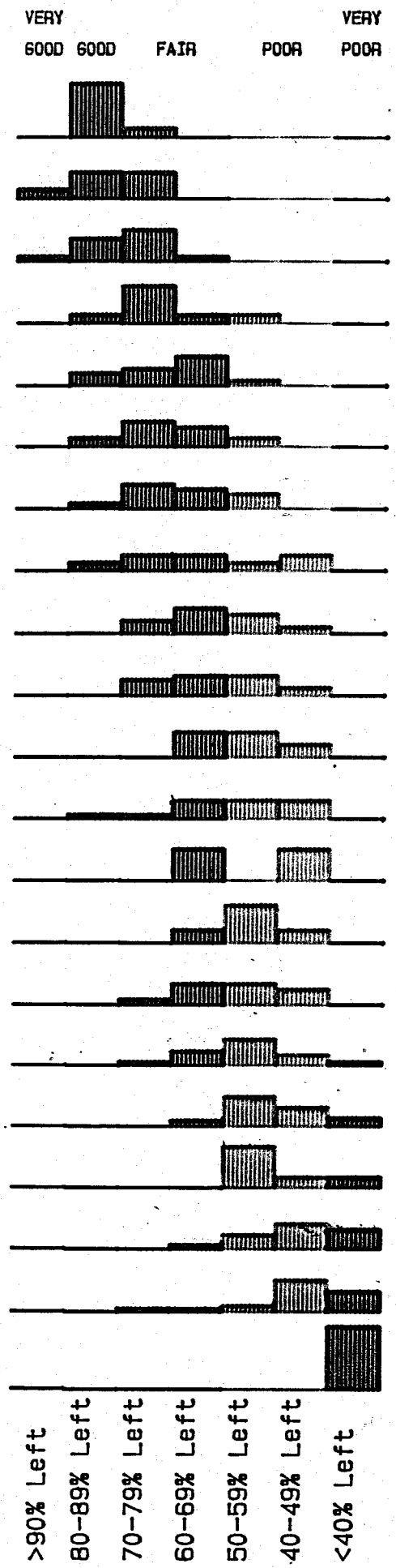
8% Moisture Content (Bale) or As Is Basis (5-Cone) as of January 27, 1988 (n = 13)

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/Ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Oil Myr (%)	Oil Hum (%)	Serial Number
21180	7003-143	Bale	242:12-16	09/11/86	2363	257	10.9	7.6	59	29	0.26	0.59	56	0.89	1.74	0.00	44.28	23.20	702
21182	Galena (43-16)	Cone	239:01-05	09/18/86	2300	311	13.5	8.9	60	38	0.26	0.40	78	0.00	0.00	0.00	0.00	0.00	738
21280	Pride of Kent	Bale	027:09-12	09/17/86	1472	149	10.1	7.0	59	37	0.28	0.93	33	2.83	0.00	0.00	0.00	0.00	905
21382	7504-113	Bale	224:12-16	09/12/86	1911	247	12.9	7.2	64	20	0.27	0.57	58	1.66	0.00	0.00	0.00	0.00	830
65009	BG x 19058M	Bale	228:23-27	09/08/86	1911	244	12.8	7.4	63	33	0.26	0.81	42	3.49	0.00	0.00	0.00	0.00	385
7003-154		Bale	231:28-32	09/10/86	1971	272	13.8	8.4	62	41	0.25	0.00	0	1.93	0.00	0.00	0.00	0.00	660
7504-111		Bale	223:12-16	09/04/86	2031	218	10.7	8.2	57	33	0.25	0.00	0	1.61	0.00	0.00	0.00	0.00	402
7504-137		Bale	234:12-16	09/12/86	2807	231	8.2	7.5	52	33	0.28	0.00	0	1.94	0.00	0.00	0.00	0.00	791
8303-061		Bale	018:17-20	08/22/86	1013	84	8.2	7.2	53	19	0.30	0.00	0	0.00	0.00	0.00	0.00	0.00	666
8303-130		Bale	020:33-36	09/08/86	960	123	12.8	7.4	63	24	0.26	0.00	0	1.53	0.00	0.00	0.00	0.00	395
8309-005		Bale	227:28-32	09/10/86	1186	89	7.5	7.0	52	22	0.27	0.00	0	2.76	0.00	0.00	0.00	0.00	650
8408-044		Bale	155:05	09/11/86	1749	182	10.4	7.0	60	28	0.26	0.79	39	2.28	0.00	0.00	0.00	0.00	883
8408-081		Bale	155:42	09/17/86	1280	119	9.3	7.6	55	21	0.26	0.00	0	2.13	0.00	0.00	0.00	0.00	920

1987 Samples with Beta-acid content >7%

1988 Bale and 5-Cone Analyses at 8% Moisture Content (Bale) or As Is Basis (5-Cone) as of January 27, 1988 (n = 44)

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/Ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil - mL/100g	H/C	H/F	Myr (%)	Hum (%)	Serial Number
21099	6921-006	Bale	240:23-27	08/20/87	1442	153	10.6	8.0	57	34	0.24	0.00	0	2.54	0.00	0.00	0.00	0.00	382
21180	7003-143	Bale	242:12-16	09/14/87	1817	193	10.6	8.8	55	28	0.24	0.00	0	1.33	0.00	0.00	0.00	0.00	583
21181	7003-243	Bale	204:17-21	09/10/87	0	0	10.0	8.2	55	38	0.23	0.00	0	0.66	0.00	0.00	0.00	0.00	627
21182	Galena (43-16)	Cone	239:01-05	09/08/87	1800	249	13.8	10.4	57	38	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	222
21182	Galena (43-16)	Bale	008:05-08	09/11/87	0	0	13.1	7.4	64	41	0.24	0.00	0	1.30	0.00	0.00	0.00	0.00	626
21198	7003-038	Cone	227:12-16	09/09/87	2400	246	10.2	7.1	59	33	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	245
21248	7311-095	Cone	218:17-21	09/10/87	2000	343	17.1	7.3	70	37	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	298
21257	7313-083	Cone	224:23-27	09/08/87	1800	271	15.1	7.6	66	40	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	203
21261	7003-075	Cone	230:12-16	09/09/87	2100	172	8.2	7.4	53	20	0.22	0.00	0	0.00	0.00	0.00	0.00	0.00	253
21280	Pride of Kent	Cone	027:09-12	09/10/87	0	0	9.3	8.0	54	38	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	308
21287	Banner	Bale	244:06-09	09/08/87	0	0	12.6	8.0	61	36	0.24	0.00	0	2.21	2.58	0.00	61.14	17.16	614
21373	7006-398	Bale	230:28-32	09/09/87	990	159	16.0	7.7	68	20	0.24	0.00	0	1.78	1.46	4.53	57.02	9.33	607
21382	7504-113	Cone	224:12-16	09/09/87	2200	213	9.7	7.1	58	21	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	247
21455	8301-010	Bale	017:72-75	09/08/87	0	0	7.5	7.7	49	23	0.27	0.00	0	2.51	0.00	0.00	0.00	0.00	542
21455	8301-010	Bale	017:76-82	09/04/87	0	0	6.4	7.3	47	24	0.28	0.00	0	1.98	0.00	0.00	0.00	0.00	543
21455	8301-010	Bale	017:67-71	09/08/87	0	0	7.2	7.6	48	23	0.26	0.00	0	1.97	2.21	0.00	51.57	22.11	550
21455	8301-010	Bale	215:23-27	09/09/87	538	40	7.4	8.1	47	23	0.23	0.00	0	2.38	0.00	0.00	0.00	0.00	606
21455	8301-010	Bale	017:62-66	09/08/87	0	0	7.8	7.6	51	23	0.24	0.00	0	1.84	0.00	0.00	0.00	0.00	608
21486	7507-109	Cone	239:23-27	09/08/87	2200	244	11.1	7.8	59	32	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	209
21490	8309-037	Cone	035:85-88	09/11/87	0	0	3.7	7.5	33	22	0.22	0.00	0	0.00	0.00	0.00	0.00	0.00	420
21490	8309-037	Bale	035:85-88	09/12/87	0	0	4.4	7.4	37	22	0.24	0.00	0	1.36	0.00	0.00	0.00	0.00	576
21490	8309-037	Bale	210:23-27	09/09/87	895	40	4.4	7.3	38	21	0.25	0.00	0	1.58	3.46	0.00	66.02	17.03	613
21490	8309-037	Bale	229:28-32	09/08/87	1519	85	5.6	7.7	42	20	0.24	0.00	0	1.48	3.43	0.00	65.47	16.79	624
64007	19105 x 19058M	Bale	232:01-05	09/02/87	2278	68	3.0	8.0	27	30	0.22	0.00	0	0.75	0.00	0.00	0.00	0.00	343
64007	19105 x 19058M	Cone	017:49-50	09/11/87	0	0	3.2	8.5	27	28	0.20	0.00	0	0.00	0.00	0.00	0.00	0.00	438
65009	BG x 19058M	Cone	228:23-27	09/08/87	2000	214	10.7	7.3	59	37	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	199
7504-026		Bale	205:12-16	09/15/87	2090	257	12.3	7.6	62	24	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	590
7504-031		Bale	206:12-16	09/15/87	1869	205	11.0	8.1	58	21	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	596
7504-111		Bale	223:12-16	09/14/87	1749	171	9.8	11.1	47	33	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	589
7504-137		Bale	234:12-16	09/14/87	2274	221	9.7	8.6	53	34	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	587
7507-062		Cone	235:23-27	09/08/87	2200	190	8.6	7.7	53	37	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	207
8032-065		Bale	240:17-21	09/15/87	1399	209	15.0	8.0	65	49	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	592
8304-067		Cone	226:12-16	09/09/87	600	37	6.1	7.4	45	25	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	248
8309-005		Cone	232:17-21	09/10/87	1200	99	8.3	7.1	54	22	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	293
8309-005		Bale	227:28-32	09/09/87	1638	117	7.1	7.2	50	22	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	646
8401-192		Cone	140:36	08/31/87	1400	193	13.8	8.8	61	26	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	19
8408-016		Cone	154:29	09/02/87	1800	183	10.2	9.2	53	26	0.22	0.00	0	0.00	0.00	0.00	0.00	0.00	65
8408-031		Bale	154:44	08/27/87	1408	105	7.5	7.8	49	23	0.24	0.00	0	0.91	0.00	0.00	0.00	0.00	335
8408-044		Cone	155:05	09/02/87	1200	127	10.6	7.5	59	27	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	72
8408-114		Bale	156:23	08/27/87	2261	142	6.3	8.2	44	26	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	261
8409-055		Cone	158:02	09/03/87	1600	108	6.7	7.2	48	23	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	123
8410-020		Cone	159:05	09/03/87	1600	113	7.1	7.1	50	22	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	129
8412-010		Bale	166:24	09/03/87	1621	150	9.3	7.2	56	38	0.27	0.00	0	0.99	0.00	0.00	0.00	0.00	159
8412-126		Cone	168:36	09/04/87	1400	121	8.6	7.1	55	24	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	144



Cluster n= 7, yr= 7, avg % Left= 81

Perle n= 7, yr= 4, avg % Left= 80

Galena n=14, yr= 7, avg % Left= 79

Nugget n=15, yr= 6, avg % Left= 72

Styrian n=26, yr= 9, avg % Left= 70

Fuggle H n=22, yr= 9, avg % Left= 69

Willamette n=13, yr= 9, avg % Left= 68

Eroica n= 8, yr= 7, avg % Left= 63

Tettnanger n=10, yr= 7, avg % Left= 61

21180 n=16, yr=10, avg % Left= 60

Chinook n= 5, yr= 5, avg % Left= 58

21181 n=17, yr= 9, avg % Left= 57

Olympic n= 5, yr= 4, avg % Left= 57

Saazer n= 5, yr= 4, avg % Left= 57

Hallertauer MF n=12, yr= 6, avg % Left= 55

Target n=16, yr= 7, avg % Left= 54

Bullion n=23, yr=10, avg % Left= 50

Hallertauer n= 6, yr= 5, avg % Left= 48

Cascade n=32, yr=10, avg % Left= 43

Brewers Gold n=23, yr=11, avg % Left= 42

65009 n=15, yr=15, avg % Left= 29

1975-1985 SIX MONTH AMBIENT STORAGE
OSU GERM PLASM COLLECTION

Agricultural Chemistry Department Oregon State University**Agricultural Research Service**U S Dept Agriculture**Corvallis, Oregon**

ranked by Accession/Selection Number.

1987 Bale and 5-Cone Analyses at 8% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Bale analyses

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	XA+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Myr (%)	Hum (%)	Serial Number
19001	Brewers Gold	Bale	001:01-04	09/11/87	1200	137	11.4	5.6	67	45	0.27	0.60	60	2.40	0.00	0.00	0.00	0.00	652
21003	Fu T4	Bale	243:23-27	08/20/87	213	14	6.5	3.8	63	27	0.28	0.40	79	1.42	0.00	0.00	0.00	0.00	377
21014	Hallertau MF	Bale	007:01-04	08/18/87	498	23	4.7	3.4	58	19	0.30	0.41	81	0.64	0.00	0.00	0.00	0.00	276
21041	Willamette	Bale	227:01-05	09/02/87	1553	104	6.7	4.3	61	33	0.33	0.39	90	1.24	0.00	0.00	0.00	0.00	552
21042	6769-002	Bale	108:13-14	08/25/87	2154	82	3.8	2.6	59	32	0.33	0.41	82	0.51	0.00	0.00	0.00	0.00	350
21044	Wye Northdown	Bale	019:05-08	08/18/87	284	23	8.3	4.5	64	24	0.25	0.33	84	1.09	0.00	0.00	0.00	0.00	274
21049	Styrian, Yugo	Bale	020:05-08	08/18/87	501	26	5.2	2.6	66	28	0.28	0.34	92	0.71	0.00	0.00	0.00	0.00	269
21049	Styrian, Yugo	Bale	214:01-05	08/20/87	495	25	5.1	3.7	58	30	0.28	0.39	84	0.78	0.00	0.00	0.00	0.00	375
21056	Bullion, 10A,VF	Bale	206:01-05	09/01/87	1621	193	11.9	5.8	67	36	0.30	0.50	54	2.05	0.00	0.00	0.00	0.00	349
21093	N. Brewer VF	Bale	012:09-12	08/19/87	412	41	9.9	3.7	72	23	0.26	0.34	92	1.05	0.00	0.00	0.00	0.00	266
21097	Müller Bitterer	Bale	030:05-08	09/15/87	1600	144	9.0	4.9	65	31	0.26	0.55	63	2.20	0.00	0.00	0.00	0.00	577
21099	6921-006	Bale	240:23-27	08/20/87	1442	153	10.6	8.0	57	34	0.24	0.52	61	2.54	0.00	0.00	0.00	0.00	382
21112	Wye Target VF	Bale	016:09-12	08/19/87	1120	134	12.0	5.5	69	32	0.25	0.35	84	0.86	0.00	0.00	0.00	0.00	374
21180	7003-143	Bale	242:12-16	09/14/87	1817	193	10.6	8.8	55	28	0.24	0.46	70	1.33	0.00	0.00	0.00	0.00	583
21181	7003-243	Bale	204:17-21	09/10/87	0	0	10.0	8.2	55	38	0.23	0.29	90	0.66	0.00	0.00	0.00	0.00	627
21182	Galena (43-16)	Bale	008:05-08	09/11/87	1200	157	13.1	7.4	64	41	0.24	0.32	87	1.30	0.00	0.00	0.00	0.00	626
21183	Eroica (34-5)	Bale	013:05-08	09/15/87	1600	214	13.4	4.9	73	43	0.26	0.45	73	1.54	0.00	0.00	0.00	0.00	575
21185	Hersbrucker Ger	Bale	004:01-04	09/11/87	600	29	4.9	6.7	42	24	0.22	0.34	86	0.97	3.39	0.00	40.96	30.88	582
21193	Nugget	Bale	237:01-05	09/03/87	2440	356	14.6	5.0	75	25	0.27	0.31	93	1.17	0.00	0.00	0.00	0.00	532
21197	Tettnang? VF	Bale	032:05-08	08/18/87	213	11	5.1	2.6	66	24	0.28	0.35	83	0.60	0.00	0.00	0.00	0.00	278
21197	Tettnang? VF	Bale	232:28-32	08/20/87	708	48	6.8	4.1	62	28	0.28	0.41	80	1.10	0.00	0.00	0.00	0.00	628
21197	Tettnang? VF	Bale	235:28-32	08/20/87	708	50	7.1	4.3	62	26	0.27	0.38	82	1.30	0.00	0.00	0.00	0.00	625
21197	Tettnang? VF	Bale	240:28-32	08/20/87	512	38	7.5	4.3	63	27	0.27	0.37	80	0.94	0.00	0.00	0.00	0.00	623
21215	Horgard 1478, Y	Bale	027:05-08	08/18/87	1139	99	8.7	4.1	68	33	0.27	0.37	82	1.15	0.00	0.00	0.00	0.00	277
21226	Chinook	Bale	226:28-32	09/15/87	2000	317	15.9	4.6	77	33	0.25	0.39	81	2.23	2.16	0.00	50.86	12.60	593
21227	Perle	Bale	220:01-05	09/01/87	913	93	10.2	4.1	71	29	0.26	0.32	88	0.83	0.00	0.00	0.00	0.00	448
21228	Ha MF? VF	Bale	218:12-16	08/20/87	785	64	8.1	4.4	65	27	0.25	0.37	79	1.05	0.00	0.00	0.00	0.00	569
21238	Blisk, Yugo	Bale	234:01-05	09/02/87	2312	305	13.2	4.8	73	34	0.26	0.63	56	2.73	0.00	0.00	0.00	0.00	496
21276	Early Prolific	Bale	023:09-12	08/19/87	533	27	5.1	2.5	67	24	0.29	0.36	85	0.68	0.00	0.00	0.00	0.00	381
21281	Sunshine	Bale	028:09-12	09/15/87	400	33	8.2	2.7	75	35	0.29	0.37	87	1.62	0.00	0.00	0.00	0.00	594
21283	Wye Viking	Bale	030:09-12	08/19/87	363	26	7.3	4.3	63	23	0.26	0.36	84	0.84	0.00	0.00	0.00	0.00	378
21287	Banner	Bale	244:06-09	09/08/87	0	0	12.6	8.0	61	36	0.24	0.54	62	2.21	2.58	0.00	61.14	17.16	614
21368	Yugo 88/150	Bale	201:01-05	09/01/87	1135	129	11.3	4.9	70	36	0.26	0.55	66	1.49	0.00	0.00	0.00	0.00	486
21369	Yugo 88/187	Bale	202:01-05	09/11/87	759	80	10.6	5.4	66	32	0.28	0.46	71	1.04	0.00	0.00	0.00	0.00	554
21370	Yugo 88/201	Bale	204:01-05	09/01/87	683	76	11.2	4.3	72	32	0.25	0.40	78	1.53	0.00	0.00	0.00	0.00	152
21373	7006-398	Bale	230:28-32	09/09/87	990	159	16.0	7.7	68	20	0.24	0.32	88	1.78	1.46	4.53	57.02	9.33	607
21384	7007-175	Bale	223:28-32	09/08/87	964	87	9.1	4.8	66	33	0.30	0.40	81	1.58	0.00	0.00	0.00	0.00	483
21384	7007-175	Bale	223:28-32	09/08/87	964	87	9.1	4.8	66	33	0.30	0.00	0	1.58	0.00	0.00	0.00	0.00	618
21455	8301-010	Bale	017:62-66	09/08/87	0	0	7.8	7.6	51	23	0.24	0.61	57	1.84	0.00	0.00	0.00	0.00	608
21455	8301-010	Bale	017:67-71	09/08/87	0	0	7.2	7.6	48	23	0.26	0.76	45	1.97	2.21	0.00	51.57	22.11	550
21455	8301-010	Bale	017:72-75	09/08/87	0	0	7.5	7.7	49	23	0.27	0.81	40	2.51	0.00	0.00	0.00	0.00	542
21455	8301-010	Bale	017:76-82	09/04/87	0	0	6.4	7.3	47	24	0.28	0.73	47	1.98	0.00	0.00	0.00	0.00	543
21455	8301-010	Bale	215:23-27	09/09/87	538	40	7.4	8.1	47	23	0.23	0.76	44	2.38	0.00	0.00	0.00	0.00	606
21456	8303-046	Bale	018:62-66	08/26/87	0	0	4.4	5.5	44	27	0.24	0.47	74	1.34	0.00	0.00	0.00	0.00	562
21456	8303-046	Bale	018:67-72	08/26/87	0	0	4.8	5.5	46	25	0.24	0.44	72	0.86	0.00	0.00	0.00	0.00	563
21456	8303-046	Bale	018:73-77	08/26/87	0	0	4.2	5.5	43	28	0.25	0.49	68	0.93	0.00	0.00	0.00	0.00	564
21456	8303-046	Bale	018:78-82	08/24/87	0	0	3.7	5.2	41	24	0.23	0.50	68	1.09	3.46	0.00	39.66	34.74	545
21456	8303-046	Bale	218:23-27	09/10/87	606	30	4.9	5.4	48	26	0.26	0.64	55	1.52	0.00	0.00	0.00	0.00	604
21457	8303-117	Bale	019:62-66	09/08/87	0	0	5.4	3.9	58	25	0.30	0.58	65	1.69	0.00	0.00	0.00	0.00	631
21457	8303-117	Bale	019:67-71	09/08/87	0	0	6.2	4.0	61	25	0.27	0.55	66	1.36	0.00	0.00	0.00	0.00	447

Agricultural Chemistry Department Oregon State University**Agricultural Research Service**U S Dept Agriculture**Corvallis, Oregon**

1987 Bale and 5-Cone Analyses at 8% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Oil Myr (%)	Oil Hum (%)	Serial Number
21457	8303-117	Bale	019:72-76	09/08/87	0	0	6.1	3.7	62	24	0.31	0.59	61	1.36	3.43	0.00	54.11	23.54	544
21457	8303-117	Bale	019:77-82	08/26/87	0	0	6.0	3.7	62	24	0.26	0.42	77	1.59	0.00	0.00	0.00	0.00	566
21457	8303-117	Bale	220:23-27	09/10/87	580	39	6.7	4.1	62	26	0.29	0.63	59	1.67	0.00	0.00	0.00	0.00	612
21458	8304-119	Bale	020:67-71	09/08/87	0	0	3.7	5.9	39	24	0.28	0.54	65	1.32	0.00	0.00	0.00	0.00	630
21458	8304-119	Bale	020:72-76	09/08/87	0	0	3.1	5.4	37	24	0.32	0.56	72	1.24	3.41	0.00	40.99	33.13	549
21458	8304-119	Bale	020:77-82	09/08/87	0	0	3.2	5.4	37	25	0.31	0.52	76	1.31	0.00	0.00	0.00	0.00	546
21458	8304-119	Bale	203:23-27	09/08/87	406	20	4.9	5.4	48	24	0.24	0.45	68	0.87	0.00	0.00	0.00	0.00	605
21459	8308-066	Bale	135:04-08	09/08/87	495	17	3.4	3.7	48	27	0.32	0.45	89	0.98	3.48	4.65	41.13	23.47	547
21459	8308-066	Bale	135:09-13	09/08/87	290	12	4.2	4.0	51	27	0.29	0.41	84	0.67	0.00	0.00	0.00	0.00	632
21459	8308-066	Bale	207:28-32	09/08/87	299	12	4.0	3.4	54	24	0.29	0.41	81	0.66	0.00	0.00	0.00	0.00	609
21470	8301-018	Bale	002:62-66	08/28/87	0	0	2.8	4.6	37	23	0.32	0.35	89	0.32	0.00	0.00	0.00	0.00	530
21470	8301-018	Bale	002:67-71	08/28/87	0	0	3.2	4.8	40	23	0.28	0.37	78	0.64	3.01	0.00	16.91	44.84	533
21470	8301-018	Bale	002:72-76	08/28/87	0	0	3.5	4.5	44	21	0.23	0.33	84	0.44	0.00	0.00	0.00	0.00	531
21470	8301-018	Bale	002:77-82	08/23/87	0	0	3.5	4.7	42	22	0.24	0.38	73	0.37	0.00	0.00	0.00	0.00	565
21471	8301-062	Bale	003:62-66	08/28/87	0	0	5.6	5.8	49	21	0.33	0.47	76	0.96	0.00	0.00	0.00	0.00	534
21471	8301-062	Bale	003:67-71	08/28/87	0	0	7.8	5.6	58	21	0.25	0.47	67	1.19	2.77	0.00	20.21	41.10	567
21471	8301-062	Bale	003:72-76	08/28/87	0	0	6.5	6.1	52	19	0.29	0.44	71	0.86	0.00	0.00	0.00	0.00	535
21473	8303-001	Bale	005:62-66	08/28/87	0	0	3.0	5.5	35	23	0.26	0.59	61	1.16	0.00	0.00	0.00	0.00	571
21473	8303-001	Bale	005:67-71	08/28/87	0	0	3.2	5.4	37	24	0.27	0.00	0	0.94	3.52	16.63	42.15	30.01	574
21473	8303-001	Bale	005:72-76	08/28/87	0	0	2.7	5.6	33	24	0.29	0.64	59	1.24	0.00	0.00	0.00	0.00	536
21473	8303-001	Bale	005:77-81	08/28/87	0	0	2.6	5.1	34	25	0.30	0.61	65	1.16	0.00	0.00	0.00	0.00	537
21475	8303-047	Bale	007:62-66	09/04/87	0	0	4.5	5.0	48	24	0.29	0.47	72	1.35	3.42	0.00	47.14	29.17	538
21475	8303-047	Bale	007:67-71	09/04/87	0	0	4.5	5.0	47	25	0.31	0.46	80	1.27	0.00	0.00	0.00	0.00	539
21475	8303-047	Bale	007:72-75	09/04/87	0	0	4.2	4.7	47	24	0.32	0.46	82	1.09	0.00	0.00	0.00	0.00	540
21475	8303-047	Bale	007:76-82	09/04/87	0	0	4.1	4.7	46	25	0.31	0.46	79	1.13	0.00	0.00	0.00	0.00	541
21478	8303-076	Bale	217:06-10	09/04/87	913	31	3.4	5.1	40	26	0.31	0.48	76	1.23	3.43	20.60	43.59	29.67	548
21481	8303-116	Bale	013:62-66	08/19/87	0	0	5.2	4.5	54	24	0.25	0.44	74	1.66	0.00	0.00	0.00	0.00	572
21481	8303-116	Bale	013:67-71	08/19/87	0	0	5.3	4.6	53	24	0.26	0.40	83	0.90	0.00	0.00	0.00	0.00	561
21481	8303-116	Bale	013:72-77	08/19/87	0	0	4.2	4.7	47	23	0.33	0.46	75	0.85	3.52	0.00	26.37	43.35	551
21481	8303-116	Bale	013:78-82	08/19/87	0	0	5.2	4.2	55	24	0.25	0.38	81	0.86	0.00	0.00	0.00	0.00	560
21484	8305-017	Bale	016:62-65	08/26/87	0	0	4.0	4.5	47	26	0.27	0.40	84	0.89	0.00	0.00	0.00	0.00	556
21484	8305-017	Bale	016:66-69	08/26/87	0	0	4.3	4.5	49	25	0.28	0.39	83	1.02	0.00	0.00	0.00	0.00	557
21484	8305-017	Bale	016:70-74	08/26/87	0	0	4.6	4.3	51	24	0.26	0.35	90	0.76	3.43	0.00	29.35	41.77	558
21484	8305-017	Bale	016:75-79	08/26/87	0	0	4.7	4.6	50	26	0.24	0.33	96	0.97	0.00	0.00	0.00	0.00	559
21484	8305-017	Bale	204:23-27	09/09/87	290	13	4.4	4.8	48	24	0.28	0.43	78	0.78	0.00	0.00	0.00	0.00	611
21490	8309-037	Bale	035:85-88	09/12/87	0	0	4.4	7.4	37	22	0.24	0.78	43	1.36	0.00	0.00	0.00	0.00	576
21490	8309-037	Bale	210:23-27	09/09/87	895	40	4.4	7.3	38	21	0.25	0.68	50	1.58	3.46	0.00	66.02	17.03	613
21490	8309-037	Bale	229:28-32	09/08/87	1519	85	5.6	7.7	42	20	0.24	0.57	62	1.48	3.43	0.00	65.47	16.79	624
21491	8405-026	Bale	149:44	08/24/87	1237	78	6.3	4.5	58	22	0.27	0.39	84	0.88	2.73	0.00	34.48	35.50	489
21492	8408-022	Bale	154:35	08/27/87	2005	145	7.2	5.7	56	24	0.25	0.46	69	1.39	0.00	0.00	0.00	0.00	284
18209	Fuggle H	Bale	010:01-04	08/18/87	661	33	5.0	2.6	66	26	0.28	0.34	86	0.44	0.00	0.00	0.00	0.00	273
56001	Hallertauer	Bale	011:01-04	08/18/87	327	15	4.7	4.5	51	20	0.23	0.46	65	0.50	3.51	0.00	36.48	36.25	281
61019	Yugo Golding	Bale	017:01-04	08/18/87	242	11	4.4	2.7	62	25	0.27	0.37	83	0.71	0.00	0.00	0.00	0.00	275
61020	Sav Golding	Bale	018:01-04	08/18/87	331	17	5.0	2.4	67	27	0.28	0.36	96	0.93	0.00	0.00	0.00	0.00	272
61021	Tettnanger	Bale	019:01-04	08/18/87	43	2	4.8	4.5	52	23	0.25	0.47	68	0.76	3.39	1.48	52.30	17.21	282
62013	Comet	Bale	020:01-04	09/11/87	1600	217	13.6	4.3	76	42	0.27	0.36	86	2.46	0.00	0.00	0.00	0.00	519
64003	19105 x 19173M	Bale	018:51-52	09/11/87	0	0	1.3	5.0	21	39	0.28	0.57	64	1.03	0.00	0.00	0.00	0.00	578
64007	19105 x 19058M	Bale	232:01-05	09/02/87	2278	68	3.0	8.0	27	30	0.22	0.50	59	0.75	0.00	0.00	0.00	0.00	343
64107	Northern Brewer	Bale	004:05-08	08/19/87	356	32	9.1	3.6	72	25	0.27	0.34	86	1.04	0.00	0.00	0.00	0.00	267
66050	Alliance	Bale	012:05-08	08/18/87	555	32	5.8	2.3	71	29	0.27	0.33	87	0.66	0.00	0.00	0.00	0.00	268

Agricultural Chemistry Department Oregon State University**Agricultural Research Service**U S Dept Agriculture**Corvallis, Oregon**

1987 Bale and 5-Cone Analyses at 8% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Myr (%)	Hum (%)	Serial Number
66052	Pride Ringwood	Bale	010:05-08	09/11/87	1600	148	9.2	6.0	61	33	0.25	0.38	80	1.12	0.09	0.00	49.89	1.06	653
6760-029		Bale	106:05-06	08/25/87	2176	94	4.3	5.4	45	46	0.28	0.00	0	1.04	0.00	0.00	0.00	0.00	508
6760-043		Bale	107:05-06	08/25/87	1237	64	5.2	5.4	49	22	0.29	0.00	0	0.98	0.00	0.00	0.00	0.00	348
6760-047		Bale	108:05-06	08/25/87	2133	97	4.6	4.2	52	43	0.31	0.00	0	1.23	0.00	0.00	0.00	0.00	351
6763-010		Bale	110:05-06	08/24/87	2730	117	4.3	3.0	59	52	0.33	0.00	0	0.93	0.00	0.00	0.00	0.00	502
6771-021		Bale	109:13-14	08/25/87	2261	114	5.0	3.4	60	40	0.31	0.00	0	0.59	0.00	0.00	0.00	0.00	342
7504-004		Bale	202:12-16	09/14/87	1655	206	12.5	7.0	64	30	0.25	0.42	74	1.75	0.00	0.00	0.00	0.00	591
7504-026		Bale	205:12-16	09/15/87	2090	257	12.3	7.6	62	24	0.25	0.46	70	2.22	0.00	0.00	0.00	0.00	590
7504-031		Bale	206:12-16	09/15/87	1869	205	11.0	8.1	58	21	0.25	0.41	77	1.74	0.00	0.00	0.00	0.00	596
7504-111		Bale	223:12-16	09/14/87	1749	171	9.8	11.1	47	33	0.23	0.50	64	2.01	0.00	0.00	0.00	0.00	589
7504-137		Bale	234:12-16	09/14/87	2274	221	9.7	8.6	53	34	0.24	0.59	55	1.52	0.00	0.00	0.00	0.00	587
7801-046		Bale	216:17-21	08/20/87	998	109	10.9	5.2	68	32	0.24	0.00	0	1.35	0.00	0.00	0.00	0.00	568
8019-003		Bale	215:01-05	09/01/87	845	73	8.6	6.5	57	38	0.30	0.00	0	1.22	0.00	0.00	0.00	0.00	441
8020-032		Bale	224:01-05	09/10/87	1305	126	9.6	4.3	69	42	0.31	0.00	0	1.23	0.00	0.00	0.00	0.00	617
8021-004		Bale	224:06-10	09/05/87	973	71	7.3	2.9	71	29	0.30	0.00	0	1.86	0.00	0.00	0.00	0.00	169
8021-011		Bale	225:01-05	09/02/87	1433	91	6.3	4.0	61	29	0.34	0.00	0	1.72	0.00	0.00	0.00	0.00	497
8021-014		Bale	225:06-10	09/04/87	538	48	8.8	2.7	76	44	0.32	0.00	0	1.00	0.00	0.00	0.00	0.00	183
8021-035		Bale	230:01-05	09/02/87	1263	102	8.1	2.7	75	39	0.35	0.00	0	1.28	0.00	0.00	0.00	0.00	370
8021-049		Bale	233:01-05	09/02/87	759	57	7.5	2.7	74	31	0.35	0.00	0	1.29	0.00	0.00	0.00	0.00	379
8022-079		Bale	246:06-09	09/08/87	742	73	9.9	3.6	73	28	0.29	0.00	0	1.48	0.00	0.00	0.00	0.00	645
8022-241		Bale	210:12-16	09/15/87	1067	93	8.7	2.3	79	44	0.30	0.00	0	0.60	0.00	0.00	0.00	0.00	597
8023-002		Bale	211:12-16	09/14/87	930	64	6.9	5.0	58	34	0.30	0.00	0	1.55	0.00	0.00	0.00	0.00	581
8024-080		Bale	213:12-16	09/14/87	964	102	10.6	4.3	71	43	0.34	0.00	0	1.17	0.00	0.00	0.00	0.00	586
8025-057		Bale	219:12-16	09/14/87	1519	122	8.0	3.0	73	28	0.30	0.00	0	1.69	0.00	0.00	0.00	0.00	584
8026-152		Bale	222:12-16	09/14/87	1357	133	9.8	4.7	67	25	0.30	0.00	0	2.02	0.00	0.00	0.00	0.00	579
8029-044		Bale	203:17-21	09/10/87	715	71	9.9	3.3	75	23	0.31	0.00	0	1.49	0.00	0.00	0.00	0.00	637
8030-012		Bale	205:17-21	09/10/87	0	0	13.1	6.9	65	35	0.25	0.00	0	1.28	0.00	0.00	0.00	0.00	603
8030-035		Bale	206:17-21	09/10/87	0	0	11.0	3.7	75	35	0.33	0.00	0	1.20	0.00	0.00	0.00	0.00	648
8030-082		Bale	209:17-21	09/11/87	717	54	7.5	2.5	75	34	0.34	0.00	0	0.75	0.00	0.00	0.00	0.00	650
8030-114		Bale	214:17-21	90/11/87	1118	100	8.9	3.1	74	36	0.34	0.00	0	1.00	0.00	0.00	0.00	0.00	638
8030-174		Bale	220:17-21	09/11/87	1476	148	10.0	4.0	72	42	0.32	0.00	0	1.16	0.00	0.00	0.00	0.00	640
8031-002		Bale	222:17-21	09/11/87	1741	194	11.1	5.7	66	33	0.26	0.00	0	1.38	0.00	0.00	0.00	0.00	601
8031-042		Bale	224:17-21	09/11/87	1152	136	11.8	5.6	68	31	0.26	0.00	0	1.34	0.00	0.00	0.00	0.00	619
8031-057		Bale	225:17-21	09/11/87	1877	217	11.5	4.9	70	45	0.26	0.00	0	1.76	0.00	0.00	0.00	0.00	649
8031-161		Bale	229:17-21	09/11/87	1849	209	11.3	4.8	70	42	0.28	0.00	0	1.30	0.00	0.00	0.00	0.00	598
8031-171		Bale	231:17-21	09/11/87	2082	184	8.8	2.9	75	35	0.37	0.00	0	1.62	0.00	0.00	0.00	0.00	585
8032-046		Bale	238:17-21	09/15/87	1186	130	11.0	5.9	65	33	0.29	0.00	0	0.76	0.00	0.00	0.00	0.00	573
8032-065		Bale	240:17-21	09/15/87	1399	209	15.0	8.0	65	49	0.26	0.00	0	3.61	0.00	0.00	0.00	0.00	592
8033-034		Bale	216:23-27	09/09/87	1800	157	8.7	4.2	67	26	0.34	0.00	0	1.25	0.00	0.00	0.00	0.00	643
8034-048		Bale	217:23-27	09/10/87	1246	66	5.3	3.5	60	30	0.35	0.00	0	1.77	0.00	0.00	0.00	0.00	599
8036-020		Bale	221:23-27	09/10/87	1160	87	7.5	2.6	74	43	0.34	0.00	0	1.49	0.00	0.00	0.00	0.00	636
8036-026		Bale	222:23-27	09/10/87	1834	101	5.5	5.1	52	40	0.26	0.00	0	1.34	0.00	0.00	0.00	0.00	635
8036-052		Bale	226:23-27	09/10/87	2312	204	8.8	2.7	77	25	0.32	0.37	91	1.71	0.00	0.00	0.00	0.00	647
8036-066		Bale	229:23-27	09/10/87	1212	101	8.3	3.4	71	31	0.32	0.00	0	1.74	0.00	0.00	0.00	0.00	602
8036-083		Bale	231:23-27	09/10/87	1382	128	9.3	4.9	66	38	0.28	0.00	0	1.30	0.00	0.00	0.00	0.00	621
8036-084		Bale	232:23-27	09/10/87	1229	80	6.5	3.1	68	26	0.33	0.00	0	1.27	0.00	0.00	0.00	0.00	620
8037-036		Bale	217:28-32	09/09/87	990	74	7.4	3.3	69	43	0.30	0.38	83	0.82	0.00	0.00	0.00	0.00	644
8037-068		Bale	218:28-32	09/09/87	1212	113	9.3	3.0	76	32	0.33	0.00	0	1.65	0.00	0.00	0.00	0.00	383
8037-075		Bale	219:28-32	09/09/87	1007	87	8.6	4.4	66	40	0.29	0.00	0	0.95	0.00	0.00	0.00	0.00	384
8037-090		Bale	220:28-32	09/09/87	1348	103	7.6	4.9	61	38	0.31	0.36	89	0.93	0.00	0.00	0.00	0.00	616

Agricultural Chemistry Department Oregon State University**Agricultural Research Service**U S Dept Agriculture**Corvallis, Oregon**

1987 Bale and 5-Cone Analyses at 0% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Oil Myr (%)	Oil Hum (%)	Serial Number
8037-098		Bale	221:28-32	09/09/87	1271	68	5.4	3.2	62	37	0.31	0.00	0	0.95	0.00	0.00	0.00	0.00	642
8037-122		Bale	222:28-32	09/09/87	1297	102	7.8	3.5	69	40	0.33	0.00	0	2.00	0.00	0.00	0.00	0.00	615
8037-136		Bale	224:28-32	09/09/87	1297	106	8.1	3.3	71	30	0.32	0.43	82	1.68	0.00	0.00	0.00	0.00	610
8301-001		Bale	205:06-10	09/03/87	1843	119	6.4	6.2	51	30	0.29	0.00	0	0.98	0.00	0.00	0.00	0.00	449
8301-007		Bale	206:06-10	09/03/87	1647	78	4.8	4.8	50	24	0.29	0.00	0	1.02	0.00	0.00	0.00	0.00	157
8301-024		Bale	207:06-10	09/03/87	1246	55	4.4	5.0	47	24	0.30	0.00	0	0.58	0.00	0.00	0.00	0.00	477
8301-036		Bale	208:06-10	09/03/87	1621	38	2.3	6.7	26	35	0.25	0.00	0	0.85	0.00	0.00	0.00	0.00	484
8301-051		Bale	209:06-10	09/03/87	1023	76	7.4	6.0	56	31	0.29	0.00	0	1.13	0.00	0.00	0.00	0.00	472
8301-057		Bale	211:06-10	09/03/87	1741	82	4.7	3.4	58	27	0.29	0.00	0	0.30	0.00	0.00	0.00	0.00	156
8301-063		Bale	210:01-05	09/01/87	742	59	7.9	5.3	60	32	0.28	0.00	0	0.87	0.00	0.00	0.00	0.00	332
8303-020		Bale	218:01-05	09/01/87	811	60	7.3	4.6	61	23	0.26	0.00	0	1.14	0.00	0.00	0.00	0.00	458
8303-037		Bale	221:01-05	09/02/87	751	34	4.5	3.3	58	20	0.32	0.00	0	0.75	0.00	0.00	0.00	0.00	372
8303-039		Bale	222:01-05	09/02/87	1032	36	3.4	4.9	41	26	0.32	0.00	0	0.68	0.00	0.00	0.00	0.00	494
8303-049		Bale	214:06-10	09/03/87	964	37	3.8	2.2	63	22	0.41	0.00	0	0.43	0.00	0.00	0.00	0.00	455
8303-086		Bale	218:06-10	09/04/87	1340	49	3.7	2.5	59	25	0.34	0.00	0	0.80	0.00	0.00	0.00	0.00	181
8303-094		Bale	219:06-10	09/04/87	1382	60	4.3	3.1	58	20	0.31	0.00	0	0.63	0.00	0.00	0.00	0.00	167
8303-122		Bale	215:06-10	09/04/87	981	83	8.4	3.2	72	24	0.29	0.00	0	1.60	0.00	0.00	0.00	0.00	179
8304-027		Bale	226:06-10	09/04/87	998	32	3.2	5.7	36	23	0.27	0.00	0	0.94	0.00	0.00	0.00	0.00	165
8304-032		Bale	227:06-10	09/04/87	793	34	4.3	3.8	53	19	0.29	0.00	0	0.63	0.00	0.00	0.00	0.00	166
8305-022		Bale	241:12-16	09/14/87	785	35	4.5	3.1	59	23	0.33	0.00	0	0.87	0.00	0.00	0.00	0.00	580
8308-016		Bale	207:17-21	09/10/87	930	57	6.2	4.3	59	26	0.30	0.00	0	1.40	0.00	0.00	0.00	0.00	641
8308-036		Bale	208:17-21	09/10/87	1400	75	5.4	4.6	54	23	0.31	0.00	0	0.69	0.00	0.00	0.00	0.00	629
8308-044		Bale	217:17-21	09/11/87	1135	83	7.3	4.0	64	23	0.31	0.00	0	1.30	0.00	0.00	0.00	0.00	600
8308-046		Bale	219:17-21	09/11/87	790	60	7.6	5.1	60	27	0.31	0.00	0	2.21	0.00	0.00	0.00	0.00	639
8309-005		Bale	227:28-32	09/09/87	1638	117	7.1	7.2	50	22	0.25	0.00	0	1.80	0.00	0.00	0.00	0.00	646
8309-007		Bale	235:17-21	09/11/87	1340	136	10.1	6.2	62	25	0.26	0.00	0	1.89	0.00	0.00	0.00	0.00	588
8309-008		Bale	237:17-21	09/11/87	1160	123	10.6	5.5	66	23	0.28	0.00	0	2.40	0.00	0.00	0.00	0.00	651
8309-024		Bale	241:17-21	09/15/87	1312	98	7.4	5.7	57	23	0.29	0.00	0	2.11	0.00	0.00	0.00	0.00	595
8401-004		Bale	137:04	08/28/87	1493	143	9.6	5.6	63	27	0.28	0.64	51	2.00	0.00	0.00	0.00	0.00	366
8401-041		Bale	137:41	08/28/87	1900	63	3.3	3.8	47	23	0.31	0.39	80	0.22	0.00	0.00	0.00	0.00	347
8401-132		Bale	139:28	08/19/87	2432	146	6.0	5.7	52	24	0.32	0.83	42	1.57	0.00	0.00	0.00	0.00	555
8401-196		Bale	140:40	08/19/87	2389	128	5.4	4.9	52	26	0.31	0.86	40	0.80	0.00	0.00	0.00	0.00	553
8402-068		Bale	142:05	08/21/87	1877	127	6.8	3.2	68	22	0.27	0.35	85	0.71	0.00	0.00	0.00	0.00	524
8402-085		Bale	142:22	08/21/87	1450	95	6.6	2.5	72	23	0.31	0.00	0	0.64	0.00	0.00	0.00	0.00	173
8402-093		Bale	142:30	08/21/87	2453	149	6.1	2.7	69	25	0.30	0.36	83	0.73	0.00	0.00	0.00	0.00	527
8402-099		Bale	142:36	08/21/87	1450	107	7.4	3.0	71	26	0.29	0.38	82	0.75	0.00	0.00	0.00	0.00	164
8402-104		Bale	142:41	08/21/87	1664	110	6.6	2.8	70	27	0.31	0.00	0	0.78	0.00	0.00	0.00	0.00	162
8402-157		Bale	143:42	08/21/87	1066	63	5.9	3.4	64	24	0.30	0.00	0	0.80	0.00	0.00	0.00	0.00	521
8402-169		Bale	144:02	08/21/87	1621	132	8.1	3.6	69	26	0.27	0.00	0	0.87	0.00	0.00	0.00	0.00	529
8402-174		Bale	144:07	08/21/87	2005	81	4.1	2.6	61	22	0.35	0.00	0	0.43	0.00	0.00	0.00	0.00	523
8403-003		Bale	144:19	08/21/87	2133	106	5.0	4.0	56	23	0.26	0.44	69	0.35	0.00	0.00	0.00	0.00	517
8403-007		Bale	144:23	08/21/87	2346	130	5.5	3.4	62	18	0.27	0.48	68	0.44	0.00	0.00	0.00	0.00	525
8403-012		Bale	144:28	08/21/87	1621	56	3.5	5.1	41	22	0.27	0.00	0	0.50	0.00	0.00	0.00	0.00	380
8403-111		Bale	146:23	08/21/87	2048	93	4.5	3.1	60	26	0.30	0.47	70	0.47	0.00	0.00	0.00	0.00	518
8403-129		Bale	146:41	08/21/87	2176	91	4.2	3.1	58	20	0.32	0.48	74	0.67	0.00	0.00	0.00	0.00	522
8404-020		Bale	147:12	08/21/87	1024	63	6.1	4.1	60	18	0.27	0.00	0	0.41	0.00	0.00	0.00	0.00	520
8405-007		Bale	149:25	08/21/87	1237	85	6.8	4.9	58	25	0.27	0.00	0	0.86	0.00	0.00	0.00	0.00	526
8405-010		Bale	149:28	08/21/87	1621	126	7.8	4.3	65	27	0.28	0.39	83	0.98	0.00	0.00	0.00	0.00	528
8405-013		Bale	149:31	08/24/87	1749	115	6.6	4.5	60	24	0.27	0.40	77	1.16	0.00	0.00	0.00	0.00	507
8405-018		Bale	149:36	08/24/87	1536	97	6.3	4.2	60	25	0.29	0.00	0	1.18	0.00	0.00	0.00	0.00	505

Agricultural Chemistry Department Oregon State University**Agricultural Research Service**U S Dept Agriculture**Corvallis, Oregon**

1987 Bale and 5-Cone Analyses at 8% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Oil Myr (%)	Oil Hum (%)	Serial Number
8405-024		Bale	149:42	08/24/87	1493	92	6.2	3.1	66	23	0.28	0.35	84	0.97	0.00	0.00	0.00	0.00	488
8405-027		Bale	149:45	08/24/87	1322	82	6.2	3.9	61	22	0.31	0.38	88	1.03	0.00	0.00	0.00	0.00	622
8405-028		Bale	149:46	08/24/87	1280	92	7.2	3.9	65	23	0.27	0.35	85	0.85	0.00	0.00	0.00	0.00	493
8405-039		Bale	150:05	08/24/87	2474	212	8.6	5.5	61	26	0.26	0.40	78	1.36	0.00	0.00	0.00	0.00	506
8405-045		Bale	150:11	08/24/87	2474	187	7.6	3.3	70	26	0.30	0.34	88	0.97	0.00	0.00	0.00	0.00	492
8405-052		Bale	150:18	08/24/87	1365	108	7.9	4.6	63	27	0.26	0.38	81	1.15	0.00	0.00	0.00	0.00	516
8405-059		Bale	150:25	08/24/87	2005	133	6.6	4.0	62	23	0.29	0.41	74	1.19	0.00	0.00	0.00	0.00	491
8405-083		Bale	150:49	08/24/87	1621	106	6.6	4.3	60	26	0.29	0.00	0	1.21	0.00	0.00	0.00	0.00	509
8405-084		Bale	150:50	08/24/87	1621	151	9.3	3.7	72	20	0.28	0.00	0	0.97	0.00	0.00	0.00	0.00	510
8405-101		Bale	151:15	08/24/87	2261	203	9.0	4.2	68	20	0.28	0.34	89	1.11	0.00	0.00	0.00	0.00	515
8405-103		Bale	151:17	08/24/87	1557	126	8.1	3.2	71	19	0.28	0.33	90	0.49	0.00	0.00	0.00	0.00	511
8405-104		Bale	151:18	08/24/87	1408	127	9.0	4.1	69	25	0.29	0.36	82	0.93	0.00	0.00	0.00	0.00	512
8405-119		Bale	151:33	08/24/87	1280	89	7.0	4.2	62	24	0.27	0.00	0	0.94	0.00	0.00	0.00	0.00	490
8406-004		Bale	151:38	08/24/87	2176	190	8.7	2.7	76	21	0.28	0.32	91	0.78	0.00	0.00	0.00	0.00	504
8406-007		Bale	151:41	08/24/87	1066	64	6.0	4.0	60	21	0.29	0.00	0	1.02	0.00	0.00	0.00	0.00	514
8406-016		Bale	151:50	08/24/87	1408	105	7.5	5.6	57	24	0.27	0.50	68	1.54	0.00	0.00	0.00	0.00	495
8406-026		Bale	152:08	08/25/87	2474	189	7.6	3.2	70	26	0.28	0.39	82	0.85	0.00	0.00	0.00	0.00	338
8406-029		Bale	152:11	08/25/87	597	41	6.9	4.0	63	21	0.26	0.00	0	0.58	0.00	0.00	0.00	0.00	331
8406-038		Bale	152:20	08/25/87	2282	194	8.5	3.4	72	22	0.28	0.49	68	0.65	0.00	0.00	0.00	0.00	500
8406-045		Bale	152:27	08/25/87	1877	154	8.2	2.8	74	25	0.31	0.44	78	1.18	0.00	0.00	0.00	0.00	487
8406-058		Bale	152:40	08/25/87	1450	94	6.5	3.8	63	24	0.33	0.34	88	0.77	0.00	0.00	0.00	0.00	499
8406-062		Bale	152:44	08/25/87	1450	138	9.5	4.5	68	21	0.29	0.41	77	1.40	0.00	0.00	0.00	0.00	503
8406-064		Bale	152:46	08/25/87	1536	123	8.0	3.8	68	25	0.28	0.46	76	1.27	0.00	0.00	0.00	0.00	501
8406-065		Bale	152:47	08/25/87	1792	138	7.7	3.9	66	17	0.28	0.30	93	0.49	0.00	0.00	0.00	0.00	513
8406-084		Bale	153:14	08/25/87	1962	169	8.6	3.8	69	22	0.27	0.38	83	1.07	0.00	0.00	0.00	0.00	346
8406-085		Bale	153:15	08/25/87	1792	143	8.0	4.1	66	24	0.29	0.42	78	1.20	0.00	0.00	0.00	0.00	498
8406-088		Bale	153:18	08/25/87	1877	172	9.2	5.1	64	22	0.27	0.54	64	1.10	0.00	0.00	0.00	0.00	325
8407-006		Bale	153:26	08/25/87	1365	115	8.4	5.1	62	23	0.28	0.43	74	1.19	0.00	0.00	0.00	0.00	344
8407-015		Bale	153:35	08/25/87	1856	144	7.8	4.4	64	27	0.28	0.50	67	1.18	0.00	0.00	0.00	0.00	323
8407-019		Bale	153:39	08/25/87	469	35	7.5	4.4	63	23	0.26	0.00	0	0.77	0.00	0.00	0.00	0.00	322
8407-020		Bale	153:40	08/25/87	1493	127	8.5	4.1	68	25	0.28	0.40	79	0.93	0.00	0.00	0.00	0.00	324
8407-021		Bale	153:41	08/25/87	768	82	10.7	4.6	70	25	0.26	0.00	0	1.32	0.00	0.00	0.00	0.00	327
8407-026		Bale	153:46	08/25/87	1024	97	9.5	4.6	67	28	0.26	0.48	67	1.11	0.00	0.00	0.00	0.00	336
8407-029		Bale	153:49	08/25/87	1066	107	10.1	3.3	75	23	0.28	0.00	0	1.20	0.00	0.00	0.00	0.00	345
8407-035		Bale	154:03	08/27/87	1450	133	9.2	4.1	69	25	0.28	0.39	78	1.15	0.00	0.00	0.00	0.00	371
8407-037		Bale	154:05	08/27/87	1664	139	8.4	3.1	73	30	0.31	0.52	69	1.40	0.00	0.00	0.00	0.00	369
8407-043		Bale	154:11	08/27/87	1536	153	9.9	4.9	67	23	0.27	0.50	67	0.83	0.00	0.00	0.00	0.00	353
8408-001		Bale	154:14	08/27/87	1962	198	10.1	5.2	66	26	0.28	0.45	74	1.63	0.00	0.00	0.00	0.00	333
8408-003		Bale	154:16	08/27/87	1749	111	6.4	5.1	55	23	0.27	0.00	0	1.35	0.00	0.00	0.00	0.00	358
8408-004		Bale	154:17	08/27/87	2261	243	10.7	5.5	66	24	0.27	0.38	79	0.99	0.00	0.00	0.00	0.00	365
8408-011		Bale	154:24	08/27/87	1664	172	10.3	5.7	65	22	0.28	0.43	72	1.02	0.00	0.00	0.00	0.00	363
8408-018		Bale	154:31	08/27/87	1578	110	6.9	7.0	50	27	0.25	0.63	53	1.26	0.00	0.00	0.00	0.00	362
8408-020		Bale	154:33	08/27/87	1792	167	9.3	6.4	59	27	0.25	0.00	0	1.75	0.00	0.00	0.00	0.00	368
8408-030		Bale	154:43	08/27/87	1792	141	7.9	5.8	58	24	0.27	0.95	34	1.42	0.00	0.00	0.00	0.00	360
8408-031		Bale	154:44	08/27/87	1408	105	7.5	7.8	49	23	0.24	0.50	62	0.91	0.00	0.00	0.00	0.00	335
8408-043		Bale	155:04	08/27/87	2389	198	8.3	4.0	67	27	0.33	0.53	67	1.55	0.00	0.00	0.00	0.00	355
8408-046		Bale	155:07	08/27/87	2901	201	6.9	6.7	51	25	0.27	0.71	50	1.28	0.00	0.00	0.00	0.00	340
8408-047		Bale	155:08	08/27/87	1920	127	6.6	6.7	50	23	0.27	0.49	68	0.91	0.00	0.00	0.00	0.00	356
8408-061		Bale	155:22	08/27/87	2240	229	10.2	4.6	69	25	0.26	0.55	63	1.12	0.00	0.00	0.00	0.00	263
8408-066		Bale	155:27	08/27/87	2304	214	9.3	6.7	58	18	0.25	0.49	65	1.10	0.00	0.00	0.00	0.00	285

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1987 Bale and 5-Cone Analyses at 8% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Accession or Nursery Number	Identification	Type Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 No HSI	%A+B Remain	Oil mL/ 100g	H/C	H/F	Myr (%)	Hum (%)	Serial Number
8408-070		Bale 155:31	08/27/87	2261	215	9.5	5.2	65	25	0.26	0.52	67	1.04	0.00	0.00	0.00	0.00	570
8408-074		Bale 155:35	08/27/87	2517	197	7.8	4.5	64	25	0.27	0.61	62	1.44	0.00	0.00	0.00	0.00	287
8408-082		Bale 155:43	08/27/87	2133	209	9.8	4.4	69	24	0.28	0.59	61	0.97	0.00	0.00	0.00	0.00	354
8408-096		Bale 156:05	08/27/87	2517	213	8.5	5.3	61	22	0.26	0.41	80	1.55	0.00	0.00	0.00	0.00	334
8408-106		Bale 156:15	08/27/87	2005	88	4.4	7.3	37	30	0.25	0.75	47	1.00	0.00	0.00	0.00	0.00	337
8408-114		Bale 156:23	08/27/87	2261	142	6.3	8.2	44	26	0.26	0.66	53	1.71	0.00	0.00	0.00	0.00	261
8408-126		Bale 156:35	08/27/87	2176	207	9.5	4.6	67	23	0.26	0.50	66	0.92	0.00	0.00	0.00	0.00	262
8409-011		Bale 157:10	08/28/87	1834	69	3.8	4.7	44	26	0.31	0.00	0	1.14	0.00	0.00	0.00	0.00	364
8409-018		Bale 157:17	08/28/87	1664	134	8.0	3.6	69	23	0.30	0.48	82	1.10	0.00	0.00	0.00	0.00	359
8409-048		Bale 157:47	08/28/87	1493	94	6.3	4.0	61	24	0.31	0.00	0	1.13	0.00	0.00	0.00	0.00	283
8409-060		Bale 158:07	08/28/87	2815	118	4.2	4.0	52	21	0.32	0.00	0	0.96	0.00	0.00	0.00	0.00	361
8409-071		Bale 158:18	08/28/87	1194	45	3.7	4.8	48	24	0.37	0.00	0	0.80	0.00	0.00	0.00	0.00	286
8409-072		Bale 158:19	08/28/87	1280	47	3.7	4.7	44	25	0.29	0.00	0	0.85	0.00	0.00	0.00	0.00	339
8410-003		Bale 158:40	08/28/87	1152	36	3.2	5.9	35	25	0.28	0.00	0	0.92	0.00	0.00	0.00	0.00	330
8410-016		Bale 159:01	08/28/87	2090	150	7.2	6.0	55	24	0.29	0.66	56	1.51	0.00	0.00	0.00	0.00	367
8410-026		Bale 159:11	08/28/87	1962	71	3.6	6.4	36	25	0.23	0.50	68	0.75	0.00	0.00	0.00	0.00	352
8410-028		Bale 159:13	08/28/87	1834	82	4.5	7.1	39	28	0.26	0.69	53	1.60	0.00	0.00	0.00	0.00	341
8410-029		Bale 159:14	08/31/87	1706	60	3.5	5.1	41	23	0.31	0.00	0	0.86	0.00	0.00	0.00	0.00	461
8410-052		Bale 159:37	08/31/87	2090	78	3.7	7.1	35	29	0.24	0.64	52	1.40	0.00	0.00	0.00	0.00	464
8410-054		Bale 159:39	08/31/87	1706	75	4.4	5.5	44	22	0.28	0.00	0	1.29	0.00	0.00	0.00	0.00	474
8410-057		Bale 159:42	08/31/87	2048	126	6.2	4.9	56	22	0.29	0.48	73	0.81	0.00	0.00	0.00	0.00	445
8410-058		Bale 159:43	08/31/87	1365	104	7.6	5.2	60	23	0.29	0.00	0	1.16	0.00	0.00	0.00	0.00	485
8410-064		Bale 159:49	08/31/87	1877	148	7.9	4.0	66	22	0.31	0.00	0	1.73	0.00	0.00	0.00	0.00	473
8410-078		Bale 160:11	08/31/87	2218	124	5.6	5.7	50	23	0.29	0.00	0	1.35	0.00	0.00	0.00	0.00	453
8410-080		Bale 160:13	08/31/87	2346	191	8.1	5.2	61	22	0.29	0.75	45	1.68	0.00	0.00	0.00	0.00	440
8410-085		Bale 160:18	08/31/87	1834	138	7.6	5.2	59	22	0.29	0.42	59	1.37	0.00	0.00	0.00	0.00	446
8410-086		Bale 160:19	08/31/87	2261	163	7.2	4.2	63	22	0.32	0.53	65	1.14	0.00	0.00	0.00	0.00	451
8410-096		Bale 160:29	08/31/87	2602	161	6.2	6.3	50	24	0.26	0.64	54	1.63	0.00	0.00	0.00	0.00	479
8410-102		Bale 160:35	08/31/87	1792	125	7.0	5.5	56	24	0.31	0.78	46	1.80	0.00	0.00	0.00	0.00	454
8410-106		Bale 160:39	08/31/87	1664	95	5.7	5.8	50	23	0.30	0.00	0	1.39	0.00	0.00	0.00	0.00	463
8410-127		Bale 161:08	08/31/87	1450	74	5.1	5.1	50	24	0.32	0.00	0	1.10	0.00	0.00	0.00	0.00	452
8411-015		Bale 161:24	08/21/87	1800	164	9.1	4.3	68	24	0.29	0.35	88	0.96	0.00	0.00	0.00	0.00	450
8411-025		Bale 161:34	08/31/87	1834	165	9.0	4.0	69	25	0.27	0.33	90	1.37	0.00	0.00	0.00	0.00	478
8411-029		Bale 161:38	08/31/87	1877	172	9.2	3.2	74	23	0.33	0.35	91	1.07	0.00	0.00	0.00	0.00	442
8411-030		Bale 161:39	08/31/87	1536	143	9.3	4.1	69	27	0.30	0.00	0	1.12	0.00	0.00	0.00	0.00	443
8411-040		Bale 161:49	08/31/87	1920	160	8.3	3.5	71	24	0.29	0.35	85	1.53	0.00	0.00	0.00	0.00	462
8411-042		Bale 161:51	08/31/87	1493	142	9.5	3.7	72	27	0.30	0.36	88	1.24	0.00	0.00	0.00	0.00	444
8411-049		Bale 162:06	09/01/87	2304	189	8.2	3.4	71	27	0.31	0.35	89	1.08	0.00	0.00	0.00	0.00	470
8411-054		Bale 162:11	08/31/87	1706	138	8.1	2.8	74	22	0.34	0.00	0	0.90	0.00	0.00	0.00	0.00	456
8411-064		Bale 162:21	08/31/87	1749	150	8.6	3.6	70	32	0.31	0.39	85	1.28	0.00	0.00	0.00	0.00	457
8411-075		Bale 162:32	08/31/87	1877	172	9.2	2.8	76	23	0.33	0.37	86	1.10	0.00	0.00	0.00	0.00	459
8411-085		Bale 162:42	08/31/87	1408	99	7.0	4.5	61	32	0.27	0.00	0	0.70	0.00	0.00	0.00	0.00	481
8411-106		Bale 163:11	09/01/87	1237	118	9.5	5.4	64	25	0.26	0.00	0	0.92	0.00	0.00	0.00	0.00	326
8411-135		Bale 163:40	09/01/87	2261	202	8.9	4.2	68	30	0.29	0.40	83	1.45	0.00	0.00	0.00	0.00	158
8411-150		Bale 164:03	09/01/87	2474	239	9.7	3.8	72	25	0.29	0.32	91	0.99	0.00	0.00	0.00	0.00	329
8411-157		Bale 164:10	09/01/87	2218	159	7.2	4.5	61	30	0.31	0.35	90	1.46	0.00	0.00	0.00	0.00	171
8411-167		Bale 164:20	09/01/87	1578	169	10.7	6.4	62	40	0.27	0.00	0	0.99	0.00	0.00	0.00	0.00	476
8411-188		Bale 164:41	09/01/87	1792	110	6.1	3.5	63	33	0.34	0.00	0	0.60	0.00	0.00	0.00	0.00	465
8411-204		Bale 165:05	09/01/87	1493	155	10.4	4.4	70	21	0.29	0.33	91	1.37	0.00	0.00	0.00	0.00	163
8411-229		Bale 165:30	09/01/87	1621	168	10.4	3.6	74	35	0.29	0.35	79	1.37	0.00	0.00	0.00	0.00	471

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1987 Bale and 5-Cone Analyses at 8% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Oil Myr (%)	Oil Hum (%)	Serial Number
8411-241		Bale	165:42	09/01/87	1536	112	7.3	4.4	62	23	0.29	0.00	0	0.74	0.00	0.00	0.00	0.00	328
8411-256		Bale	166:05	09/03/87	1493	141	9.5	5.6	63	36	0.26	0.00	0	1.10	0.00	0.00	0.00	0.00	482
8411-261		Bale	166:10	09/03/87	1450	116	8.0	4.6	63	30	0.29	0.00	0	0.73	0.00	0.00	0.00	0.00	376
8411-262		Bale	166:11	09/03/87	1536	148	9.6	4.8	67	27	0.28	0.34	87	1.12	0.00	0.00	0.00	0.00	155
8411-265		Bale	166:14	09/03/87	2005	159	7.9	4.3	65	40	0.28	0.00	0	1.10	0.00	0.00	0.00	0.00	153
8412-002		Bale	166:16	09/03/87	2005	202	10.1	5.6	64	38	0.30	0.33	89	1.74	0.00	0.00	0.00	0.00	460
8412-010		Bale	166:24	09/03/87	1621	150	9.3	7.2	56	38	0.27	0.36	84	0.99	0.00	0.00	0.00	0.00	159
8412-012		Bale	166:26	09/03/87	2261	184	8.2	4.1	67	22	0.29	0.35	90	0.67	0.00	0.00	0.00	0.00	160
8412-016		Bale	166:30	09/03/87	1578	180	11.4	4.6	71	30	0.27	0.36	85	1.17	0.00	0.00	0.00	0.00	469
8412-019		Bale	166:33	09/03/87	2815	316	11.2	4.4	72	22	0.30	0.37	86	1.59	0.00	0.00	0.00	0.00	357
8412-022		Bale	166:36	09/03/87	1834	198	10.8	4.0	73	26	0.29	0.33	90	1.23	0.00	0.00	0.00	0.00	475
8412-025		Bale	166:39	09/03/87	1920	138	7.2	4.5	62	27	0.28	0.35	88	0.99	0.00	0.00	0.00	0.00	154
8412-034		Bale	166:48	09/04/87	1322	125	9.5	4.7	67	29	0.31	0.41	83	1.12	0.00	0.00	0.00	0.00	175
8412-041		Bale	167:03	09/04/87	1237	105	8.5	4.6	65	36	0.28	0.00	0	1.11	0.00	0.00	0.00	0.00	182
8412-058		Bale	167:20	09/04/87	2389	260	10.9	5.7	65	20	0.29	0.45	69	1.32	0.00	0.00	0.00	0.00	260
8412-062		Bale	167:24	09/04/87	1493	138	9.2	4.9	65	29	0.28	0.00	0	1.12	0.00	0.00	0.00	0.00	170
8412-075		Bale	167:37	09/04/87	2303	230	10.0	4.3	70	25	0.30	0.43	79	1.91	0.00	0.00	0.00	0.00	186
8412-079		Bale	167:41	09/04/87	1749	174	10.0	5.2	66	29	0.29	0.46	76	1.33	0.00	0.00	0.00	0.00	184
8412-086		Bale	167:48	09/04/87	1365	115	8.4	4.1	68	22	0.31	0.00	0	0.93	0.00	0.00	0.00	0.00	467
8412-101		Bale	168:11	09/04/87	1450	135	9.3	5.4	63	20	0.27	0.32	88	1.16	0.00	0.00	0.00	0.00	280
8412-113		Bale	168:23	09/04/87	1200	99	8.3	5.3	61	31	0.27	0.00	0	1.59	0.00	0.00	0.00	0.00	264
8412-114		Bale	168:24	09/04/87	1280	83	6.5	3.7	64	30	0.31	0.00	0	0.49	0.00	0.00	0.00	0.00	172
8412-121		Bale	168:31	09/04/87	1749	182	10.4	6.2	63	37	0.26	0.38	78	1.18	0.00	0.00	0.00	0.00	265
8412-125		Bale	168:35	09/04/87	2346	198	8.5	5.8	59	28	0.28	0.31	89	1.25	0.00	0.00	0.00	0.00	176
8412-135		Bale	168:45	09/04/87	2304	190	8.3	5.0	62	38	0.26	0.43	75	1.31	0.00	0.00	0.00	0.00	270
8412-138		Bale	168:48	09/04/87	2304	229	9.9	5.4	65	25	0.29	0.36	85	1.32	0.00	0.00	0.00	0.00	161
8412-139		Bale	168:49	09/04/87	1664	136	8.2	3.5	70	21	0.33	0.32	97	0.84	0.00	0.00	0.00	0.00	466
8412-150		Bale	169:08	09/04/87	2048	100	4.9	5.6	46	35	0.27	0.40	77	1.01	0.00	0.00	0.00	0.00	271
8412-154		Bale	169:12	09/04/87	1536	131	8.5	4.9	64	28	0.27	0.00	0	1.04	0.00	0.00	0.00	0.00	279
8412-156		Bale	169:14	09/04/87	1877	158	8.4	4.7	64	28	0.29	0.00	0	1.19	0.00	0.00	0.00	0.00	177
8412-165		Bale	169:23	09/04/87	1066	75	7.1	3.1	69	30	0.35	0.00	0	0.82	0.00	0.00	0.00	0.00	187
8412-166		Bale	169:24	09/04/87	2176	175	8.0	5.5	60	23	0.27	0.35	88	0.80	0.00	0.00	0.00	0.00	180
8412-183		Bale	169:41	09/04/87	1920	199	10.4	4.9	68	27	0.29	0.50	69	1.71	0.00	0.00	0.00	0.00	174
8412-186		Bale	169:44	09/04/87	1109	114	10.3	5.5	65	23	0.28	0.00	0	1.31	0.00	0.00	0.00	0.00	178
8412-188		Bale	169:46	09/04/87	1792	193	10.8	6.9	61	27	0.25	0.37	78	1.35	0.00	0.00	0.00	0.00	373
8412-196		Bale	170:02	09/04/87	0	0	10.3	5.2	66	36	0.27	0.36	87	1.07	0.00	0.00	0.00	0.00	185
8412-199		Bale	170:05	09/05/87	0	0	9.5	5.1	65	26	0.28	0.35	89	1.35	0.00	0.00	0.00	0.00	168
8412-214		Bale	170:20	09/08/87	2389	215	9.0	4.0	69	25	0.30	0.49	74	1.40	0.00	0.00	0.00	0.00	634
8412-224		Bale	170:30	09/08/87	1792	135	7.5	2.4	76	21	0.35	0.00	0	0.90	0.00	0.00	0.00	0.00	468
8412-225		Bale	170:31	09/08/87	2261	175	7.8	3.9	66	25	0.28	0.38	88	0.49	0.00	0.00	0.00	0.00	480
8412-234		Bale	170:40	09/08/87	2432	166	6.8	3.9	64	35	0.30	0.39	82	0.68	0.00	0.00	0.00	0.00	633

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1987 Bale and 5-Cone Analyses at 8% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

ranked by Accession/Sel. numbers

Conc analyses

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Myr (%)	Hum (%)	Serial Number
19185	LGpFuRedV-OP	Cone	006:49-50	09/11/87	0	0	3.9	2.4	61	39	0.25	0.54	63	0.00	0.00	0.00	0.00	0.00	427
21016	Fu M, VF	Cone	009:01-04	08/18/87	693	42	6.1	3.3	65	27	0.23	0.40	78	0.00	0.00	0.00	0.00	0.00	2
21040	Columbia	Cone	023:05-08	09/10/87	1700	154	9.1	5.3	63	39	0.26	0.42	75	0.00	0.00	0.00	0.00	0.00	314
21041	Willamette	Cone	024:05-08	09/10/87	1600	142	8.8	4.5	66	27	0.27	0.37	81	0.00	0.00	0.00	0.00	0.00	321
21053	Aurora, Yugo	Cone	003:09-12	09/10/87	1200	141	11.7	4.0	74	19	0.27	0.35	84	0.00	0.00	0.00	0.00	0.00	320
21056	Bullion, 10A,VF	Cone	013:09-12	09/10/87	1800	198	11.0	4.6	70	34	0.25	0.44	74	0.00	0.00	0.00	0.00	0.00	310
21080	Backa, Yugo	Cone	008:09-12	09/10/87	600	35	5.9	6.6	47	21	0.21	0.30	91	0.00	0.00	0.00	0.00	0.00	318
21091	6771-019	Cone	237:28-32	09/08/87	1800	115	6.4	5.0	56	29	0.31	0.37	81	0.00	0.00	0.00	0.00	0.00	201
21092	Cascade VF	Cone	014:09-12	09/10/87	2000	143	7.2	5.7	56	38	0.24	0.39	78	0.00	0.00	0.00	0.00	0.00	306
21097	Huller Bitterer	Cone	030:05-08	09/10/87	1600	122	7.6	4.6	62	32	0.24	0.48	69	0.00	0.00	0.00	0.00	0.00	311
21179	Hersbrucker Eng	Cone	006:01-04	09/10/87	4003	115	2.9	4.8	38	23	0.23	0.31	90	0.00	0.00	0.00	0.00	0.00	316
21182	Galena (43-16)	Cone	239:01-05	09/08/87	1800	249	13.8	10.4	57	38	0.25	0.29	93	0.00	0.00	0.00	0.00	0.00	222
21185	Hersbrucker Ger	Cone	004:01-04	09/10/87	600	33	5.4	6.6	45	23	0.22	0.32	89	0.00	0.00	0.00	0.00	0.00	319
21187	Southern Brewer	Cone	028:01-04	09/10/87	1600	139	8.7	3.6	71	42	0.24	0.28	95	0.00	0.00	0.00	0.00	0.00	313
21194	7006-311	Cone	238:01-05	09/08/87	1600	240	15.0	6.1	71	26	0.24	0.41	76	0.00	0.00	0.00	0.00	0.00	215
21195	7006-408	Cone	210:28-32	09/08/87	1600	162	10.1	4.3	70	28	0.31	0.37	81	0.00	0.00	0.00	0.00	0.00	205
21196	Bullion 6A	Cone	007:05-08	09/10/87	1800	190	10.6	5.1	67	35	0.26	0.40	77	0.00	0.00	0.00	0.00	0.00	307
21198	7003-038	Cone	227:12-16	09/09/87	2400	246	10.2	7.1	59	33	0.24	0.33	87	0.00	0.00	0.00	0.00	0.00	245
21199	7004-003	Cone	212:17-21	09/10/87	1800	169	9.4	5.3	64	36	0.26	0.41	76	0.00	0.00	0.00	0.00	0.00	297
21202	6903-107	Cone	208:28-32	09/08/87	1900	130	6.8	5.6	55	45	0.26	0.34	86	0.00	0.00	0.00	0.00	0.00	200
21217	Star, Belg	Cone	029:05-08	08/18/87	405	16	3.9	2.5	62	23	0.23	0.37	81	0.00	0.00	0.00	0.00	0.00	1
21220	Eroica VF	Cone	229:12-16	09/09/87	2400	305	12.7	5.9	68	44	0.26	0.35	83	0.00	0.00	0.00	0.00	0.00	244
21225	Olympic	Cone	210:17-21	09/10/87	1200	133	11.1	4.9	69	35	0.25	0.48	69	0.00	0.00	0.00	0.00	0.00	301
21226	Chinook	Cone	226:28-32	09/08/87	2000	272	13.6	4.7	74	34	0.26	0.33	86	0.00	0.00	0.00	0.00	0.00	210
21227	Perle	Cone	032:01-04	09/10/87	1200	108	9.0	3.4	72	30	0.26	0.33	86	0.00	0.00	0.00	0.00	0.00	312
21231	Leavy Sel	Cone	247:01-05	09/08/87	2000	56	2.8	5.3	35	27	0.27	0.75	48	0.00	0.00	0.00	0.00	0.00	217
21238	Blisk, Yugo	Cone	022:05-08	09/10/87	1600	184	11.5	4.5	72	37	0.26	0.59	59	0.00	0.00	0.00	0.00	0.00	315
21239	Bobek, Yugo	Cone	208:23-27	09/08/87	1200	81	6.7	4.0	63	28	0.31	0.38	80	0.00	0.00	0.00	0.00	0.00	211
21240	Buket, Yugo	Cone	212:23-27	09/08/87	1600	190	11.9	5.7	67	23	0.28	0.52	65	0.00	0.00	0.00	0.00	0.00	196
21246	7311-032	Cone	241:28-32	09/08/87	1700	242	14.2	4.8	75	39	0.28	0.35	84	0.00	0.00	0.00	0.00	0.00	212
21247	7311-068	Cone	215:17-21	09/10/87	2200	324	14.7	4.6	76	41	0.28	0.35	85	0.00	0.00	0.00	0.00	0.00	296
21248	7311-095	Cone	218:17-21	09/10/87	2000	357	17.9	8.9	67	37	0.26	0.32	88	0.00	0.00	0.00	0.00	0.00	298
21250	7311-152	Cone	226:17-21	09/10/87	1800	259	14.4	4.4	77	29	0.31	0.34	85	0.00	0.00	0.00	0.00	0.00	294
21251	7312-009	Cone	225:12-16	09/09/87	2000	262	13.1	4.8	73	39	0.29	0.38	80	0.00	0.00	0.00	0.00	0.00	255
21253	7312-041	Cone	213:23-27	09/08/87	2400	301	12.5	6.1	67	40	0.31	0.34	86	0.00	0.00	0.00	0.00	0.00	195
21254	7312-083	Cone	214:23-27	09/08/87	2200	244	11.1	3.4	77	27	0.34	0.37	81	0.00	0.00	0.00	0.00	0.00	194
21256	7312-032	Cone	219:23-27	09/08/87	2500	364	14.6	6.1	71	43	0.29	0.45	72	0.00	0.00	0.00	0.00	0.00	193
21257	7313-083	Cone	224:23-27	09/08/87	1800	271	15.1	7.6	66	40	0.28	0.40	78	0.00	0.00	0.00	0.00	0.00	203
21261	7003-075	Cone	230:12-16	09/09/87	2100	172	8.2	7.4	53	20	0.22	0.33	87	0.00	0.00	0.00	0.00	0.00	253
21280	Pride of Kent	Cone	027:09-12	09/10/87	1600	149	9.3	8.0	54	38	0.25	0.82	43	0.00	0.00	0.00	0.00	0.00	308
21285	Id sel BOR 704	Cone	231:12-16	09/09/87	2100	51	2.4	2.7	47	19	0.32	0.58	60	0.00	0.00	0.00	0.00	0.00	254
21286	Kirin II	Cone	240:12-16	09/09/87	2600	95	3.7	3.8	49	51	0.31	0.34	86	0.00	0.00	0.00	0.00	0.00	258
21373	7006-398	Cone	026:47-48	09/11/87	0	0	12.8	5.8	69	20	0.24	0.40	77	0.00	0.00	0.00	0.00	0.00	433
21382	7504-113	Cone	224:12-16	09/09/87	2200	213	9.7	7.1	58	21	0.23	0.38	80	0.00	0.00	0.00	0.00	0.00	247
21396	Tolhurst Wye	Cone	032:09-12	09/10/87	200	3	1.4	2.9	33	30	0.28	0.63	56	0.00	0.00	0.00	0.00	0.00	309
21397	Hallertau MF T4	Cone	038:85-88	09/11/87	0	0	2.8	3.6	43	27	0.25	0.90	39	0.00	0.00	0.00	0.00	0.00	413
21397	Hallertau MF T4	Cone	170:46	09/04/87	400	14	3.5	3.7	49	24	0.25	0.36	83	0.00	0.00	0.00	0.00	0.00	136
21403	Sticklebract	Cone	229:01-05	09/08/87	2000	232	11.6	5.0	70	43	0.26	0.30	91	0.00	0.00	0.00	0.00	0.00	223
21404	Green Bullet	Cone	231:01-05	09/08/87	1600	111	6.9	3.3	68	40	0.28	0.43	75	0.00	0.00	0.00	0.00	0.00	237
21405	Superalpha	Cone	236:28-32	09/08/87	1700	144	8.5	4.3	66	36	0.27	0.35	85	0.00	0.00	0.00	0.00	0.00	197

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1987 Bale and 5-Cone Analyses at 8% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 No HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Myr (%)	Hum (%)	Serial Number
21405	Superalpha	Cone	240:01-05	09/08/87	1200	138	11.5	6.3	65	35	0.27	0.30	91	0.00	0.00	0.00	0.00	0.00	219
21406	AlphaAroma	Cone	241:01-05	09/08/87	2000	157	7.9	2.6	75	24	0.27	0.29	93	0.00	0.00	0.00	0.00	0.00	229
21409	7003-081	Cone	233:12-16	09/09/87	2000	138	6.9	5.3	56	23	0.24	0.32	88	0.00	0.00	0.00	0.00	0.00	250
21455	8301-010	Cone	010:13-16	09/11/87	0	0	9.4	5.0	65	21	0.25	0.82	43	0.00	0.00	0.00	0.00	0.00	403
21456	8303-046	Cone	016:25-28	09/11/87	0	0	5.5	5.8	49	23	0.22	0.90	39	0.00	0.00	0.00	0.00	0.00	393
21457	8303-117	Cone	007:33-36	09/11/87	0	0	6.6	4.1	62	21	0.24	0.75	47	0.00	0.00	0.00	0.00	0.00	390
21458	8304-119	Cone	022:65-68	09/11/87	0	0	3.3	4.6	42	27	0.26	0.93	37	0.00	0.00	0.00	0.00	0.00	422
21459	8308-066	Cone	022:81-84	09/11/87	0	0	5.7	3.3	63	23	0.26	0.62	56	0.00	0.00	0.00	0.00	0.00	426
21460	S Afr HP1/86	Cone	211:23-27	09/08/87	2000	105	5.2	4.1	56	30	0.24	0.29	93	0.00	0.00	0.00	0.00	0.00	202
21469	8301-011	Cone	001:62-82	09/11/87	0	0	4.0	5.1	44	23	0.25	0.84	42	0.00	0.00	0.00	0.00	0.00	419
21469	8301-011	Cone	011:13-16	09/11/87	0	0	5.3	4.5	54	22	0.25	0.83	43	0.00	0.00	0.00	0.00	0.00	404
21470	8301-018	Cone	18:13-16	09/11/87	0	0	5.6	4.2	57	19	0.22	0.76	47	0.00	0.00	0.00	0.00	0.00	398
21471	8301-062	Cone	019:17-20	09/11/87	0	0	9.9	3.4	75	18	0.23	0.66	53	0.00	0.00	0.00	0.00	0.00	400
21472	8302-004	Cone	004:62-82	09/11/87	0	0	4.1	6.3	40	25	0.23	0.84	42	0.00	0.00	0.00	0.00	0.00	421
21472	8302-004	Cone	036:17-20	09/11/87	0	0	2.9	4.5	39	27	0.28	0.99	34	0.00	0.00	0.00	0.00	0.00	399
21473	8303-001	Cone	011:21-24	09/11/87	0	0	4.7	5.0	49	19	0.23	0.71	50	0.00	0.00	0.00	0.00	0.00	402
21474	8303-006	Cone	006:62-82	09/11/87	0	0	8.2	4.7	64	23	0.23	0.63	56	0.00	0.00	0.00	0.00	0.00	439
21474	8303-006	Cone	016:21-24	09/11/87	0	0	6.0	6.3	49	21	0.23	0.79	45	0.00	0.00	0.00	0.00	0.00	401
21475	8303-047	Cone	017:25-28	09/11/87	0	0	6.3	5.2	55	21	0.23	0.72	50	0.00	0.00	0.00	0.00	0.00	389
21476	8303-053	Cone	008:62-82	09/11/87	0	0	5.8	3.2	65	20	0.25	0.50	67	0.00	0.00	0.00	0.00	0.00	432
21476	8303-053	Cone	023:25-28	09/11/87	0	0	6.3	4.2	60	19	0.23	0.68	52	0.00	0.00	0.00	0.00	0.00	394
21477	8303-074	Cone	004:29-32	09/11/87	0	0	5.3	5.7	48	21	0.22	0.41	76	0.00	0.00	0.00	0.00	0.00	388
21477	8303-074	Cone	009:62-82	09/11/87	0	0	3.6	5.2	41	23	0.26	0.68	52	0.00	0.00	0.00	0.00	0.00	431
21478	8303-076	Cone	006:29-32	09/11/87	0	0	3.8	5.3	42	24	0.23	0.86	41	0.00	0.00	0.00	0.00	0.00	391
21478	8303-076	Cone	010:62-82	09/11/87	0	0	5.6	5.3	51	20	0.24	0.62	57	0.00	0.00	0.00	0.00	0.00	423
21479	8303-084	Cone	011:62-82	09/11/87	0	0	6.9	3.9	64	24	0.25	0.68	52	0.00	0.00	0.00	0.00	0.00	408
21479	8303-084	Cone	014:29-32	09/11/87	0	0	5.7	5.3	52	22	0.22	0.69	51	0.00	0.00	0.00	0.00	0.00	395
21480	8303-091	Cone	012:62-82	09/11/87	0	0	5.5	5.8	49	24	0.25	0.69	51	0.00	0.00	0.00	0.00	0.00	429
21480	8303-091	Cone	021:29-32	09/11/87	0	0	6.4	6.2	51	24	0.24	0.41	76	0.00	0.00	0.00	0.00	0.00	387
21481	8303-116	Cone	006:33-36	09/11/87	0	0	7.0	4.7	60	23	0.24	0.35	84	0.00	0.00	0.00	0.00	0.00	386
21482	8304-068	Cone	014:62-82	09/11/87	0	0	4.4	6.1	42	25	0.24	0.99	34	0.00	0.00	0.00	0.00	0.00	435
21482	8304-068	Cone	021:41-44	09/11/87	0	0	4.0	6.3	39	21	0.23	0.82	43	0.00	0.00	0.00	0.00	0.00	436
21483	8304-075	Cone	015:62-82	09/11/87	0	0	2.2	5.7	28	21	0.23	1.21	25	0.00	0.00	0.00	0.00	0.00	424
21483	8304-075	Cone	028:41-44	09/11/87	0	0	2.6	5.7	32	20	0.24	0.67	53	0.00	0.00	0.00	0.00	0.00	437
21484	8305-017	Cone	024:69-72	09/11/87	0	0	5.7	4.4	56	22	0.24	0.63	56	0.00	0.00	0.00	0.00	0.00	425
21486	7507-109	Cone	239:23-27	09/08/87	2200	244	11.1	7.8	59	32	0.25	0.36	82	0.00	0.00	0.00	0.00	0.00	209
21490	8309-037	Cone	035:05-08	09/11/87	0	0	3.7	7.5	33	22	0.22	1.23	24	0.00	0.00	0.00	0.00	0.00	420
21494	7506-131	Cone	234:17-21	09/10/87	2400	203	8.5	5.4	61	22	0.27	0.38	80	0.00	0.00	0.00	0.00	0.00	292
21495	7506-123	Cone	236:17-21	09/10/87	2000	207	10.3	6.5	61	36	0.23	0.34	85	0.00	0.00	0.00	0.00	0.00	289
56002	Backa	Cone	012:01-04	09/10/87	600	27	4.5	4.9	48	20	0.22	0.26	98	0.00	0.00	0.00	0.00	0.00	317
64003	19105 x 19173M	Cone	018:51-52	09/11/87	0	0	1.0	3.6	22	30	0.27	0.97	35	0.00	0.00	0.00	0.00	0.00	434
64007	19105 x 19058M	Cone	017:49-50	09/11/87	0	0	3.2	8.5	27	28	0.20	0.52	65	0.00	0.00	0.00	0.00	0.00	438
65009	BG x 19058M	Cone	220:23-27	09/08/87	2000	214	10.7	7.3	59	37	0.26	0.56	61	0.00	0.00	0.00	0.00	0.00	199
7003-154		Cone	231:28-32	09/08/87	2000	134	6.7	5.4	55	38	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	198
7507-062		Cone	235:23-27	09/08/87	2200	190	8.6	7.7	53	37	0.23	0.52	65	0.00	0.00	0.00	0.00	0.00	207
7610-104		Cone	238:28-32	09/08/87	1800	265	14.7	4.4	77	30	0.29	0.46	71	0.00	0.00	0.00	0.00	0.00	208
7611-025		Cone	239:28-32	09/08/87	1800	69	3.9	1.6	71	30	0.57	0.61	57	0.00	0.00	0.00	0.00	0.00	188
8036-087		Cone	233:23-27	09/08/87	1800	167	9.3	4.2	69	37	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	204
8036-099		Cone	234:23-27	09/08/87	2200	180	8.2	2.6	76	52	0.26	0.64	55	0.00	0.00	0.00	0.00	0.00	206
8301-009		Cone	207:01-05	09/08/87	1200	45	3.7	5.8	39	30	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	232

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Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Myr (%)	Hum (%)	Serial Number
8301-047		Cone	208:01-05	09/08/87	1000	61	6.1	4.9	55	17	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	233
8301-063		Cone	020:17-21	09/11/87	0	0	10.6	5.8	65	19	0.21	0.00	0	0.00	0.00	0.00	0.00	0.00	396
8303-016		Cone	216:01-05	08/18/87	1000	39	3.9	2.8	58	27	0.33	0.00	0	0.00	0.00	0.00	0.00	0.00	234
8303-017		Cone	217:01-05	09/08/87	1000	58	5.8	3.2	65	20	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	236
8303-029		Cone	219:01-05	09/08/87	1200	35	2.9	4.0	42	20	0.29	0.00	0	0.00	0.00	0.00	0.00	0.00	230
8303-042		Cone	223:01-05	09/08/87	1200	55	4.6	3.6	56	26	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	231
8303-043		Cone	226:01-05	09/08/87	1000	64	6.4	4.0	61	21	0.30	0.00	0	0.00	0.00	0.00	0.00	0.00	235
8303-044		Cone	228:01-05	09/08/87	800	48	6.0	3.2	65	24	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	224
8303-058		Cone	235:01-05	09/08/87	800	40	5.0	3.5	58	18	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	226
8303-066		Cone	036:25-28	09/11/87	0	0	7.2	4.8	60	23	0.22	0.00	0	0.00	0.00	0.00	0.00	0.00	392
8303-066		Cone	236:01-05	09/08/87	800	34	4.2	4.3	49	23	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	225
8303-077		Cone	244:01-05	09/08/87	800	51	6.3	3.7	63	24	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	228
8303-081		Cone	011:29-32	09/11/87	0	0	8.2	4.5	65	22	0.23	0.37	82	0.00	0.00	0.00	0.00	0.00	397
8303-085		Cone	245:01-05	09/08/87	1000	50	5.0	5.4	48	21	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	218
8303-088		Cone	246:01-05	09/08/87	600	34	5.7	5.4	51	22	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	221
8303-094		Cone	248:01-05	09/08/87	600	18	3.0	3.4	47	21	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	220
8303-097		Cone	249:01-05	09/08/87	600	25	4.2	4.9	46	20	0.29	0.00	0	0.00	0.00	0.00	0.00	0.00	216
8303-122		Cone	012:33-36	09/11/87	0	0	7.8	4.2	65	23	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	385
8304-015		Cone	201:12-16	09/09/87	400	20	4.9	3.7	57	21	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	239
8304-020		Cone	203:12-16	09/09/87	200	9	4.6	6.9	40	23	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	242
8304-021		Cone	204:12-16	09/09/87	200	6	3.0	4.4	41	22	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	241
8304-023		Cone	208:12-16	09/09/87	800	18	2.2	5.2	30	23	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	238
8304-029		Cone	209:12-16	09/09/87	1000	26	2.6	3.2	45	20	0.33	0.00	0	0.00	0.00	0.00	0.00	0.00	240
8304-037		Cone	212:12-16	09/09/87	800	34	4.3	4.6	49	20	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	243
8304-048		Cone	215:12-16	09/09/87	800	38	4.8	6.2	44	24	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	256
8304-054		Cone	220:12-16	09/09/87	800	38	4.8	6.0	45	23	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	246
8304-067		Cone	226:12-16	09/09/87	600	37	6.1	7.4	45	25	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	248
8304-089		Cone	232:12-16	09/09/87	800	31	3.8	6.6	37	24	0.29	0.00	0	0.00	0.00	0.00	0.00	0.00	252
8304-090		Cone	236:12-16	09/09/87	1200	42	3.5	5.4	39	23	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	251
8304-091		Cone	202:23-27	09/08/87	400	31	7.8	6.0	57	27	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	191
8304-120		Cone	023:65-68	09/11/87	0	0	4.7	5.6	46	21	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	430
8304-120		Cone	237:12-16	09/09/87	1400	61	4.3	5.6	44	22	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	249
8304-126		Cone	029:65-68	09/11/87	0	0	3.0	4.8	38	25	0.25	0.51	66	0.00	0.00	0.00	0.00	0.00	414
8305-018		Cone	239:12-16	09/09/87	800	53	6.6	3.9	63	22	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	259
8306-002		Cone	243:12-16	09/09/87	600	39	6.4	3.0	68	26	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	257
8308-008		Cone	202:17-21	09/10/87	200	10	4.8	5.7	46	26	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	305
8308-015		Cone	205:23-27	09/08/87	1200	76	6.3	4.9	56	25	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	189
8308-016		Cone	207:17-21	09/10/87	930	55	5.9	4.9	55	23	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	299
8308-020		Cone	036:73-76	09/11/87	0	0	6.4	4.5	59	26	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	418
8308-036		Cone	208:17-21	09/10/87	1400	63	4.5	3.7	55	23	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	304
8308-042		Cone	213:17-21	09/10/87	1200	65	5.4	3.4	61	20	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	300
8308-044		Cone	030:77-80	09/11/87	0	0	6.6	4.0	62	21	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	417
8308-044		Cone	207:23-27	09/08/87	299	20	6.8	4.4	61	22	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	192
8308-046		Cone	032:77-80	09/11/87	0	0	8.7	4.6	66	26	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	428
8308-061		Cone	205:28-32	09/08/87	600	37	6.2	3.8	62	24	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	214
8308-068		Cone	242:01-05	09/08/87	800	48	6.0	3.9	61	23	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	227
8308-070		Cone	026:81-84	09/11/87	0	0	5.9	4.7	55	25	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	416
8308-070		Cone	223:17-21	09/10/87	1000	51	5.1	3.9	56	24	0.29	0.00	0	0.00	0.00	0.00	0.00	0.00	295
8309-004		Cone	227:17-21	09/10/87	800	39	4.8	6.1	44	32	0.30	0.00	0	0.00	0.00	0.00	0.00	0.00	291
8309-005		Cone	033:81-84	09/11/87	0	0	5.9	6.2	49	23	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	412

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Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Oil Myr (%)	Oil Hun (%)	Serial Number
8309-005		Cone	232:17-21	09/10/87	1200	99	8.3	7.1	54	22	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	293
8309-006		Cone	233:17-21	09/10/87	1600	87	5.4	3.8	59	25	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	288
8309-007		Cone	035:81-84	09/11/87	0	0	9.8	6.5	60	25	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	409
8309-008		Cone	036:81-84	09/11/87	0	0	8.0	4.4	64	25	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	405
8309-010		Cone	038:81-84	09/11/87	0	0	6.8	4.9	58	25	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	411
8309-010		Cone	239:17-21	09/10/87	1600	90	5.6	5.8	49	27	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	303
8309-012		Cone	040:81-84	09/11/87	0	0	9.3	3.2	75	22	0.26	0.47	69	0.00	0.00	0.00	0.00	0.00	406
8309-022		Cone	050:81-84	09/11/87	0	0	6.6	3.7	64	23	0.26	0.65	54	0.00	0.00	0.00	0.00	0.00	407
8309-024		Cone	241:17-21	09/10/87	1312	78	6.0	5.8	51	23	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	290
8309-029		Cone	027:85-88	09/11/87	0	0	10.1	5.4	65	24	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	410
8309-029		Cone	242:17-21	09/10/87	600	50	8.3	5.7	59	22	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	302
8309-034		Cone	209:23-27	08/18/87	1200	82	6.8	4.5	60	25	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	190
8309-036		Cone	034:85-88	09/11/87	0	0	7.6	5.8	57	26	0.24	0.81	44	0.00	0.00	0.00	0.00	0.00	415
8401-004		Cone	137:04	08/28/87	1493	142	9.5	5.8	62	25	0.25	0.41	76	0.00	0.00	0.00	0.00	0.00	9
8401-034		Cone	137:34	08/28/87	1300	72	5.6	5.2	51	30	0.25	0.53	64	0.00	0.00	0.00	0.00	0.00	4
8401-041		Cone	137:41	08/28/87	1900	36	1.9	2.4	44	21	0.31	0.32	89	0.00	0.00	0.00	0.00	0.00	3
8401-065		Cone	138:13	08/28/87	1800	135	7.5	4.9	61	23	0.28	0.49	68	0.00	0.00	0.00	0.00	0.00	6
8401-068		Cone	138:16	08/28/87	1800	109	6.1	4.1	59	27	0.23	0.30	91	0.00	0.00	0.00	0.00	0.00	8
8401-070		Cone	138:18	08/28/87	1700	111	6.5	4.1	61	30	0.26	0.41	76	0.00	0.00	0.00	0.00	0.00	5
8401-076		Cone	138:24	08/28/87	1900	70	3.7	3.3	53	27	0.32	0.40	78	0.00	0.00	0.00	0.00	0.00	7
8401-106		Cone	139:02	08/31/87	1400	111	7.9	4.0	66	26	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	10
8401-108		Cone	139:04	08/31/87	1600	126	7.9	4.1	66	24	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	12
8401-113		Cone	139:09	08/31/87	1400	83	5.9	3.6	62	28	0.22	0.40	77	0.00	0.00	0.00	0.00	0.00	14
8401-125		Cone	139:21	08/31/87	1400	90	6.4	4.8	57	30	0.22	0.00	0	0.00	0.00	0.00	0.00	0.00	11
8401-145		Cone	139:41	08/31/87	1400	125	9.0	4.9	65	20	0.22	0.35	84	0.00	0.00	0.00	0.00	0.00	13
8401-158		Cone	140:02	08/31/87	1600	168	10.5	6.0	64	26	0.22	0.30	91	0.00	0.00	0.00	0.00	0.00	18
8401-161		Cone	140:05	08/31/87	1200	116	9.7	5.3	65	21	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	16
8401-163		Cone	140:07	08/31/87	1400	125	8.9	4.0	69	26	0.24	0.35	84	0.00	0.00	0.00	0.00	0.00	17
8401-175		Cone	140:19	08/31/87	1400	141	10.1	4.5	69	26	0.23	0.36	82	0.00	0.00	0.00	0.00	0.00	15
8401-192		Cone	140:36	08/31/87	1400	126	9.0	4.8	65	27	0.24	0.26	99	0.00	0.00	0.00	0.00	0.00	19
8402-021		Cone	141:10	08/31/87	1800	123	6.8	4.3	61	24	0.23	0.34	85	0.00	0.00	0.00	0.00	0.00	31
8402-036		Cone	141:25	08/31/87	1500	143	9.6	4.8	67	26	0.22	0.41	76	0.00	0.00	0.00	0.00	0.00	30
8402-045		Cone	141:34	08/31/87	1500	110	7.3	3.0	71	26	0.25	0.34	86	0.00	0.00	0.00	0.00	0.00	24
8402-080		Cone	142:17	08/31/87	1600	118	7.4	3.4	69	27	0.23	0.38	80	0.00	0.00	0.00	0.00	0.00	25
8402-106		Cone	142:43	08/31/87	1400	123	8.8	3.6	71	22	0.22	0.37	81	0.00	0.00	0.00	0.00	0.00	29
8402-136		Cone	143:21	08/31/87	1600	135	8.4	3.4	71	24	0.24	0.32	88	0.00	0.00	0.00	0.00	0.00	27
8403-008		Cone	144:24	08/31/87	1800	104	5.8	3.2	65	19	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	26
8403-017		Cone	144:33	08/31/87	1800	85	4.7	2.8	63	21	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	20
8403-041		Cone	145:05	08/31/87	1000	67	6.7	4.3	61	21	0.21	0.27	96	0.00	0.00	0.00	0.00	0.00	23
8403-045		Cone	145:09	08/31/87	1200	84	7.0	4.1	63	19	0.23	0.29	93	0.00	0.00	0.00	0.00	0.00	22
8403-075		Cone	145:39	08/31/87	1900	51	2.7	3.8	41	24	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	28
8403-086		Cone	145:50	08/31/87	1900	95	5.0	3.3	60	15	0.25	0.42	75	0.00	0.00	0.00	0.00	0.00	21
8403-112		Cone	146:24	09/01/87	1500	94	6.3	3.8	63	20	0.25	0.28	94	0.00	0.00	0.00	0.00	0.00	56
8404-003		Cone	146:47	09/01/87	1600	66	4.1	4.6	47	18	0.23	0.34	85	0.00	0.00	0.00	0.00	0.00	37
8404-006		Cone	146:50	09/01/87	1400	74	5.3	4.4	54	20	0.22	0.31	90	0.00	0.00	0.00	0.00	0.00	44
8404-018		Cone	147:10	09/01/87	1400	44	3.2	4.5	41	18	0.23	0.31	89	0.00	0.00	0.00	0.00	0.00	50
8404-023		Cone	147:15	09/01/87	1800	79	4.4	3.9	53	23	0.26	0.29	93	0.00	0.00	0.00	0.00	0.00	57
8404-028		Cone	147:20	09/01/87	1600	72	4.5	5.4	46	19	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	53
8404-042		Cone	147:34	09/01/87	1600	59	3.7	6.5	36	25	0.22	0.00	0	0.00	0.00	0.00	0.00	0.00	43
8404-063		Cone	148:03	09/01/87	1600	113	7.0	4.6	61	16	0.23	0.28	94	0.00	0.00	0.00	0.00	0.00	51

Agricultural Chemistry Department Oregon State University**Agricultural Research Service**U S Dept Agriculture**Corvallis, Oregon**

1987 Bale and 5-Cone Analyses at 8% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	H/C	H/F	Myr (%)	Hum (%)	Serial Number
8404-072		Cone	148:12	09/01/87	1800	135	7.5	4.3	64	21	0.25	0.36	83	0.00	0.00	0.00	0.00	0.00	55
8404-079		Cone	148:49	09/01/87	1900	121	6.4	5.3	55	21	0.22	0.43	74	0.00	0.00	0.00	0.00	0.00	49
8404-088		Cone	148:28	09/01/87	1800	96	5.3	6.4	45	21	0.20	0.42	76	0.00	0.00	0.00	0.00	0.00	48
8404-089		Cone	148:29	09/01/87	1600	113	7.1	4.3	62	18	0.23	0.27	97	0.00	0.00	0.00	0.00	0.00	42
8404-099		Cone	148:39	09/01/87	1200	51	4.2	3.8	53	19	0.22	0.00	0	0.00	0.00	0.00	0.00	0.00	47
8404-106		Cone	148:46	09/01/87	2000	153	7.7	5.7	58	19	0.23	0.29	92	0.00	0.00	0.00	0.00	0.00	36
8404-114		Cone	149:02	09/01/87	1800	64	3.5	6.0	37	24	0.22	0.00	0	0.00	0.00	0.00	0.00	0.00	32
8404-120		Cone	149:08	09/01/87	1400	74	5.3	5.5	49	23	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	33
8405-002		Cone	149:20	09/01/87	2000	93	4.6	4.4	51	38	0.23	0.34	85	0.00	0.00	0.00	0.00	0.00	38
8405-014		Cone	149:32	09/01/87	1500	68	4.5	4.1	53	24	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	54
8405-031		Cone	149:49	09/01/87	1600	122	7.6	5.2	59	24	0.24	0.32	88	0.00	0.00	0.00	0.00	0.00	35
8405-038		Cone	150:04	09/01/87	1400	116	8.3	4.6	64	25	0.25	0.38	80	0.00	0.00	0.00	0.00	0.00	34
8405-048		Cone	150:14	09/01/87	1000	54	5.4	5.1	51	27	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	52
8405-100		Cone	151:14	09/01/87	1600	104	6.5	4.7	58	23	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	40
8405-111		Cone	151:25	09/01/87	1200	52	4.4	3.8	53	23	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	41
8405-115		Cone	151:29	09/01/87	1200	78	6.5	5.3	55	26	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	45
8406-008		Cone	151:42	09/01/87	1200	110	9.2	5.7	62	25	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	46
8406-010		Cone	151:44	09/01/87	0	0	7.7	5.5	58	23	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	39
8406-030		Cone	152:12	09/02/87	1400	111	8.0	4.4	64	27	0.24	0.54	63	0.00	0.00	0.00	0.00	0.00	58
8406-044		Cone	152:26	09/02/87	1400	111	7.9	4.3	65	23	0.24	0.45	72	0.00	0.00	0.00	0.00	0.00	59
8406-049		Cone	152:31	09/02/87	1800	164	9.1	3.1	75	22	0.26	0.40	78	0.00	0.00	0.00	0.00	0.00	85
8406-054		Cone	152:36	09/02/87	1600	89	5.6	4.7	54	23	0.27	0.38	80	0.00	0.00	0.00	0.00	0.00	87
8406-068		Cone	152:50	09/02/87	1400	90	6.4	5.0	56	22	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	64
8406-079		Cone	153:09	09/02/87	1600	127	8.0	4.3	65	23	0.27	0.35	84	0.00	0.00	0.00	0.00	0.00	86
8406-090		Cone	153:20	09/02/87	2000	166	8.3	4.1	67	20	0.25	0.29	93	0.00	0.00	0.00	0.00	0.00	93
8407-003		Cone	153:23	09/02/87	1600	99	6.2	3.4	65	18	0.24	0.28	95	0.00	0.00	0.00	0.00	0.00	63
8407-008		Cone	153:28	09/02/87	1400	101	7.2	3.9	65	26	0.24	0.35	84	0.00	0.00	0.00	0.00	0.00	67
8407-009		Cone	153:29	09/02/87	1600	95	5.9	4.2	59	22	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	88
8407-022		Cone	153:42	09/02/87	1400	102	7.3	4.0	64	24	0.25	0.38	79	0.00	0.00	0.00	0.00	0.00	61
8407-023		Cone	153:43	09/02/87	1600	136	8.5	4.9	64	23	0.25	0.28	94	0.00	0.00	0.00	0.00	0.00	62
8407-032		Cone	153:52	09/02/87	1200	91	7.5	4.2	64	24	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	60
8407-038		Cone	154:06	09/02/87	1400	151	10.8	4.6	70	30	0.24	0.39	78	0.00	0.00	0.00	0.00	0.00	76
8407-041		Cone	154:09	09/02/87	1500	157	10.5	5.9	64	27	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	78
8407-042		Cone	154:10	09/02/87	1400	118	8.5	4.6	65	24	0.25	0.40	77	0.00	0.00	0.00	0.00	0.00	79
8408-005		Cone	154:18	09/02/87	1400	68	4.8	3.2	60	27	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	90
8408-006		Cone	154:19	09/02/87	1600	162	10.1	5.4	65	26	0.24	0.34	86	0.00	0.00	0.00	0.00	0.00	71
8408-012		Cone	154:25	09/02/87	1800	171	9.5	5.0	65	23	0.25	0.30	91	0.00	0.00	0.00	0.00	0.00	77
8408-016		Cone	154:29	09/02/87	1800	183	10.2	9.2	53	26	0.22	0.41	77	0.00	0.00	0.00	0.00	0.00	65
8408-019		Cone	154:32	09/02/87	1400	55	4.0	3.1	56	18	0.27	0.36	82	0.00	0.00	0.00	0.00	0.00	69
8408-028		Cone	154:41	09/02/87	1800	127	7.1	5.7	55	22	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	73
8408-034		Cone	154:47	09/02/87	1800	133	7.4	6.8	52	24	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	75
8408-044		Cone	155:05	09/02/87	1200	127	10.6	7.5	59	27	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	72
8408-051		Cone	155:12	09/02/87	1600	145	9.1	4.2	69	23	0.26	0.36	82	0.00	0.00	0.00	0.00	0.00	80
8408-058		Cone	155:19	09/02/87	1600	80	5.0	2.6	66	21	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	68
8408-062		Cone	155:23	09/02/87	1600	141	8.8	4.4	67	23	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	78
8408-063		Cone	155:24	09/02/87	1600	164	10.3	5.2	66	24	0.25	0.30	92	0.00	0.00	0.00	0.00	0.00	81
8408-071		Cone	155:32	09/02/87	1600	90	5.6	5.3	51	20	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	82
8408-072		Cone	155:33	09/02/87	2000	180	9.0	5.1	64	20	0.23	0.27	97	0.00	0.00	0.00	0.00	0.00	89
8408-078		Cone	155:39	09/02/87	1600	140	8.7	6.8	56	25	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	84
8408-079		Cone	155:40	09/02/87	1600	158	9.9	5.5	64	21	0.25	0.39	79	0.00	0.00	0.00	0.00	0.00	92

Agricultural Chemistry Department Oregon State University**Agricultural Research Service**U S Dept Agriculture**Corvallis, Oregon**

1987 Bale and 5-Cone Analyses at 0% Moisture Content(Bale) or As Is Basis(5-Cone) as of August 15, 1988

Accession or Nursery Number	Identification	Type	Location	Harvest Date	Yield Lb/Ac	Alpha Lb/ac	Alpha %	Beta %	Alpha Ratio	CoH	HSI	6 Mo HSI	%A+B Remain	Oil mL/ 100g	Oil H/C	Oil H/F	Oil Myr (%)	Oil Hum (%)	Serial Number
8408-080		Cone	155:41	09/02/87	1800	140	7.8	5.9	57	22	0.25	0.44	73	0.00	0.00	0.00	0.00	0.00	74
8408-084		Cone	155:45	09/02/87	1600	135	8.4	5.5	60	20	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	91
8408-087		Cone	155:48	09/02/87	1800	160	8.9	5.3	63	24	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	83
8408-089		Cone	155:50	09/02/87	1800	161	8.9	6.0	60	24	0.25	0.33	87	0.00	0.00	0.00	0.00	0.00	66
8408-092		Cone	156:01	09/03/87	2000	173	8.7	4.7	65	22	0.25	0.33	87	0.00	0.00	0.00	0.00	0.00	120
8408-093		Cone	156:02	09/03/87	1800	177	9.8	5.9	62	27	0.25	0.40	77	0.00	0.00	0.00	0.00	0.00	116
8408-108		Cone	156:17	09/03/87	2000	198	9.9	6.8	59	23	0.27	0.38	80	0.00	0.00	0.00	0.00	0.00	121
8408-115		Cone	156:24	09/03/87	1800	145	8.0	5.7	59	21	0.23	0.41	76	0.00	0.00	0.00	0.00	0.00	128
8408-119		Cone	156:28	09/03/87	1700	112	6.6	5.9	53	25	0.25	0.62	57	0.00	0.00	0.00	0.00	0.00	119
8408-125		Cone	156:34	09/03/87	1600	119	7.4	5.3	58	21	0.25	0.30	91	0.00	0.00	0.00	0.00	0.00	131
8409-002		Cone	157:01	09/03/87	1600	102	6.4	5.5	54	22	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	110
8409-055		Cone	158:02	09/03/87	1600	108	6.7	7.2	48	23	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	123
8410-020		Cone	159:05	09/03/87	1600	113	7.1	7.1	50	22	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	129
8410-040		Cone	159:25	09/03/87	1400	51	3.6	4.6	44	24	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	130
8410-047		Cone	159:32	09/03/87	1600	61	3.8	6.4	38	25	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	125
8410-068		Cone	160:01	09/03/87	1600	107	6.7	5.7	54	18	0.23	0.00	0	0.00	0.00	0.00	0.00	0.00	127
8410-069		Cone	160:02	09/03/87	1800	150	8.3	6.2	57	22	0.30	0.32	89	0.00	0.00	0.00	0.00	0.00	124
8410-071		Cone	160:04	09/03/87	1600	83	5.2	4.1	56	22	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	122
8410-075		Cone	160:08	09/03/87	1800	152	8.5	5.9	59	22	0.25	0.32	88	0.00	0.00	0.00	0.00	0.00	117
8411-027		Cone	161:36	09/03/87	2000	186	9.3	3.9	71	25	0.29	0.34	85	0.00	0.00	0.00	0.00	0.00	126
8411-066		Cone	162:23	09/03/87	2000	157	7.9	3.9	67	32	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	95
8411-141		Cone	163:46	09/03/87	1200	124	10.4	5.6	65	19	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	96
8411-165		Cone	164:18	09/03/87	1800	151	8.4	4.3	66	24	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	106
8411-170		Cone	164:23	09/03/87	2000	150	7.5	3.6	68	20	0.27	0.33	87	0.00	0.00	0.00	0.00	0.00	100
8411-192		Cone	164:45	09/03/87	1800	125	6.9	4.8	59	33	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	103
8411-201		Cone	165:02	09/03/87	1600	124	7.8	5.3	59	21	0.26	0.35	84	0.00	0.00	0.00	0.00	0.00	107
8411-209		Cone	165:10	09/03/87	1600	152	9.5	5.3	64	31	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	111
8411-213		Cone	165:14	09/03/87	1600	99	6.2	4.8	56	33	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	101
8411-251		Cone	165:52	09/03/87	1800	105	5.8	6.2	49	37	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	112
8411-254		Cone	166:03	09/03/87	1600	113	7.1	4.6	60	34	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	110
8411-264		Cone	166:13	09/03/87	1800	159	8.8	6.3	58	28	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	102
8411-265		Cone	166:14	09/03/87	2005	147	7.3	4.9	60	42	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	114
8412-001		Cone	166:15	09/03/87	2000	228	11.4	3.8	75	21	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	104
8412-027		Cone	166:41	09/03/87	1400	116	8.3	3.1	73	30	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	99
8412-039		Cone	167:01	09/03/87	1400	133	9.5	4.8	67	21	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	109
8412-046		Cone	167:08	09/03/87	1800	183	10.2	3.9	72	22	0.28	0.30	92	0.00	0.00	0.00	0.00	0.00	108
8412-051		Cone	167:13	09/03/87	1400	143	10.2	4.0	72	24	0.30	0.40	78	0.00	0.00	0.00	0.00	0.00	105
8412-054		Cone	167:16	09/03/87	1200	125	10.4	5.4	66	32	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	115
8412-061		Cone	167:23	09/03/87	2000	158	7.9	4.7	63	25	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	97
8412-077		Cone	167:39	09/03/87	2000	174	8.7	4.6	66	19	0.27	0.31	89	0.00	0.00	0.00	0.00	0.00	113
8412-088		Cone	167:50	09/03/87	1800	168	9.3	4.5	68	23	0.25	0.41	76	0.00	0.00	0.00	0.00	0.00	98
8412-090		Cone	167:52	09/03/87	1800	159	8.8	4.9	64	30	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	94
8412-093		Cone	168:03	09/04/87	1300	94	7.2	4.5	62	26	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	146
8412-095		Cone	168:05	09/04/87	1300	126	9.7	5.8	62	35	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	139
8412-097		Cone	168:07	09/04/87	1600	136	8.5	3.0	74	24	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	150
8412-105		Cone	168:15	09/04/87	1900	169	8.9	5.4	62	22	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	148
8412-113		Cone	168:23	09/04/87	1200	89	7.4	4.9	60	30	0.30	0.00	0	0.00	0.00	0.00	0.00	0.00	151
8412-126		Cone	168:36	09/04/87	1400	121	8.6	7.1	55	24	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	144
8412-128		Cone	168:38	09/04/87	2000	148	7.4	4.0	65	31	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	138
8412-149		Cone	169:07	09/04/87	1200	80	6.7	4.2	61	40	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	143
8412-163		Cone	169:21	09/04/87	1600	130	8.2	3.5	70	24	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	137
8412-167		Cone	169:25	09/04/87	1600	89	5.5	4.8	54	36	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	135
8412-179		Cone	169:37	09/04/87	1200	116	9.7	6.9	58	28	0.24	0.00	0	0.00	0.00	0.00	0.00	0.00	134
8412-185		Cone	169:43	09/04/87	1400	101	7.2	4.7	60	22	0.25	0.00	0	0.00	0.00	0.00	0.00	0.00	140
8412-205		Cone	170:11	09/04/87	1800	133	7.4	3.4	68	23	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	132
8412-207		Cone	170:13	09/04/87	1800	169	9.4	3.7	72	22	0.26	0.33	86	0.00	0.00	0.00	0.00	0.00	147
8412-217		Cone	170:23	09/04/87	1600	158	9.9	4.5	69	23	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	149
8412-219		Cone	170:25	09/04/87	1800	130	7.2	4.0	65	19	0.26	0.00	0	0.00	0.00	0.00	0.00	0.00	133
8412-222		Cone	170:28	09/04/87	1800	134	7.4	4.9	60	24	0.26	0.32	88	0.00	0.00	0.00	0.00	0.00	145
8412-227		Cone	170:33	09/04/87	1800	132	7.3	3.1	70	26	0.27	0.00	0	0.00	0.00	0.00	0.00	0.00	142
8412-229		Cone	170:35	09/04/87	1800	155	8.6	4.6	65	27	0.28	0.00	0	0.00	0.00	0.00	0.00	0.00	141
U415-090		Cone	216:28-32	09/08/87	1600	214	13.4	5.4	71	28	0.26	0.73	49	0.00	0.00	0.00	0.00	0.00	213

Male Lupulin Analyses

Only 10 male flower samples were collected in 1987. The results agreed with previous data for alpha and beta-acids and cohumulone. The storage characteristics showed greater variation between years. The 1986-sample of 19058M is probably a mislabeled sample.

Accession Number	Year(s)	% Alpha	% Beta	Sum A+B	CoH	Crush 3 hr HSI	Safe Period
19046M	76-84(9)	7.9	52.8	60.7	35	1.31(6)	2.63(4)
(7/11)	1986	12.0	63.7	75.7	32	0.27	3.45
(7/21)	1986	12.7	63.9	76.6	41	0.39	
(7/13)	1987	9.9	55.3	65.2	43	1.80	0.90
19058M	76-85(10)	25.2	48.2	73.3	16	1.73(8)	1.61(3)
	1986	1.8	65.7	67.5	21	1.05	
	1987	25.5	51.6	77.1	18	2.21	1.90
21237M	82-85(4)	26.4	23.0	49.4	19	0.61(2)	2.30(1)
	1987	39.9	29.8	69.8	17	0.32	4.15
21326M	75-82(7)	47.6	18.4	66.0	25	0.44(5)	5.00(1)
	1987	53.0	17.5	70.5	25	0.32	8.40
21381M	83-84(3)	20.5	44.0	64.5	21	1.40(1)	0.75(1)
	1986	26.2	48.7	74.9	19	0.32	3.07
	1987	20.9	54.7	75.7	20	2.17	1.90
63015M	76-84(9)	50.4	23.7	74.1	23	0.35(6)	7.84(4)
(7/16)	1986	57.1	24.9	82.0	28	0.31	9.99
(7/21)	1986	58.3	23.8	82.1	27	0.30	
	1987	56.5	22.9	79.4	22	0.29	9.99
64033M	76-85(6)	25.0	41.9	66.9	20	0.49(4)	4.95(2)
	1986	30.6	44.2	74.8	21	0.29	
	1987	20.3	45.9	66.2	22	0.83	2.15
64035M	76-84(8)	37.9	28.6	66.5	19	0.38(5)	3.93(3)
	1986	51.5	30.4	81.9	20	0.28	
	1987	40.4	28.2	68.6	18	0.30	5.10
64037M	76-85(6)	25.0	44.2	69.1	19	1.37(3)	3.70(2)
	1986	26.4	44.9	71.3	22	0.94	
	1987	25.8	45.2	71.0	19	2.02	1.85
8309-026M	1986	17.2	32.0	49.2	28	0.51	2.10
	1987	18.4	35.2	53.5	26	0.72	2.75

We dried one male flower sample of 21362M in the hop dryer (35-40°C), normal procedure, and compared the safe-period with another sample dried in the microwave oven for 15 min twice. A fraction of the normally dried lupulin was also cooked 5 min in the microwave oven (high power). The spectrophotometric analysis showed that the microwave drying reduced the alpha- and beta-acids about 25%. The alpha-acids seem to be affected more than beta-acids, since the alpha ratio decreased with microwave drying. The safe-period was reduced from 8.4 to 2.4 hours, even though the initial HSI did not change very much. Cooking the normally dried lupulin for 5 min also reduced the safe-period. Microwave drying is not suitable for drying male flowers, since both the resin content and storage characteristics are changed.

Treatment	% Alpha	% Beta	Sum	Alpha Ratio	CoH	Initial HSI
Normal	53.0	17.5	70.5	75	25	0.26
Microwave	41.0	16.2	57.1	72	23	0.27

TREATMENT	Initial HSI	Crush 3hr HSI	Safe-Period
Normal	0.26	0.32	8.40
Microwave	0.27	0.42	2.40
Normal + MW	0.28	0.32	6.90

Agricultural Chemistry Department Oregon State University**Agricultural Research Service**U S Dept Agriculture**Corvallis, Oregon**

1987 Lupulin Summary as of February 10, 1988

Accession or Nursery No	Identification	Location	Harvest Date	% Alpha	% Beta	% Alpha + Beta	Alpha Ratio	CoH	HSI	Crush (3 hr)	Safe Period	Permea-bility	Calculated HSI6mo	Remain	H/C	Serial Number	
19046M	LC-S x Fu-S	014:53-54	07/13/87	9.9	55.3	65.2	15	43	0.19	1.80	0.90	0.00	0.00	0	0.00	5	
19058M	Ea Gr x OP	018:53-54	07/08/87	25.5	51.6	77.1	33	18	0.22	2.21	1.90	0.00	0.00	0	0.00	3	
21237M	S Af PH 1/10	029:57-58	07/24/87	39.9	29.8	69.8	57	17	0.24	0.32	4.15	0.00	0.00	0	0.00	8	
21326M	7303-149M	034:55-56	07/23/87	41.0	16.2	57.1	72	23	0.27	0.42	2.40	0.00	0.00	0	0.00	10	MICROWAVE
21326M	7303-149M	034:55-56	07/23/87	53.0	17.5	70.5	75	25	0.26	0.32	8.40	0.00	0.00	0	0.00	11	
21381M	7506-182M	049:59-60	06/29/87	20.9	54.7	75.7	28	20	0.20	2.17	1.90	0.00	0.00	0	0.00	1	
63015M	BG(BG x 19062M)	026:55-56	07/13/87	56.5	22.9	79.4	71	22	0.25	0.29	9.99	0.00	0.00	0	0.00	4	
64033M	Zattler 2L1180P	030:55-56	07/15/87	20.3	45.9	66.2	31	22	0.20	0.83	2.15	0.00	0.00	0	0.00	7	
64035M	Zattler 7K4910P	001:57-58	07/13/87	40.4	28.2	68.6	59	18	0.25	0.30	5.10	0.00	0.00	0	0.00	6	
64037M	Zattler 7K4910P	004:57-58	07/07/87	25.8	45.2	71.0	36	19	0.21	2.02	1.85	0.00	0.00	0	0.00	2	
8309-026M		115:07-08	07/28/87	18.4	35.2	53.5	34	26	0.24	0.72	2.75	0.00	0.00	0	0.00	9	

Laboratory Note
Hop Chemistry Section
Agricultural Chemistry Department
Oregon State University
March 31, 1987

Comparison of Ambient and -4°C Storage

(work done with samples from the 1985 crop.)

We conduct 6 month ambient temperature storage trials on commercial varieties and promising selections. The conditions were picked for several reasons: (1) hops oxidize faster at ambient temperature than in cold storage; (2) varietal differences in storageability are magnified during ambient temperature storage; and (3) 6 months storage allows us to complete the analyses before the next crop is harvested. The conditions are much harsher than used in commercial storage of hops.

To get some idea of the difference between ambient and frozen storage, two varieties from the 1985 crop that had been stored at -4°C since harvest were analyzed this month. After 18 months at -4°C storage, seedless Yakima Cluster and Cascade kept about 85% of the initial alpha- and beta-acids and oil content. After 6 months ambient temperature storage, the Cluster had 76% of the oil remaining and about 80% of the alpha- and beta-acids (calculated by HSI). Cascade had 34% of oil and alpha- and beta-acids remaining after 6 months ambient storage. The detailed results are given in the table below.

Both varieties stored very ~~well~~ at -4°C. Although some oil and resins were lost, there wasn't any difference between the % remaining for both varieties. These results are encouraging since we keep our samples at -4°C for 1-3 months before analysis.

Comparison of Ambient and Frozen Storage

	Cluster			Cascade			
	Initial	-4°C	~20°C	Initial		-4°C	~20°C
% Alpha	9.7	8.2	5.8	4.8		4.2	1.7
% Beta	6.2	4.9	4.0	6.7		5.1	2.5
HSI	0.259	0.358	0.388	0.288		0.339	0.990
% lost(HSI)		17	21			15	66
CoH	45	44	44	39		39	39
mL oil/100 g	0.90	0.77	0.68	1.58		1.37	0.54
% oil lost		15	25			14	66
Area %							
% Myrcene	56.38	51.56	35.64	65.0	61.3	54.18	6.19
% Caryophyllene	5.13	4.70	6.30	3.14	2.28	2.57	1.39
% Farnesene				4.17	2.72	3.47	0.49
% Humulene	14.90	12.96	15.47	8.51	6.83	7.69	6.50
microliters/100 g							
Myrcene	507	397	242	1027	968	742	33
Caryophyllene	46	35	41	50	36	35	8
Farnesene				66	43	48	3
Humulene	134	85	100	134	108	105	35
Oxidation Prod.	-	15	21	-	-	13	205

DSIR DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

SUMMARY OF OSU DATA ON 1986 HARVEST

4 GENOTYPES, 3 RFT SITES

New Zealand-grown hop varieties
analyzed at OSU-Ag. Chem. (Nickerson)
in 1987.

	Super Alpha (Control)	77-8 (Hallertauer triploid)	77-39 (First Choice triploid)	79-32 (Smoothcone triploid)
alpha acid	13.3	7.2	9.1	15.6
beta acid	8.8	5.1	11.3	8.8
HSI	.28	.35	.28	.29
Co H	38	35	41	41
mg oil/100g	1.57	1.37	1.43	1.70
μL oil/g alpha acid	118	186	158	108
Humulene/caryophyllene	2.42	2.51	4.32	2.93
major hydrocarbons	1307	1202	1256	1432
oxidation products	5.87	10.63	2.37	4.87
Floral estery	20.3	15.1	23.7	16.4
Citrus Piney	131	36	79	124

Each figure is the mean of 3 value conducted on separate samples at each of the Regional Farm Trial sites.

Department of
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Corvallis, Oregon 97331-6502 (503) 754-3791

October 19, 1987

Dr. Paul Hoskins
Busch Agricultural Resources
Suite 110
10777 Sunset Hills
St. Louis, Missouri 63127

Dear Paul,

We have not received any Hallertauer triploid samples from Idaho or Washington yet. I am sending you a table of the chemical results of these selections grown commercially in Oregon and from the plots at OSU.

Dr. Haunold collected green maturity samples from the commercial plantings, from this information it looks like they are ready to be picked at 20% dry matter. I included the maturity data, the dry matter determination using the microwave oven didn't work and overestimated dry matter. We finally got the right apparatus to do dry matter determination by toluene distillation, so the later results are accurate.

Finally got our data compiled for 1975-1985 and the averages for some "Nobel Aroma" varieties are in the last table. These results are for OSU samples, the samples were in -4°C storage until analyzed.

We will send the information on the oil composition and Idaho and Washington samples as soon as possible.

Sincerely yours,

Gail Nickerson, Chemist

cc A.H.

1987 OREGON HALLERTAUER TRIPLOIDS

Certified Analyses of Samples Taken by Oregon Department of Agriculture

				At 8% Moisture Content			
Variety	Grower ID	Broker	Bales	% Alpha	% Beta	mL oil/100g	Cohumulone
21455	7G-214-E	Steiner	19	5.8	8.1	1.91	22
	OSU			7.1	7.7		23
21456	7G-211-A	Steiner	12	3.3	4.8	0.97	28
	OSU			4.4	5.4		26
21457	7G-205-B	Barth	19	4.4	3.6	1.03	25
	OSU			6.3	3.9		25
21458	7G-252	Barth	15	2.4	5.2	0.76	28
	OSU			3.7	5.4		24
21459	7G-235-X	Barth	37	3.5	3.6		26
	OSU			3.7	3.6		26

1987 ANALYSES OF HALLERTAUER TRIPLOID SELECTIONS

Maturity and Harvest Results

21455 (Goschie 76-214-E 19 bales)

Date	Dry Matter or (Moisture Content)	Dry Weight Basis % Alpha-Acids	% Beta-Acids	mL oil/100g	CoHumulone
Aug 5	19.05 microwave	4.2	6.2		24
13	19.92 microwave	3.8	6.4		23
17	19.3	4.3	7.1		24
21	18.6	4.6	7.8		23
25	19.7	5.7	9.0	2.29	24
31	19.3	6.2	9.6	2.68	25
HARVEST					
Sept 1	(10.0)	6.3	8.8	2.08	22

21456 (Weathers 76-211-A 12 bales)

Date	Dry Matter or (Moisture Content)	Dry Weight Basis % Alpha-Acids	% Beta-Acids	mL oil/100g	CoHumulone
Aug 5	21.71 microwave	2.2	3.0		26
10	18.0	3.0	4.8		24
17	19.7	2.8	3.9		26
24	19.8	2.8	4.8	1.80	25
Harvest					
Aug 25	(11.0) Loose	3.4	5.5	1.32	27
	(7.60)	3.6	5.2	1.05	28

21457 (Colemans 76-205-B 19 bales)

Date	Dry Matter or (Moisture Content)	Dry Weight Basis % Alpha-Acids	% Beta-Acids	mL oil/100g	CoHumulone
Aug 5	23.2 microwave	3.3	2.9		23
13	21.5 microwave	3.7	3.2		24
17	18.9	4.5	3.5		24
24	20.3	4.3	3.8	1.56	24
HARVEST					
Aug 31	(6.95)	4.8	3.9	1.12	25

1987 ANALYSES OF HALLERTAUER TRIPLOID SELECTIONS

Maturity and Harvest Results

21458 (Serres 7G-252 15 bales)

Date	Dry Matter or (Moisture Content)	Dry Weight Basis % Alpha-Acids	% Beta-Acids	mL oil/100g	CoHumulone
Aug 5	20.6 microwave	1.7	3.4		27
13	20.1 microwave	2.5	4.7		23
17	17.8	2.8	5.4		27
HARVEST					
Aug 24	(10.85) Loose	2.4	5.2	0.79	25
	(12.70)	2.6	5.6	0.83	28

21459 (Stauffer 7G-235-X 37 bales)

Date	Dry Matter or (Moisture Content)	Dry Weight Basis % Alpha-Acids	% Beta-Acids	mL oil/100g	CoHumulone
Aug 5	18.3 microwave	2.1	3.0		24
17	13.2	3.5	3.3		25
25	17.0	3.4	3.9	0.69	28
31	17.4	4.5	4.6	0.84	28
Sept 7	19.7	4.3	4.5	1.17	25
Harvest					
Sept 11	(9.0)	3.8	3.9	0.80	26

CHEMICAL ANALYSES OF EUROPEAN VARIETIES GROWN IN OREGON

1975-1985

		At 8% Moisture Content									
Variety	Lb/Ac	Alpha Acid	Beta Acid	Alpha Ratio	CoH	6 mo % Remain	Oil mL/100g	% Myrc	% Humu	H/C	H/F
Hallertauer	490	4.3	4.6	48	21	46	0.73	44.5	32.1	3.47	----
Hallertauer MF	559	4.0	4.6	52	20	54	0.80	31.7	39.7	3.45	----
Backa (56001)	986	4.8	6.0	44	25	67	0.63	40.0	33.8	3.28	----
Backa (21080)	843	4.1	6.1	40	25	66	0.60	55.7	21.0	2.80	----
Hersbrucker E	733	5.5	6.4	46	23	55	0.68	44.4	30.0	3.22	----
Hersbrucker G	776	5.2	7.4	40	25	61	0.63	49.9	25.0	3.18	----
Saazer	205	4.3	3.6	55	24	51	0.62	37.1	22.7	3.37	1.85
Spalter	251	4.7	4.6	55	23	49	0.62	45.4	17.2	3.43	1.44
Tettnang(21015)	234	4.5	3.8	55	24	61	0.56	41.6	21.4	3.45	1.71
Tettnang(61021)	412	4.7	4.7	49	22	57	0.66	45.2	21.2	3.41	1.45
Fuggle H	856	5.5	2.8	66	26	73	0.91	42.7	26.9	3.13	5.70
Fuggle N VF	955	5.9	3.2	65	26	71	1.02	43.8	27.0	2.98	5.62
Styrian	1228	5.6	3.0	65	28	71	0.92	44.3	28.5	3.37	7.50
Golding Yugo	1104	5.5	2.9	66	27	73	0.90	44.0	28.2	2.93	5.91
Golding Sajvin.	896	5.6	2.7	67	27	74	0.91	49.8	25.4	2.87	6.53
N. Brewer	688	9.5	4.0	70	26	75	1.61	54.0	22.9	2.72	----
Huller Bitter	1004	9.0	4.9	64	27	68	1.31	50.9	9.0	2.02	----
Perle	677	10.4	4.2	71	28	81	0.94	35.0	35.3	3.03	----

Department of
Agricultural Chemistry

College of
Agricultural Sciences

Oregon State University

Corvallis, Oregon 97331-6502 (503) 754-3791

November 4, 1987

Dr. Paul Hoskins
Busch Agricultural Resources
10777 Sunset Hills, Suite 110
St. Louis, Missouri 63127

Dear Paul,

We have analyzed the **Hallertauer triploid selections** from Idaho and Washington. Steiner and Barth also sent samples from Oregon. The results are very encouraging because the Idaho and Oregon analytical results are very close. I am sending the certificates for these analyses and the initial Oregon analyses. We have not completed the oil composition analyses, but will send you the results as soon as possible.

Sincerely,

Gail Nickerson
Chemist

HALLERTAUER TRIPLOID SELECTIONS

1987 Analyses of Commercially Grown Samples

WASHINGTON, OREGON and IDAHO — Results on Dry Weight Basis

Variety	Location	Grower ID	Analysis Date	% Alpha	% Beta	HSI	CoH	mL Oil 100 g
21455	ID	106-5X	10/27	5.9	7.0	0.30	24	1.54
	OR	214-E	9/3	6.3	8.8	0.24	22	2.08
		"	11/2	5.9	8.0	0.28	24	1.47
	WN	321-6	10/27	2.9	5.0	0.33	27	0.33
21456	ID	106-6X	10/27	3.4	4.9	0.29	26	0.88
	OR	211-A	8/28	3.5	5.2	0.26	26	1.05
		"	11/2	3.4	4.9	0.32	26	0.96
21457	ID	106-X7	10/27	5.0	3.8	0.28	26	1.21
	OR	205-B	8/31	4.8	3.8	0.28	25	1.12
		"	11/2	4.8	3.8	0.33	24	1.13
21458	ID	106-X8	10/27	3.2	5.8	0.26	24	0.66
	OR	252	8/31	2.6	5.6	0.27	28	0.83
		"	11/2	2.2	4.6	0.33	27	0.98
21459	ID	106-X9	10/27	4.8	4.3	0.28	27	0.77
	OR	235-X	9/16	3.8	3.9	0.28	26	----
		"	11/2	3.6	3.8	0.34	28	0.89

Note: The samples were plugs from one bale, except for the first OR analyses which were composited core samples.

HOP RESEARCH COUNCIL

PRESIDENT

Paul Hoskins, Ph.D.
Busch Ag. Res., Inc.
One Bush Place
St. Louis, MO 63118
(314) 577-3697

VICE PRESIDENT
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Detroit, MI 48207
(313) 446-2630

SECRETARY
Darwin Davidson, Ph.D.
Adolph Coors Co.
Golden, CO
(303) 277-2398

TREASURER
Ronald Brulotte
Rt. 1, Box 1482
Toppenish, WA 98948
(509) 865-4247

October 1, 1987

To: Hop Research Council Members

Re: **Distribution of Triploid Hallertau Varieties**

Attached is the inventory of the 1987 crop of triploid Hallertau varieties grown in three different states.

As stated in the minutes of the August 12, 1987 meeting of the HRC, one bale of each variety grown in each state (except for 21457 grown in Washington) will be held in the warehouse for dealers and researchers to obtain small samples.

One brewer's sample from each variety grown in each state will be mailed to the brewing and hop dealer members of HRC.

Dealer members who need additional samples should contact Sam Likens to place the order for number of samples needed. This will enable proper allocation of samples as part of the HRC program.

The 21457 variety grown in Washington will be established in a new yard. The present yard will be maintained during the 1988 crop year to observe its second year's growth.

The cooperation of the hop research personnel and the HRC members in establishing this triploid Hallertau program is greatly appreciated.

Paul H. Hoskins

PHH/vs

cc: A. Haunold
S. Kenny
S. Likens

ANHEUSER-BUSCH COMPANIES

Interoffice Correspondence

RECEIVED SEP 24 1987

September 21, 1987

To: Paul Hoskins

Re: Triploid Hallertau Inventory

Per your request the following information was obtained:

Variety	Location	Grower	# Bales	Storage Location
21455	WA	Tom Carpenter	12	S.S. Steiner - Yakima
21456	WA	J. I. Haas	6	John I Haas - Toppenish
21457	WA	Ken Gamache	30 lbs.	S.S. Steiner - Yakima
21458	WA	Ron Brulotte	10	Barth - Yakima
21459	WA	Ron Brulotte	21	Barth - Yakima
21455	ID	Dan Dixon	6	S.S. Steiner - Yakima
21456	ID	"	4	"
21457	ID	"	2	"
21458	ID	"	2	"
21459	ID	"	2	"

OR. Certified Analyses (GTN)

		α β Cohf o.c		
21455	OR 6.3 8.8 22 2.48	Herman Goschie	19	S.S. Steiner - Salem
21456	OR 3.6 5.2 28 1.45	Karl Weathers	12	S.S. Steiner - Salem
21457	OR 4.8 3.9 25 1.12	Bob Coleman	19	Barth (Hubbard)
21458	OR 2.6 5.6 28 0.83	Paul Serres	15	Barth (Hubbard)
21459	OR 3.8 3.9 26 1.01	Bob Stauffer	37	Barth (Hubbard)

/John T. Reeves

JTR/cm

cc: Gary Wittgenstein
Roger Reinhardt

copies to: Sam Likens
Gail Nickerson

Adolph Coors Company
Golden, Colorado 80401
(303) 279-6565

July 14, 1987

Dr. Al Haunold
Dept. Crop Science
Oregon State University
Corvallis, OR 97331

Dear Al:

Enclosed you will find the results of the aroma evaluations of the triploid Hallertau samples. Of the Hop Research Council supported hops, we preferred 21455, with 21457 and 21456 following closely. The 21458 and 21459 samples, however, were too floral/citrus compared to the import Hallertau control sample.

Of the additional seventeen triploid Hallertau samples, 21484 and 21470 were closest to the control, with the "technician hop," 21373, also very close. (See Table I) The samples that are questionable agronomically, but having good aroma qualities include 21482, 21474 and 21483. The samples definitely heading in the wrong direction, as far as aroma is concerned, are the following: 21469, 21479, 21477, 21480, 21476 and 21472. Borderline selections were 21473, 21478 and 21481.

If you have any questions and comments regarding the results of these evaluations, please feel free to contact me or Robert T. Foster II.

Sincerely,

Amy Edwards
Adolph Coors Company
Quality Assurance
Mail #BC600
Golden, CO 80401
303-277-2086

AE/fs:7B204

Enclosure

Approval: ___ ___

pc: Robert T. Foster, II
Darwin Davidson
Kathy Weber
John Sitzman
Nick Hughes

TABLE I
Aroma Ranking and Comments vs. Import Hallertau Sample

Overall Order of Rank		Comments
	HRC Supported Hops	
2	21455	Best of HRC hops, aromatic
8	21456	Good balance, pleasant
7	21457	Good balance, Hallertau type
15	21458	Too floral, citrus
20	21459	Too floral, perfumed, cinnamon
	Coors Supported Hops	
1	21484	Closest to Hallertau
3	21470	Very good - well blended, pleasant
4	21373	(Technician Hop) very good Cascade-like floral, big cones
6	21475	Good tobacco, big cones
9	21471	Cluster-like onion
11	21473	Perfumed, lime
13	21478	Spicy, floral
14	21481	Low intensity, Hallertau type
16	21472	Floral, fresh
	Agronomic?? - Good Aroma	
5	21482	Poor color, good Hallertau aroma
10	21474	Close to Hallertau, poor color, harsh feel
12	21483	Pleasant, good balance
	Agronomic?? - Off-Aroma	
17	21476	Cascade-like, low intensity
18	21480	Strong aroma, good color
19	21477	Too pine forest and floral, gritty feel
21	21479	Too floral
22	21469	Too floral citrus

AE/fs:7B204

STROH

THE STROH BREWERY COMPANY
100 RIVER PLACE
DETROIT, MICHIGAN 48207-4291
(313) 446-2000

OK - telephoned 1/7-88

December 28, 1987

Al Haunold, Oregon State Univ., Dept. of Crop Science, Agric. Hall 37, Corvallis, OR 97331
Steve Kenny, IAREC, Prosser, WA 99350-0030
John Muller, S.S. Steiner, Inc., PO Box 9009, Yakima, WA 98909
Lloyd Rigby or Gene Probasco, John I. Haas, Inc., PO Box 1441, Yakima, WA 98907
Peter Mahony, John Barth Inc., PO Box 443, Hubbard, OR 97032
Dan Dixon, Greenleaf Farms, Inc., PO Box 189, Caldwell, ID 83605

Dear Colleagues:

Test Brews with 1987 Aroma Lines

As you probably know, our philosophy in choosing aroma hops for pilot test brewing is that, in the absence of more exact knowledge, the best we can do is choose those hops that have a high oil content relative to the alpha content.

For example, if one aroma hop has 8% alpha and 2.0 ml oil, and another has 4% alpha and 0.8 ml oil, then the first is the one to test, as it will not only give more aroma at a given BU, it will also do so at half the cost of brewing with the other one.

A problem this year is that I have received more hop samples than ever, but VERY few oil analyses. Enclosed is a table of the samples I have, with all analyses received. Can I ask each of you to check your own files, and if you have analytical values that are missing, to write them into the table and return it to me a.s.a.p.? Unless you complete the analysis for me, we shall not be able to brew with these samples, as the entire amount would be used up in analysis.

With many thanks and best wishes until we meet at Long Beach on Jan. 19-20,

Sincerely,

Morten Meilgaard

encl.

samples analyzed Nov. 30, 1987 by G B Nickerson, from dealer's plugs

Dealer	Grower	Variety#	oil	alpha	beta	HSI	H2O	coh	Notes
Oregon									
	Haunold	21373	1.78	16.0	7.7	.24		20	
		"Tech. Choice"		~~5.3~~	~~7.1~~	~~0.286~~		~~24~~	
Steiner	Goschie, Salem	21455	1.40	~~3.1~~	~~5.3~~	~~.265~~		~~20~~	
Barth	Bob Coleman	21457	1.00	4.83	3.74	.330	6.95	24	
Barth	Paul Serres, Woodb.	21458	0.90	~~2.3~~ 1.9	~~4.9~~ 4.0	.330	12.7	27	picked too early
Barth	Bob Stauffer, Hubba.	21459	0.80	3.42	3.84	.340	9.0	28	
	Don Weathers, Salem	21490		~~8?~~	baby planting - no analysis				
	Paul Serres, Woodb.	21491		~~10?~~	baby planting - no analysis				
Washington									
Steiner	Tom Carpenter	21455	0.30	2.9	5.2	.259		27	looks strange
Haas	JI Haas, Toppenish	21456	0.80	2.9	3.4	.360		26	
Barth		21458	0.80	2.7	3.4	0.350		18	
Barth		21459	0.90	3.8	3.1	0.340		25	
	Kenny	8154-230	0.87	5.92	4.27	.224		23	
	Kenny	8154-237	1.28	8.99	5.02	.239		21	
	Kenny	8154-264	1.99	6.47	5.09	.232		21	
	Kenny	8254-167	1.32	6.28	6.50	.207		17	
	Kenny	8254-253	0.94	2.61	4.46	.198		22	
	Kenny	8309-037							
	same as 21490, see above								
Idaho			oil	as is					
Steiner	Dixon, Caldwell	21455	1.40	5.3	6.4	.30		24	
Steiner	Dixon, Caldwell	21456	0.80	3.1	4.5	.29		26	
Steiner	Dixon, Caldwell	21457	1.10	4.5	3.4	.28		25	
Steiner	Dixon, Caldwell	21458	0.60	2.9	5.3	.26		25	
Steiner	Dixon, Caldwell	21459	0.70	4.4	3.9	.28		27	
21490 (Oregon plot sample)			1.48	5.6	7.7	.24		26	
21491	-"-		0.88	6.3	4.5	0.27		22	

MILLER BREWING COMPANY

November 13, 1987

Dr. A. Haunold
USDA
Agricultural Research Service
Oregon State University
Corvallis, Oregon 97331

Dear Al:

I have enclosed sensory data on the pilot beers which were made with the Triploid Hallertau selections you provided from the 1986 crop.

In our experiment we included Hallertau Hersbrucker as the control (P.B. 3893). The results of this testing showed that:

1. Beer made with USDA 21458 had the most aroma strength, fruity/estery and hop character.

2. Beer made with USDA 21456 had the least intensity for these attributes.

3. Beers made with USDA 21455, USDA 21457 and USDA 21459 were similar to the control beer.

We are interested in continuing to evaluate these selections as you program moves forward.

A. J. Rehberger/jmp
Director Process Improvement & Development

85P.DOC

Miller Brewing Co.: Oregon State/USDA Triploid Aroma Hop Selections
1986 crop. hand samples, pilot brewing. Analyzed: Sept. 1987.

Characteristic	P.B. 3836 21455	P.B. 3837 21456	P.B. 3838 21457	P.B. 3839 21458	P.B. 3840 21459	P.B. 3893 Control (Hallertauer m.f.)	F-Value	Level of Significance	Multiple Range Test
Aroma Strength	13.4	12.7	13.8	14.3	13.6	12.9	3.42	99.3%	14.3 13.8 13.6 13.4 12.9 12.7
Fruity/Estery	11.0	9.9	11.1	11.7	10.7	10.6	2.32	95.0%	11.7 11.1 11.0 10.7 10.6 9.9
Hop Character	11.3	10.1	10.8	11.6	11.1	10.5	2.54	96.5%	11.6 11.3 11.1 10.8 10.5 10.1
Sulphidic/tic	3.9	3.8	3.9	5.0	4.3	4.4	1.82	NSD	
Diacetyl	3.5	3.0	3.7	2.8	2.9	2.7	3.08	98.7%	3.7 3.5 3.0 2.9 2.8 2.7
Bitterness	12.8	12.5	12.9	12.9	12.6	12.8	0.29	NSD	
Aftertaste	13.2	12.4	12.7	13.2	12.5	12.9	1.05	NSD	

N = 30

less fruity sl.more bitter similar to control and 21457

no sample

less fruity, similar to control, pleasant, sl. more bitter than control, less hop character

medium strong hop aroma, pleasant, most aromatic, more fruity than control or 21459

fruity, mild bitterness med.strong aroma, pleasant, 2nd most aromatic

bland, mild, weak hop aroma

additional comments by 3 panelists: Selection 21458: grapefruity

original ORE 036
✓ 1 copy A. Haunold
1 copy S. Ladd
1 copy A. Burton

United States Department of Agriculture
Cooperative State Research Service
Office of the Administrator
Washington, D.C. 20250

Project Review and Comment Sheet

Cooperating Institution:
Oregon State University

Status: Revised Type: Hatch

Project No.: ORE00036 Reg'l. Project No.: _____

Title: BREEDING, GENETICS, PATHOLOGY, CHEMISTRY AND CULTURE OF HOPS

Date of Transmittal Letter: JUNE 5,1987

Action: Approved X Deferred ___ Acknowledged ___ Other _____
(specify)

Effective Date: * 01/07/87
(day,month,year)

CRIS Accession No.: 0025152

Environmental Impact Statement Required: Yes ___ No X

Comments:

_____ _____Group Leader 6/25/87
(signature) (date)

* Approval date for use of Federal funds.

Form 166

U.S. DEPARTMENT OF AGRICULTURE
RESEARCH WORK UNIT/PROJECT DESCRIPTION - RESEARCH RESUME
U.S. DEPT. OF AGRICULTURE, STATE AND OTHER AGRICULTURAL EXPERIMENT STATIONS

DATE (Day, Month, Year): 01 JUL 87
AMENDMENT: ☐

1. ACCESSION NO.	AGENCY IDENTIFICATION NO. 2.	3.	4.	5. WORK UNIT/PROJECT NO.	6. STATUS
0025152	CSRS	ORE	0000	ORE00036	New A ☐ Extended B ☐ Revised C ☒ Terminated E ☐ Pending F ☐

7. TITLE

BREEDING, GENETICS, PATHOLOGY, CHEMISTRY AND CULTURE OF HOPS

8. PERFORMING ORGANIZATION	CITY	STATE/COUNTRY	ZIP CODE	CONG. DISTRICT
CROP SCIENCE AGRICULTURAL EXPERIMENT STATION OREGON STATE UNIVERSITY	CORVALLIS	OR USA	97331	

13. RESPONSIBLE ORGANIZATION	CITY	14. STATE	ZIP CODE
OREGON AGRICULTURAL EXPERIMENT STATION	CORVALLIS	OR	97331

12. INVESTIGATOR NAME(S) (Last name & initials)
1 Haunold, A
2 Nickerson, G B
3
4
5
6

15. RESPONSIBLE INDIVIDUAL (Last name & initials): Davis, S. L.

16. RESEARCH LOCATION ON CAMPUS? A ☒ Yes B ☐ No

PROJECT TYPE

17-1. FOR USDA USE: A ☐ Contract B ☐ Grant C ☐ Coop. Agmt. D ☐ In-house

17-2. FOR USDA USE: Contr./Gr./Agmt. with SAES A ☐ Other B ☐

18-1. FOR STATE USE: 1890/T ☐ SP GR ☐ RD V ☐ CRGO ☐ Alcohol Ind ☐ SBRG ☐; Hatch H ☒ M-S ☐ State S ☐ AH A ☐ Native Latex L ☐

CONTRACTS, GRANTS & COOPERATIVE AGREEMENTS

18-4. CONTR/GR/AGMT./NO.

19-1. FACE AMOUNT

18-5. FOR STATE USE: ARS A ☐ ERS B ☐ FS C ☐ ACS D ☐ SRS E ☐

19-2. TOTAL SYS.

20. F Y

21. FACILITIES: A ☐ Federally-owned B ☐ Federally-leased C ☐ Combined D ☒ State E ☐ Other

22.-23. REGIONAL PROJECT NO.

24. OBJECTIVES 25. APPROACH (Use space needed for "24. OBJECTIVES", then indicate "25. APPROACH".)

24. Develop new aroma hop varieties with improved yield and quality, increased pest resistance and early maturity. Develop and continue to upgrade management practices to assist Oregon hop growers to remain competitive in domestic and world markets.

25. Conduct a comprehensive hop breeding and genotype development program. Major goals are: 1. Desirable aroma and flavor characteristics to attract new domestic and foreign brewer customers. 2. Improve yield and disease resistance. 3. Develop hops with early maturity to take the place of Fuggle which has been declining in recent years. 4. Develop improved production practices to enhance hop yields and quality, control fungal and insect pests and weeds in Oregon hop yards.

27. KEYWORDS

Plant Genetics, Breeding, Hop diseases, Hop aroma, Alpha acids, Pest resistance, Weed control

U.S. DEPARTMENT OF AGRICULTURE

RESEARCH WORK UNIT/PROJECT L CRIPTION-CLASSIFICATION OF RESEAR.

U.S. DEPT. OF AGRICULTURE, STATE AGRICULTURAL EXPERIMENT STATION AND OTHER INSTITUTIONS

DATE (Day, Month, Year): 01 JUL 87

1. ACCESSION NO.	AGENCY IDENTIFICATION NO. 2.	3.	4.	5. WORK UNIT/PROJECT NO.	31. HATCH MARKETING
0025152	CSRS	OR	HATCH	ORE00036	☐ Yes ☐ No %

32. BASIC RESEARCH	33. APPLIED RESEARCH	34. DEVELOPMENT EFFORT	35. FORESTRY
50 %	50 %	%	%

CLASSIFICATION BY ACTIVITY, COMMODITY, SCIENCE, AND RESEARCH PROBLEM AREA

	ACTIVITY		COMMODITY		SCIENCE		RESEARCH PROBLEM AREA	PRODUCT OF (2) X (4) X (6)
	CODE (1)	% (2)	CODE (3)	% (4)	CODE (5)	% (6)	CODE (7)	% (8)
36.	4500	10	2830	100	0412	100	207	10
37.	4600	30	2830	100	1112	40	208	12
38.	4600	30	2830	100	0512	60	208	18
39.	5000	50	2830	100	0512	100	307	50
40.	5100	10	2830	100	1524	100	405	10
41.								
42.								
43.								
44.								
45.								
46.								
47.								

SPECIAL CLASSIFICATION

Fields 48-77 are used to identify special areas of research such as Pollution, Health and Medical, Tobacco-Health, Weather, Nuclear Radiation, Poverty, Natural Beauty, Sub-Commodities, Pesticide Targets, Water Resources, Energy, Home Economics, Sub-Activities (SEA/AR) and Special Research Programs (SEA/AR). Refer to your agency manual for specific codes and instructions.

CODE	%	CODE	%	CODE	%	CODE	%	CODE	%
48. C2830	100	54.		60.		66.		72.	
49. PST2	20	55.		61.		67.		73.	
50.		56.		62.		68.		74.	
51.		57.		63.		69.		75.	
52.		58.		64.		70.		76.	
53.		59.		65.		71.		77.	

79. COOPERATORS

A ☒ USDA B ☐ Other Federal Agencies C ☐ Industry and other D ☐ State

COOPERATING DEPARTMENTS WITHIN STATE PERFORMING INSTITUTION

80.

81. Department of Agricultural Chemistry

82.

83. REPORTING DEPARTMENT WITHIN STATE PERFORMING INSTITUTION

Agricultural Experiment Station
Crop Science Department

AD FORM 417
JUN 1979

U.S. DEPARTMENT OF AGRICULTURE
RESEARCH WORK UNIT/PROJECT DESCRIPTION - PROGRESS REPORT
U.S. DEPT. OF AGRICULTURE, STATE AGRICULTURAL EXPERIMENT STATIONS AND OTHER INSTITUTIONS

DATE (Day, Mo., Yr.): 13-OCT-87

1. ACCESSION NO.	2. AGENCY IDENTIFICATION NO.	3.	4.	5. WORK UNIT / PROJECT NO.	22-23. REGIONAL PROJECT NO.	TYPE / GRANT NO.
0025152	CSRS	ORE	0000	OREO0036		HATCH

7. TITLE
BREEDING, GENETICS, PATHOLOGY, CHEMISTRY AND CULTURE OF HOPS

8. PERFORMING ORGANIZATION
CROP SCIENCE
AGRICULTURAL EXPER. STATION
OREGON STATE UNIV
CORVALLIS
OREGON 97331

12. INVESTIGATOR NAME(S)
1. HAUNOLD A
2. NICKERSON G B
3.
4.
5.
6.

6. STATUS TERMINATED	30. ESTIMATED TERMINATION DATE	84. PERIOD COVERED (Mo., Yr.) FROM:	THRU:
E ☐	30 JUN 92	01/87	12/87

16. PROGRESS REPORT

USDA 21180 (for Miller Brewing Co.) and 21181 (for the Hop Research Council) were again harvested from Oregon commercial plots, while USDA 21202 was discarded. The 5 triploid Hallertauer-derived seedling selections USDA 21455, 21456, 21457, 21458, and 21459 were harvested for the first time from 3-acre commercial plots. Yields ranged from 600 lb/A (for USDA 21456) to over 2000 lb/A (for USDA 21459). Commercial brewing trials are scheduled for early 1988. Over 500 single plants were sampled from the 1985-Nursery to identify additional promising triploid aroma hops. A new nursery from a diploid Tettnanger female crossed to two tetraploid monoecious male hops was established to develop triploid hops with a Tettnanger or Saazer aroma profile. Two additional Hallertauer-derived triploid aroma hops (USDA 21490 and 21491) were established in 5A commercial plots. Two virus-free Tettnanger selections obtained from Germany were established in 3A commercial plots. The two Idaho selections Banner (USDA 21287) and Aquila (USDA 21222) were established in 4A commercial plots, prior to anticipated release.

17. PUBLICATIONS

Haunold, A., Austria's hop industry from a global perspective. Agrar. Rundschau 1987 (1): 18 - 20.

Kralj, D., and A. Haunold. The breeding potential of native hops (humulus lupulus L.) from Yugoslavia. Monatschr. f. Brauwiss. 1987 (7): 287 - 293.

Kralj, D., and A. Haunold. Breeding potential of native hops (Humulus lupulus L.) from Yugoslavia II. Genetica 19: No. 1. 47 - 60. 1987.

Haunold, A., and G.B. Nickerson. Development of a hop with European aroma characteristics. J. Amer. Soc. Brew. Chem. 45: (accepted for publication)

Nickerson, G.B., P.A. Williams, and A. Haunold. Composition of male hop oil. ASBC Newsletter 45 (1): 19. 1987. (Abstract).

Burkhardt, R., G. Nickerson, and J. Munroe. Hop Analysis check service (HACS). J. Am. Soc. Brew. Chemists 45: (3): 119. 1987.

APPROVED (Signature)	TITLE	DATE
	Director Agricultural Experiment Station	

ACCESSION: 0141065 YR 87 PUB PG 1 MODE: 5358-05-00 CWU: 5358-22000-001-00D

TITLE: IMPROVED HOP GERMPLASM, VARIETIES, AND PRODUCTION PRACTICES

PERIOD COVERED FROM 01/87 THRU 12/87

USDA Hop Research, Corvallis, OR.
proj.leader. A. Haunold

APPROVED: R.E. WELTY 01/88

POSITION TITLE: RESEARCH LEADER

PROGRESS REPORT

USDA 21180 and 21181 were again harvested from Oregon commercial plots, while USDA 21202 was discarded. The 5 triploid Hallertauer-derived seedling selections USDA 21455, 21456, 21457, 21458, and 21459 were harvested for the first time from 3-acre commercial plots. Yields ranged from 600 lb/A (for USDA 21456) to over 2000 lb/A (for USDA 21459). Commercial brewing trials are scheduled for early 1988. Six of the 16 advanced Hallertauer-derived triploid aroma selections were harvested from 20-hill plots. One of these, USDA 21484, was closest to Hallertauer mittelfrueher of any aroma selection evaluated thus far. Over 500 single plants were sampled from the 1985-Nursery (1984 crosses) to identify additional promising triploid aroma hops. A new nursery from a diploid Tettnanger female crossed to 2 tetraploid monoecious male hops (1986 crosses) was established to develop triploid hops with a Tettnanger of Saazer aroma profile. Two additional Hallertauer-derived triploid aroma hops (USDA 21490 and 21491) were established in 5A commercial plots in Oregon. Planting stock was also sent to Prosser, WA. Two virus-free Tettnanger selections obtained from Germany were established in 3A commercial plots in Oregon. The two Idaho selections Banner (USDA 21287) and Aquila (USDA 21222) were established in 4A commercial plots in Oregon prior to the anticipated release by Idaho. The high-alpha, low-cohumulone selection USDA 21373 had below-average yields in Oregon nursery plots but excellent quality (16% alpha; 20% cohumulone).

PUBLICATIONS

(1)
BURKHARDT, R., NICKERSON, G., and MUNROE, J. 1987. Hop analysis check service (HACS). J. Amer. Soc. Brew. Chem. 45 (3):119.

(2)
KRALJ, D., and HAUNOLD, A. 1987. The breeding potential of native hops (Humulus lupulus L.) from Yugoslavia. Monatsschr. f. Brauwiss. 1987 (7):298-293.

(3)
KRALJ, D., and HAUNOLD, A. 1987. Breeding potential of native hops (Humulus lupulus L.) from Yugoslavia. II. Genetica 19 (1):47-60.

(4)
HAUNOLD, A. 1987. Austria's hop industry from a global perspective. Agrar. Rundschau 1987 (1):18-20.

(5)
HAUNOLD, A., and NICKERSON, G.B. 1987. Development of a hop with European aroma characteristics. J. Amer. Soc. Brew. Chem. 45:146-151.

(6)
NICKERSON, G.B., WILLIAMS, P.A., and HAUNOLD, A. 1987. Composition of male hop oil. ASBC Newsletter 45(1):19. (Abstr.)

PROJECT # 36
RESEARCH PROJECT OUTLINE
OREGON AGRICULTURAL EXPERIMENT STATION

Title: Breeding, Genetics, Chemistry, Pathology, and Culture of Hops.

Personnel and Departments:
Project Leader: Alfred Haunold, Crop Science Department and USDA-ARS.
Cooperators:
Max Deinzer, Agricultural Chemistry
Gail B. Nickerson, Agricultural Chemistry
Arnold P. Appleby, Crop Science
Calvin B. Skotland, Plant Pathology, Prosser, Washington

Date: Revised July 1, 1987 previous revision: July 1, 1982

Duration: 5 years See 1982 HRC-OAS Rep. p. 16

Introduction: In 1982, when this project was last revised, Oregon had a modern all-time high of 7300 acres of hops with 13.14 million pounds of production and a farmgate value in excess of $20 million. This was at the height of the world hop cycle when prices had quadrupled in a short period of time and reached levels never before seen in this country. The inevitable price collapse brought on by overplanting not only saw a dramatic decrease of Oregon's hop acreage but also restructuring and planting of new varieties at a level never before experienced by American hop growers.

The two sister selections Bullion and Brewer's Gold, collectively named English Hops by the trade, accounted for 32% of the 1982 acreage and 45% of total production that year, followed by Fuggle (29%), Cascade (22%), and the new triploid aroma hop Willamette (12%) which was released by the Oregon Agricultural Experiment Station in 1976. Less than five years later the varietal picture in Oregon had changed dramatically. The English hops and Cascade had disappeared almost completely, while Willamette had expanded to nearly 40% of total hop acreage, representing the most widely grown variety in the state. Nugget, a new super-alpha hop variety developed by the Oregon Agricultural Experiment Station and released in 1983, had skyrocketed to 26% of total Oregon acreage and nearly 36% of production, while Fuggle had dropped to less than 900 acres and barely 10% of total production in 1986.

The past year, 1986, was one of restructuring, a process continuing from 1985 with increased plantings of Willamette and Nugget to take advantage of the superior yield potential of these two new varieties as well as renewed interest by domestic and foreign customers.

Willamette, an aroma hop similar to the desirable Fuggle but with higher yield potential, has seen a steady acreage expansion during the past few years despite a generally declining trend of U.S hop acreage overall. Willamette is best adapted to the relatively cool, moist climate of Western Oregon and has received little attention in other U.S. hop growing areas. Unexpectedly, a major U.S. brewery announced its intention in late 1986 to buy unlimited quantities of Oregon-grown Willamette in future years and

encouraged expansion of this variety not only in Oregon but also in other major U.S. hop growing areas. Precise figures are not available at this date but it is estimated conservatively that in Oregon alone between 1000 and 1500 additional acres of Willamette were sold in recent months. The only limiting factor was the ability of Oregon growers to harvest and process additional acreage.

Nugget, a replacement of Bullion and Brewer's Gold has averaged over 50% more alpha acid production per acre than the two English hops during the short period of commercial production. Nugget, stimulated by great interest of hop processors and extract producers, is expected to increase moderately in future years.

In addition to alpha acid content, which accounts for the pleasant bitter flavor of hops, American and foreign brewers also need aroma hops to provide the hoppy flavor to their beer. Historically most of these hops have been imported from abroad, primarily Central and Western Europe. These hops produce low yields and are economically unattractive to American growers. The release of the aroma variety Cascade in 1972, now grown primarily in Washington, was the first success in competing aggressively with imported aroma hops. Willamette has been another contributing factor to reducing imports.

Background Information for Project Objectives during 1987-1992:

A. Reduced USDA funding for hop research: A management decision by USDA-ARS in 1983 resulted in severe curtailment of USDA hop research. The apparent success of the hop research project during the past 20 years which resulted in the release of 6 new hop cultivars and over 20 germplasm lines prompted USDA administrators to conclude that USDA had built a solid foundation so that major hop research funding could be assumed by individual hop growing states or by hop grower and brewery organizations or a combination of the three, all of which would reap major benefits from continued hop research.

   Hop breeding/genetics research was to be continued on an interim basis with some shift of emphasis toward long-range goals. The geneticist was appointed curator for hop germplasm without additional funding. A Biological Aid (technician) position supporting the breeding and agronomy program was eliminated.

   The USDA hop pathology position at Oregon State University was eliminated. The USDA hop chemist position was closed out upon retirement of the incumbent and financial support of hop chemistry research was reduced to a 25% funding for an OSU (State) Chemist II position.

   About 40% of the remaining USDA hop research funds were shifted to Prosser, WA under a new cooperative agreement.

B. Development of Noble Aroma Hops with European flavor characteristics: When this project was last reviewed in 1982 it was pointed out that additional aroma hop varieties were needed to enable Oregon and U.S. growers to better compete in world hop markets for aroma hops. Hallertauer mittelfrüher, a low yielding long established German aroma hop

has been a worldwide standard for hop aroma. Its production has declined steadily in traditional German hop growing areas due to susceptibility to a progressive strain of Verticillium wilt that appeared in Germany about 25 years ago.

Crosses made in 1983 and 1984 between a tetraploid Hallertauer mittelfrüher obtained from the Hop Research Institute at Wye College, England, and 10 male parents developed and selected by the USDA Hop Research Program at Corvallis primarily for their aroma potential, resulted in a number of selections with aroma and quality potential similar to Hallertauer mittelfrüher. Hand samples of a number of seedling selections from the first year of testing in Oregon experimental plots were evaluated by interested brewers and five selections were chosen for advanced testing. Brewers felt so strongly about the superior potential of these selections that the customary phase of intermediate testing (10 to 20 hills and pilot brewing) was bypassed in favor of 3-acre commercial plantings followed by plant-scale brewing trials in order to rapidly advance one or more of these aroma selections to varietal status.

The five selections, USDA accession numbers 21455, 21456, 21457, 21458 and 21459 were planted in 3- to 4-acre commercial locations in the Willamette Valley in 1986 and the first crop will be harvested in 1987. Brewing trials are scheduled for late 1987 and early 1988. Commercial plots of these 5 aroma selections were also established in the Yakima Valley and Idaho to evaluate their potential for other U.S. hop growing areas.

C. Proposed Research Program, 1987-1992:

1. Release one or more aroma hops with Hallertauer quality profile.
2. Develop additional aroma varieties with quality and oil characteristics similar to the German Tettnanger or the Czechoslovakian Saazer, two additional aroma hops in great demand on world hop markets, by using two recently discovered tetraploid male aroma hops.
3. Select and release additional triploid male hops as yield stimulators to enable Oregon growers to produce seedless hops without the customary yield losses when hops are grown in the absence of males.
4. Continue to upgrade the USDA Hop Germplasm Collection at Oregon State University by introduction of valuable germplasm from abroad and selection of desirable genotypes from segregating populations.
5. Assist Oregon growers in expanding the acreage of Perle, a German high-alpha aroma hop obtained in 1980, and of testing the two diploid experimental hops USDA 21180 and 21181 in off-station trials and the two Idaho selections I43-11 and I33-6 under Oregon conditions.
6. Continue to improve management practices for improving yields, quality, disease and insect control, weed and sucker control to enable Oregon hop growers to remain competitive in world hop markets.

Procedure:

1. Harvest 3-acre plots of the five advanced selections USDA 21455, 21456, 21457, 21458 and 21459 from Oregon commercial plots and cooperate with interested brewers in commercial brewing evaluation. Since two to three years of brewing trials and taste panel evaluation are required, one or more selections could be released as new varieties in 1990 or 1991.
2. Select aroma hops with a Tettnanger or Saazer aroma/quality profile from a new seedling nursery to be field planted in 1987. Two tetraploid aroma-type males, crossed to Tettnanger, may yield desirable triploid selections. Study the chromosome distribution in the seedling progeny and evaluate the feasibility of using tetraploid males.
3. Evaluate approximately 40 early to medium early flowering triploid Hallertauer males as pollinators under Oregon conditions and release desirable genotypes to Oregon growers as yield stimulators.
4. Develop laboratory procedures to identify hops with desirable brewing characteristics, to evaluate the oil composition of desirable aroma hops, study the relationship between storage stability and aroma potential, and develop methods for estimating levels of hop enzymes associated with storage stability, particularly alpha acid oxidase and alpha acid synthetase.
5. Select additional aroma hops with medium-high alpha acid content and higher oil content to study the feasibility of combining these two quality traits in a single genotype.
6. Monitor the virus status of hop germplasm, experimental genotypes, and known cultivars. Study transmission of virus diseases, particularly Prunus necrotic ringspot virus and Hop mosaic virus under Oregon conditions..
7. Continue to acquire hop germplasm from various hop research centers around the world. Upgrade the USDA Hop Germplasm Collection by adding new genotypes selected from segregating populations.

Present Outlook:

Tetraploid male hops have never been used for hop breeding. Cytological analysis and progeny evaluation of 2 diploid x tetraploid crosses may demonstrate a new approach for polyploid hop breeding.

It is reasonable to assume that one ore more new hop varieties will result from the present emphasis on aroma hop breeding. Conservative estimates indicate that a new aroma hop with Hallertauer quality characteristics accepted by U.S. brewers would add between 1000-2000 additional acres to Oregon hop production. A Tettnanger-type hop containing farnesene would be an additional benefit.

Foreign brewers, particularly in Japan, are very interested in this work and might become new customers. The farmgate value of Oregon hops currently estimated to be around 15-17 million dollars annually could easily top 20 million dollars or more with the addition of one or more new aroma varieties.

Budget:

Sources of funds are as follows:

1. U.S. Hop Research Council
2. Oregon Hop Commission
3. Miller Brewing Company
4. USDA-ARS direct support of 1 SY

Ron

Subj: Technology Transfer Activities 121

ATTENTION: All Research Leaders

December 24, 1987

SUBJECT: Technology Transfer Activities in FY 1987

TO: All Research Leaders, PWA

FROM: Daniel A. Niffenegger
Assistant Area Director, PWA

A Technology Transfer listing was supposed to be included in the FY 1988 Annual Resource Management Plan (ARMP). However, instructions for this listing were buried in one of the many sets of ARMP preparation instructions sent out in July. So far as I can determine, Prosser was the only location that picked up on the request.

The Area Office is now being asked for information that can only be provided by the locations.

Wanted:

1. A listing of all meetings held with client groups that were of significant consequence to the technology transfer emphasis of ARS. Identify the name of the client organization, the date, and the topic for discussion for each significant meeting held during FY 1987. At the bottom of the listing, give the name and location of the Research Unit reporting.

2. If one of the meetings listed above is worthy of inclusion in a report to the Congress, please send me a short paragraph written as you would write an interpretive summary for a publication.

Paragraphs that might go to the Congress are wanted right away--before the first of the year, if possible. Please get the listing to me as soon as is feasible, but no later than January 15.

Action?

December 28, 1987

SUBJECT: Technology Transfer Information for ARMP requested by D. A. Niffenegge

TO: G. M. Banowetz, A. G. Berlage, D. B. Churchill, A. Haunold, J. A Kamm, G. W. Mueller-Warrant, and E. J. Trione

FROM: Ronald E. Welty, Research Leader

Please supply above information by January 8, 1988. If you have a meeting worthy of inclusion in a report to Congress, provide me with this information as soon as possible. Thank you.

Dec. 30, 1987.

prepared by: A. Haunold
USDA-ARS, Corvallis, OR.

Request from Daniel A. Niffenegger, USDA

Technology Transfer activity-- Hop project (A. Haunold).

Development of hop cultivars with European aroma characteristics to reduce imports.

Cooperating industries:

Hop Research Council
Anheuser Busch Companies
The Stroh Brewery Co.
Miller Brewing Co.
Adolph Coors Co.
Hop Growers of America Inc.
Oregon Hop Commission.

5 selections with acceptable yield, good quality and aroma characteristics and good disease resistance were planted in 3 acre commercial plots in Oregon, Washington and Idaho. They were harvested for the first time in 1987 and are now awaiting plant-scale brewing trials and tastepanel evaluation. Two additional selections were planted in 5-acre off-station plots in 1987.

Material initially developed from USDA germplasm and foreign introductions. Lead Agency: USDA, benefits and technology to be transferred upon public release (if any) of new hop cultivars.

Benefits: Reduce imports of foreign aroma hops which currently account for about 15 mill. lbs (estimated value about 40 mill US$ or higher).

Meetings and progress reporting to industry groups during 1987:

January: Hop Research Council meeting, San Diego, CA
US Hop Convention, Hop Growers of America

Feb: Miller Brewing Co., Portland, OR.

March: Or. Hop Commission
Idaho Hop Commission

April, May, June: Various telephone conferences with above mentioned brewers and grower organizations

July: Oregon Hop Field Day

August: Summer meeting, Hop Research Council

September: Telefone conferences with hop dealers and brewers concerning experimental hop.
European Brewery Convention, Munich, W.Germany

October: Master Brewers Association
Anheuser Busch Co.
Miller Brewing Co.

Nov. Miller Brewing Co.
Adolph Coors Brewery Co.
Stroh Brewery Co.

Dec. Hop Research Council
Hop Growers of America Inc.

CSRS Review: Jan. 28, 1987.

OSU Crop Science Dept. Project 36
USDA Project 5709-20010-012-00P (regional project serving WA, OR, ID, CA)

Improved Hop Germplasm, Varieties, and Production Practices.

Leader: Dr. Alfred Haunold (since 1965)

History: OSU-USDA cooperative project established 1930, with emphasis on downy mildew control and variety evaluation. Expanded in 1950's to include breeding, genetics, agronomy, physiology and chemistry. Recent retrenchment with emphasis on genetics and chemistry.

Present Personnel: One USDA and one OSU (industry supported) scientist, 2 technicians, 4-6 seasonal helpers.

Recent Accomplishments:
6 new hop cultivars
20 germplasm lines
About 65 scientific publications (since 1968)
Active participation in -
US Hop Research Council
National Hop Research Advisory Committee
NW Clonal Germplasm Repository (Curator for Hops)
Am. Soc. Brew. Chemists (Editorial Board)
Crop Science Society (Assoc. Editor 1979-81)
Sci. Commission of Int'l Hop Prod. Bureau
Master Brewers Association (Shortcourse, seminars)

Impact on Oregon's Economy:
1986 production: 8.5 Mill. lbs. - all from cultivars released since 1972. Farm gate value: about $17 million.

Impact on US Economy: (WA, OR, ID, CA):
United States is the second largest hop producer worldwide. 1986 production: 49 Mill lbs. - about 1/2 from new cultivars. Total Farm gate value: about $100 million in 1986.

About 50% of all US grown hops are exported to over 70 countries. Avg. net favorable trade balance (1981-85): $21.5 million.

Future Plans: Develop "noble aroma" hops with European flavor characteristics to replace imports. Five advanced selections of triploid Hallertauer seedlings are now in 3A commercial trials in WA, OR, and ID. Brewing trials are scheduled for the 1987 crop.

Seedlings from crosses involving Tettnanger, another desirable European aroma hop, will be field planted in 1987. Cytological analysis to identify triploids, field and greenhouse evaluation for vigor, maturity, disease resistance and yield potential will take 3-5 years.

Detailed chemical analyses involving UV spectrophotometry, GC, HPLC and MS technology are used to identify desirable genotypes. All major US brewers are actively cooperating with this project.

Oregon Agricultural Experiment Station
1986 Research Success Example

4/03-87

Project Number: ORE00 0036 CRIS Accession Number:
Project Title: Breeding, Genetics, Pathology Chemistry and Culture of hops.
Principal Investigator(s): Dr. Alfred Haunold
Department: Crop Science
Source of Research Funds:

___Hatch Formula
___McIntire-Stennis Coop. Forestry
___Animal Health & Disease (Sec. 1433)
___Forest/Rangeland Renewable Resources
___Competitive Grants
X Other Non-Federal industry grant (Oregon Hop Commission)
___Hatch Regional
___Evans-Allen
___Special Research Grant - USDA
___Competitive Res. Grant - USDA
___State Appropriation

1.)
Title: Development of hops with European Aroma characteristics.

2.) Over 15 million lbs of European aroma hops are imported to the US annually, because hops with such flavor / aroma characteristics are currently unavailable in this country, since yields of these varieties grown here are too low to be economical for US growers.

3) Five seedling selections from crosses between the German Hallertauer mittelfrueh variety with selected males were planted in 3-acre commercial off-station trials for agronomic evaluation and commercial brewing trials. The first commercial crop expected in 1987 will be evaluated by several major US brewers who also import substantial quantities of foreign hops.

4)Possible payoff: Acceptance of even one of the selections as a replacement for imports could mean an initial annual market of several million lbs of hops for Oregon growers, with additional annual income of about 2-5 Mill. dollars initially. Development of export markets particularly in the FarEast and South America would be an additional benefit in later years.

CSRS REVIEW of the OSU Crop Science Department: Jan. 26-30, 1987

Reviewers: Dr. D.L. Auld (ID), J.C. DeLouche (MS), R.A.Forsberg (WI), M.G. Merkle (TX), and S.C. Wiggans (CSRS).

The USDA-ARS program in hops plays a vital role in supporting a industry which is unique to the Pacific Northwest. This program has had and will contine to have a positive impact on the agricultural economy of this region. Due to the dioecious nature and perennial growth habit of this species, this crop has the unique potential to benefit from the utilization of recently developed technology. The use of somatic hybridization and mutation breeding procedures to develop faciated dwarfs could reduce the labor and expense required to produce a crop of hops. Such efforts would also complement efforts within the Department and the College to increase the emphasis on basic research.

Specific Recommendations

1. Organize an intergated team, from existing personnel resources, to study the feasibility and development of new/alternative crops.

2. Support the emerging meadowfoam industry by developing improved cultivars and cultural practices.

3. Transfer economic traits from cuphea to proven oilseed crop species, by genetic engineering.

4. Enhance the already successful hop breeding program by incorporation of innovative breeding principles. Apply for plant patents to protect U.S. growers from competition with third world countries with cheap farm labor.

ACCESSION: 0048427 YR 87 PUB PG 1 MODE: 5358-05-00 CWU: 5358-22000-001-01S

TITLE: DEVELOPMENT AND CULTURE OF HIGH QUALITY HOPS

USDA cooperative agreement 58-9AHZ-3-742, Washington STate Univ.
Prosser, WA.

PERIOD COVERED FROM 01/87 THRU 09/87

USDA ADODR: Dr. A. Haunold, Corvallis, OR.
WA State Univ. cooperator: Dr. S.T. Kenny.

APPROVED: RONALD E. WELTY 01/88

POSITION TITLE: RESEARCH LEADER

PROGRESS REPORT

USDA selections 21180, 21181, 21455, 21456, 21458, and 21459, and WA selection 415-90 were evaluated in large trials. Yield and alpha acid content were 2150 kg/ha and 7.0%, 2800 and 8.0%, and 1020 and 2.9%, 1240 and 2.3%, 1020 and 2.9%, 1880 and 4.1%, and 1930 and 12.6%, respectively. USDA 21457 was also grown, but an unknown soil condition prevented production. Additional aroma selections developed by the Corvallis USDA and the Prosser USDA cooperative program continue to be evaluated. Seedlings from the 1986 crosses for aroma and low-trellis germplasm enhancement were established in the field. A study on the effect of Prunus necrotic ringspot virus on alpha acid production and yield of Savinja Golding, L-1, and Galena showed significant yield and alpha acid reductions of 350 kg/ha and 0.8% (actual units), 330 and 0.5%, and 245 and 1.3%, respectively. Protein extracts from hop shoots were used to determine the usefulness of starch gel electrophoresis for establishing hop cultivar identity when only vegetative material is present. Twenty cultivars were screened, and eighteen could be uniquely identified using these isozymes: phosphoglucomutase, 6-phosphogluconate dehydrogenase, malate dehydrogenase, phosphoglucoisomerase, aspartate aminotransferase, and catalase.

PUBLICATIONS

(1)
KENNY, S.T., and ABROL, B. 1987. Identification of Humulus lupulus cultivars by isozyme analysis. Agronomy Abstracts Amer. Soc. Agron., Madison, WI, p. 67.
(2)
(3)
(4)
(5)

Arnold

Agricultural Research Service
Research Management Information System
ARS CRIS Project System
11/04/87

Executive Summary Sheet

for CWU 5358-22000-001-01S
Accession Number 0048427
MODE Code 5358-05-00

Specific Cooperative Agreement Award date 23/09/83

DEVELOPMENT AND CULTURE OF HIGH QUALITY HOPS

PROSSER WASHINGTON

Project Status: ACTIVE 23/09/83 30/04/88

Current Official Funding Levels:

Net to Location (including indirect): FY 88 (0)
Total All FY's (- 273,719)

***** Official Strategic Plan Codes *****

2.2.04.1.n 100 %

Why Project was Initiated: Extramural Research best alternative

Comments:
550A #00947 approved (FY 87 oblig. & extension to 30 APR 88).
Fld 19 corrected to 87 funds obligated.
Formerly CWU 5090-20013-010S & 5709-20010-006-01S.

Last Modified 7/31/87 by Salvin, Agnes

*******OFFICIAL PROJECT*******

USDA | Date Modified: 7/31/87

RES. Work Unit/Project Desc.-Res. Resume

1. Acc: 0048427 | 2-4 Agcy ID: ARS 5358-0500 | 5. Wk Unit/Prog: 5358-22000-001-01S | 6. Status: A= ACTIVE

7. Title: DEVELOPMENT AND CULTURE OF HIGH QUALITY HOPS

8. Performing Organization: 8537 1107
IRRIGATED AGR RES & EXT CENTER
WASHINGTON STATE UNIVERSITY

Responsible Organization: 0358 6556
PACIFIC WEST
AREA OFFICE
AGRICULTURAL RESEARCH SERVICE

City	State/County/Zip	Cong. Dst	City	State	Zip
PROSSER	WASHINGTON 99350	04	ALBANY	CALIFORNIA	94710

12. Investigator(s)
HAUNOLD A
FAULKNER L R

16: Research Location on campus:
B= NO

Project Type
17-1: C= COOP-AGMT 17-2: A= SAES

18-4: 58-9AHZ-3-742
19-1: 0071775 19-2: 0.4 20: 87

21. Facilities: C= COMBINED

22. Regional Project No.
A: B:
C: D:

24. OBJECTIVES

Develop improved hop lines, develop improved production practices, and test hop varieties and selections for adaption to irrigated hop producing areas.

25. APPROACH

Identify, select and develop new hop experimental lines for segregating progenies with improved genetic and agronomic characteristics. Identify hereditary characters, resistance to diseases and insects in cooperation with a geneticist, plant pathologist and entomologist. Evaluate commercial potential of domestic and foreign varieties and advanced selections for agronomic and cultural adaptability and production in the irrigated Pacific Northwest. (This is a continuation of research conducted under General C/A No. 58-9AHZ-1-550, Washington State University, to terminate 30 SEP 83, CWU 5702-20010-003A, Access.#0046434).

27. KEYWORDS

CULTURAL-PRACTICES PLANT-GROWTH HOP-GENOTYPES PLANT-INTRODUCTIONS PRODUCTION-PRACTICES CROP-YIELDS STORAGE-STABILITY RESIN-CONTENT CROP-QUALITY DISEASE-INSECT-RESISTANCE AROMA-PROPERTIES VARIETIES

Recommended			Approved			Concurred		
Signature	Title	Date	Signature	Title	Date			
			BROOKS					

28 Award Date:(DMY) 230983 | 29 Start Date:(DMY) 230983 | 30 Termination:(DMY) 300488 | Duration: 044

********** Official Strategic Plan Codes **********

2.2.04.1.n 100 %

Res. Work Unit/Project Description - Classification of Research

1. Acc No: 0048427 | 2-4 ID No: ARS 5358-0500 | 5. WK Unit/Proj No: 5358-22000-001-01S | 31. Hatch Marketing

32: Basic Res: 020% | 33: Applied Res: 080% | 34: Development Effort: 000%

Classification by Activity, Commodity, Science, and Research Problem Area

	Activity (2)		Commodity (4)		Science (6)		Research Problem Area	Product of (2)x(4)x(6)
	Code	%	Code	%	Code	%		Code
36:	4900	40	2800	100	0212	100	405	40
37:	4500	10	2800	100	0212	100	207	10
38:	4600	10	2800	100	0212	100	208	10
39:	5000	40	2800	100	0212	100	307	40
40:								
41:								
42:								
43:								
44:								
45:								

Special Classification

Code	Description	%	Code	Description	%
A4910	GERMPLSM,COL,MAINT,DIST	020			
A4940	REPROD,GROWTH,DEVELOPMENT	020			
A4564	INSECT/HOST INTERACTIONS	010			
A4615	BREED DISEASE RESIST PLNT	010			
A5011	IMPR BREEDS & VARIET	020			
A5019	OTHER PERFORM IMPROVM	020			
C2831	HOPS	100			
PST2	NONPESTICIDAL CONTROL	020			

79: Cooperators

D= STATE

83: Reporting Department

0200 AGRONOMY & SOILS

Cooperating Departments within State Performing Institution

80:0200 AGRONOMY & SOILS

81:

82:

Washington
State University

Irrigated Agriculture Research and Extension Center,
Prosser, Washington 99350-0030
509-786-2226

MEMORANDUM

DATE: April 2, 1987

TO: A. Haunold

THROUGH: L. R. Faulkner

FROM: S. T. Kenny

SUBJECT: QUARTERLY PROGRESS REPORT FOR THE PERIOD 1/1/87 TO 3/31/87
FOR C/A No. 58-9AHZ-3-742

Table 1 lists the hop acid characterization and pedigree information of 30 advanced selections developed by this program. It is identical to Table 4 in the 31 December letter report. Analysis of the essential oil profiles of these selections were completed during this period and are reported in Table 2. These tables were sent to four breweries; two breweries selected samples to examine.

Seedlings from the crosses described in Table 5 in the 31 December letter report were started in germination trays and later transplanted to flats.

STK:hg

Table 1. Hop acid characterization of the advanced aroma selections from the Prosser breeding program grown in 1986.

Selection	Yield (lbs/acre)	% Alpha Acid	% Beta Acid	HSI	A:B Ratio	Coh
8153-020	571	4.3	3.2	.244	1.4	22
8154-212	1291	6.9	2.9	.268	2.4	20
-230	1527	6.4	3.6	.248	1.8	17
-237	2200	8.9	3.6	.268	2.5	20
-264	1611	8.7	4.0	.254	2.2	21
-274	1102	7.4	3.0	.272	2.5	25
-297	822	4.0	2.5	.299	1.6	16
8252-115	867	4.0	3.3	.275	1.2	20
-139	842	3.2	3.3	.254	1.0	17
-146	1277	3.6	2.5	.243	1.4	21
-155	886	5.1	3.4	.219	1.5	21
8253-014	1393	3.2	2.6	.239	1.2	22
-028	1719	3.0	3.2	.242	0.9	21
-138	884	3.0	3.2	.229	0.9	21
-229	1491	3.5	4.0	.278	0.9	25
-239	942	3.0	3.1	.279	1.0	15
8254-133	938	3.7	3.5	.261	1.1	22
-142	1032	5.5	5.5	.240	1.0	21
-143	1251	4.9	4.0	.229	1.3	21
-146	1196	4.5	5.4	.230	0.8	20
-165	1467	4.0	4.4	.220	0.9	22
-167	1070	5.1	5.5	.201	0.9	16
-193	1474	3.8	4.7	.251	0.8	19
-196	814	5.0	4.3	.266	1.2	21
-244	928	3.3	4.9	.250	0.7	20
-253	1512	5.3	4.8	.292	1.1	20
-258	1474	4.9	4.2	.290	1.2	21
-265	735	3.4	5.6	.236	0.6	20
-267	774	4.3	6.4	.254	0.7	20
-328	1232	3.5	5.2	.230	0.7	19

Pedigree Information:
8153 - BOR704 x OP
8154 - Hersbrucker x OP
8252 - BOR704 x 19172M
8253 - BOR704 x 64033M
8254 - BOR704 x 64037M

Table 2. Essential oil evaluation of advanced aroma selections from the Prosser breeding program grown in 1986.

Selection	Major Oil Components					Other Oil Components[1]							
	MYR %	CAR %	HUM %	H/C	OIL	FAR %	LIN %	GAA %	CIT %	GAB %	SEL %	MU? %	HEB[2] %
8153-020	22.8	12.7	41.9	3.30	.30			1.3				3.2	1.3
8154-212	2.5	19.9	51.4	2.58	UNK			2.1				6.4	1.4
-230	41.0	12.0	29.3	2.44	.39							2.7	
-237	46.2	11.5	26.5	2.30	.99							2.8	
-264	40.0	11.5	29.7	2.58	.69		1.1					2.7	
-274	49.3	9.9	22.6	2.28	.86		1.1					2.2	
-297	39.7	13.8	29.6	2.14	.45							2.8	
8252-115	20.0	7.9	24.3	3.07	.41			2.3	1.0	10.5	10.7	5.6	1.7
-139	34.0	6.6	18.4	2.79	.30			1.9	1.0	7.6	7.7	4.7	
-146	12.9	16.8	49.5	2.95	.31			1.8		1.2		4.3	1.5
-155	38.5	12.3	32.5	2.64	.47			1.2				2.9	
8253-014	25.2	13.5	44.7	3.31	.53			1.4				3.4	1.0
-028	24.1	12.9	44.3	3.43	.36			1.2				3.2	1.7
-138	28.4	12.3	42.8	3.48	.40			1.3				3.3	1.2
-229	30.3	12.3	41.4	3.37	.55			1.1				2.9	1.7
-239	35.2	10.9	36.5	3.35	.55			1.1				2.8	
8254-133	27.7	12.5	42.2	3.37	.43	1.2		1.1				2.9	
-142	32.3	10.9	37.1	3.41	.54			1.1				2.6	1.2
-143	20.5	12.6	43.4	3.45	.39	1.9		1.4				3.4	1.0
-146	37.3	10.6	35.3	3.33	.59							2.4	
-165	20.7	14.0	46.3	3.31	.38			1.6				3.5	1.4
-167	24.6	12.5	42.1	3.37	.59			1.3				3.1	1.1
-193	22.0	13.1	44.8	3.42	.43	1.5		1.4				3.3	1.3
-196	28.9	10.9	37.3	3.42	.60			1.3		1.3		3.1	1.1
-244	32.9	11.5	38.4	3.34	.48	1.8		1.1				2.6	1.0
-253	34.3	10.8	35.5	3.29	.64	2.5		1.1				2.7	
-258	29.1	12.2	40.2	3.30	.64	2.1		1.2				3.0	
-265	22.1	13.9	46.5	3.35	.75			1.5				3.5	1.2
-267	28.9	12.5	41.3	3.30	.71			1.2				2.9	1.2
-328	14.4	14.9	51.8	3.47	UNK			1.6		1.2		4.1	

[1] Only compounds with a concentration greater than 1% are listed.

[2] Abreviation Codes:

MYR = Myrcene
CAR = Caryophyllene
HUM = Humulene
H/C = H/C RATIO
OIL = mg oil/100g
FAR = Farnesene
LIN = Linalool
GAA = Geranyl Acetate A
CIT = Citronellol
GAB = Geranyl Acetate B
SEL = Selinene
MU? = Methyl Undecenoate (questionable identification)
HEB = Humulene Monoexpoxide II

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Irrigated Agriculture Research and Extension Center,
Prosser, Washington 99350-0030
509-786-2226

M E M O R A N D U M

DATE: July 8, 1987

TO: A. Haunold

THRU: L. R. Faulkner

FROM: S. T. Kenny

SUBJECT: QUARTERLY PROGRESS REPORT FOR THE PERIOD 4/1/87 TO 6/30/87
FOR C/A No. 58-9AHZ-3-742

Table 1 lists the number of progeny from crosses first described in the December 31, 1986, letter report which were transplanted to the field in May. Plants will be strung for harvest in 1988.

Growth in three-acre off-station trails of Hallertauer triploid selections USDA 21455, 21456, 21457, 21458, and 21459 was monitored. Softwood propagation of USDA 21490, a Hallertauer triploid selection with higher alpha acid content than the other selections, was begun.

To add to available identification methods of vegetative hop plants, a survey of isozymic variability was started. In this period, 18 enzymes were examined for their isozymic variation in 20 hop cultivars. All U.S. grown cultivars are included in the survey. Preliminary findings indicate that for some enzymes there is no isozymic variation among cultivars, but other enzymes are useful in unique identification.

A trial to evaluate the rate of mite population growth on 55 progeny described in Table 2 was started near the end of this period.

SK:ns

Table 1. Number of progeny established in May 1986 by the Prosser hop breeding program.

Cross Number	Number of Progeny	Female Parent	Male Parent
8651	0	Perle	19060M
8652	1		19047M
8653	30		19173M
8654	0		64033M
8655	30		21088M
8656	25		8154-224M
8657	50	Elsasser	19060M
8658	50		19173M
8659	40		21088M
8660	10		8154-224M
8692	30	21373	19060M
8693	30		19170M
8694	20		21088M
8695	20		21337M
8696	25		8153-032M
8697	25		8153-056M
8680	10	404-006	21272M
8681	30		21337M
8682	20		21381M
8683	20		8153-056M
8684	20	406-057	21272M
8685	50		21337M
8686	30		21361M
8687	25		8153-046M

Pedigree described in Table 5 of quarterly letter report of 31 December 1986.

Table 2. Progeny for screening of mite population growth.

Cross Number	Number of Progeny	Female Parent	Male Parent
8551	12	7003-81	OP
8552	13	L-8 Cluster	OP
8553	15	21163	OP
8411	10	64007	21137M
8412	5	64007	21361M

Pedigree

7003-81 65009 x 19046M
(Brewer's Gold x Early Green-unknown seedling) x (Late Cluster seedling x Fuggle seedling)

21163 19105 x 6616-61M
(Late Grape seedling x Fuggle-Fuggle seedling) x (Brewer's Gold x Fuggle-Colorado wild male)

64007 19105 x 19058M
(Late Grape seedling x Fuggle-Fuggle seedling) x (Early Green x unknown seedling)

21137M 65009 x 64035M
(Brewer's Gold x Early Green-unknown seedling) x (Bavarian x English germplasm)

21361M 56013 x [65009 x 64035M]
Cascade x [(Brewer's Gold x Early Green-unknown seedling) x (Bavarian x English germplasm)

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M E M O R A N D U M

DATE: November 13, 1987

TO: A. Haunold

THRU: L. R. Faulkner

FROM: S. T. Kenny

SUBJECT: QUARTERLY PROGRESS REPORT FOR THE PERIOD 7/1/87 to 9/30/87 FOR C/A NO. 58-9AHZ-3-742

Growth and harvest of three-acre off-station trials of Hallertauer triploid selections USDA 21455, 21456, 21457, 21458, and 21459 was monitored in Washington and Idaho. Brewing quality analysis of samples from these trials is in progress. Two additional Hallertauer triploid selections were proposed for off-station trials for 1988. A large field nursery of USDA 21490 was established, and a small field nursery of USDA 21491 was established. Propagation of 21491 is continuing in the greenhouse.

The study of isozymic variation among hop cultivars continued. Results indicate that phosphoglucomutase, 6-phosphogluconate dehydrogenase, malate dehydrogenase, phosphoglucoisomerase, aspartate aminotransferase and catalase are the most useful isozyme systems for cultivar identification.

The study to evaluate the rate of mite population growth on 55 progeny described in the July 8, 1987 letter report was completed. The results are listed in Table 1. The progeny means of families 8553 and 8551 indicate lower mite reproduction in these families compared to the other families. Comparison of progeny means and female parent values indicates that there may be some heritable component to mite resistance.

SK:ns

Table 1. Population statistics describing mite growth on hop leaves.

	Mean of All Progeny			Mean Female Parent			
Family	IRNI	GT	NRR	Parent	IRNI	GT	NRR[1]
8553	0.199	19.8	58.9	21163	0.236	19.4	99.9
8551	0.217	18.9	65.4	7003-81	Not Available		
8411 & 12	0.234	19.0	79.3	64007	0.242	18.8	97.0
8552	0.236	18.5	85.4	L-8	0.246	18.5	95.8
LSD(0.05)	0.053	0.55	12.8		0.037	0.48	18.4

[1] IRNI - Intrinsic rate of natural increase; GT - Generation time; NRR - Net reproductive rate.

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M E M O R A N D U M

DATE: December 31, 1987

TO: A. Haunold

THRU: L. R. Faulkner

FROM: S. T. Kenny

SUBJECT: Quarterly Progress Report for the Period 10/1/87 to 12/31/87 for C/A No. 58-9AHZ-3-742

Yield and brewing quality analyses of advanced selections USDA 21180, 21181, 21455, 21456, 21457, 21458 and 21459 and Washington 415-90 which were monitored in large off-station trials are listed in Table 1.

Triploid Hallertauer selections from the Corvallis breeding program and the Prosser breeding program were analyzed for yield and brewing qualities. Results are reported in Tables 2, 3, 4 and 5.

Table 6 summarizes the results of the isozyme survey to determine if starch gel electrophoresis could provide sufficient information to identify the hop cultivars grown in the US. Of the twenty cultivars examined, only two, Fuggle and Styrian, could not be uniquely identified. These are thought to be closely related clones.

Savinja Golding, L-1 and Galena plants with different virus infection combinations were harvested and brewing quality determined. Results indicated significant yield reductions of 314 lbs/acre for Savinja Golding, 293 lbs/acre for L-1 and 219 lbs/acre for Galena when plants were infected with Prunus necrotic ringspot virus (PNRV) alone or in combinations with other viruses. PNRV infection reduced alpha acid content of Savinja Golding by 16%, L-1 by 8% and Galena by 13%. Complete results are reported in Table 7.

Table 1. Yield and brewing quality data for experimental hops in commercial trials.

Selection	Location and Year	Yield lb/A	% Alpha	Coh	ml oil/ 100g	% Myr	% Cary	% Hum	% Farn	H:C Ratio[1]
21180	Topp. 87	2,500	7.0	30	1.97	30.3	18.8	31.0	0.0	1.65
	86	2,300	9.5							
	85	2,050	8.5							
	84	1,750	10.9							
21181	Topp. 87	1,910	8.0	38	1.01	22.2	20.5	35.3	0.1	1.72
	86	2,900	6.0							
	85	2,220	7.9							
	84	2,040	6.5							
21455	Gran. 87	910	2.9	25	0.73	24.5	17.0	41.4	0.2	2.43
	86	Establishment								
21456	Mabt. 87	1,110	2.3	29	0.85	19.5	14.1	45.8	0.0	3.25
	86	Establishment								
21457	Topp. 87	*	3.3	28	0.77	21.8	13.2	43.6	0.0	3.31
	86	Establishment								
21458	Topp. 87	910	2.9	28	0.83	14.5	15.7	49.5	0.4	3.15
	86	Establishment								
21459	Topp. 87	1,682	4.1	27	0.79	24.2	10.2	31.1	9.1	3.14
	86	Establishment								
21455	Idaho 87	810	5.3	25	1.63	30.1	13.1	30.1	0.5	2.31
	86	Establishment								
21456	Idaho 87	475	2.9	29	1.05	22.6	12.7	41.7	0.2	3.29
	86	Establishment								
21457	Idaho 87	540	4.5	26	1.18	31.6	10.6	35.6	0.1	3.35
	86	Establishment								
21458	Idaho 87	950	2.7	26	0.83	16.0	14.6	48.2	0.2	3.30
	86	Establishment								
21459	Idaho 87	630	4.0	27	0.69	20.0	10.3	33.0	8.8	3.21
	86	Establishment								
415-90	Pros. 87	1,726	12.6	29	1.48	49.5	5.5	13.1	3.5	2.38
	86	2,085	9.7							
	85	1,580	10.6							

[1] Locations: Gran. - Granger, WA; Mabt. - Mabton, WA; Pros. - Prosser, WA; Topp. - Toppenish, WA. All Idaho locations are Wilder, ID. Coh - cohumulone; Myr - myrcene; Cary - caryophyllene; Hum - humulene; Farn - farnesene; H/C - humulene:caryophyllene ratio; * 21457 plot in Washington was nearly destroyed by Verticillium dahliae infection.

Table 2. Yield and hop acid data for advanced triploid Hallertauer selections grown in small plots at Prosser and Mabton in 1987.

	PROSSER						MABTON					
Selection	Yield lb/A	% Alpha	% Beta	HSI	Coh	A:B Ratio	Yield lb/A	% Alpha	% Beta	HSI	Coh	A:B Ratio
21455	1208	4.31	6.22	.223	26	0.69	1292	4.40	6.16	.227	25	0.71
21456	628	2.75	4.48	.232	29	0.62	681					
21457	1066	4.32	3.69	.224	26	1.17	770	3.42	3.23	.250	28	1.06
21458	440	2.63	4.34	.210	29	0.61	625	2.21	4.70	.239	31	0.47
21459	550	2.92	3.13	.238	29	0.93	1513	3.19	3.48	.241	29	0.92
21469							1731	2.16	4.46	.226	30	0.48
21470	1060	2.94	4.57	.241	26	0.64	1372	2.08	3.97	.237	26	0.52
21471	718	4.50	3.91	.244	26	1.15	1400	5.44	4.81	.230	24	1.13
21472	489	1.39	4.04	.251	37	0.34	1456	1.48	4.44	.272	36	0.33
21473	797	1.84	4.33	.218	31	0.43	1212	1.87	4.12	.259	27	0.45
21474	829	2.38	5.02	.224	29	0.47	1692	4.02	4.03	.245	28	1.00
21475	876	4.09	3.64	.267	37	1.12	1115	2.82	3.96	.307	29	0.71
21476	709	3.68	3.84	.235	25	0.96	1178	2.86	3.16	.275	29	0.90
21477	588	2.39	4.73	.213	33	0.51	892	1.88	4.17	.249	32	0.45
21478							1238	3.33	3.93	.248	31	0.85
21479							1209	3.42	4.53	.240	30	0.76
21480	93	4.12	4.46	.213	28	0.92	1227	4.06	5.04	.231	27	0.81
21481	841	3.25	3:51	.220	29	0.93	1165	3.66	3.98	.258	30	0.92
21482	80	2.49	3.95	.204	32	0.63	1056	1.45	4.64	.287	34	0.31
21483	806	2.01	5.12	.212	34	0.39	1101	1.17	4.70	.224	32	0.25
21484							1080	2.21	3.72	.249	33	0.59
21490	1045	3.51	6.09	.201	24	0.58						

Table 3. Yield and hop acid data for triploid Hallertauer selections grown in small plots at Prosser in 1987.

Selection	Yield lb/A	% Alpha	% Beta	HSI	Coh	A:B Ratio
8301-001	1294	3.68	4.48	.235	33	0.82
8301-007	391	2.72	4.43	.252	28	0.61
8301-024	453	2.45	4.15	.274	25	0.59
8301-036	1130	1.19	4.39	.266	25	0.27
8301-048	136	1.59	2.69	.210	28	0.59
8301-056	1501	1.57	4.46	.223	31	0.35
8301-057	1581	4.11	3.95	.241	30	1.04
8301-063	919	5.47	4.23	.195	28	1.29
8301-069	1272	3.35	3.66	.244	34	0.92
8303-003	1191	2.56	4.39	.238	27	0.58
8303-015	497	1.68	3.79	.217	28	0.44
8303-039	1044	2.01	4.22	.209	28	0.48
8303-042	1081	2.12	4.22	.233	30	0.50
8303-049	1068	2.00	2.50	.287	27	0.80
8303-076	880	2.58	4.48	.237	27	0.57
8303-086	976	2.64	2.54	.283	26	1.04
8303-088	1539	2.70	4.59	.214	34	0.59
8303-094	909	2.91	3.24	.251	20	0.90
8303-101	637	2.79	3.08	.266	35	0.91
8303-121	1202	2.79	3.29	.237	23	0.85
8303-125	841	1.78	2.82	.290	27	0.63
8303-134	120	2.08	3.84	.203	29	0.54
8304-012	526	2.06	5.45	.200	29	0.38
8304-020	188	3.27	6.30	.201	29	0.52
8304-021	492	2.43	4.27	.220	27	0.57
8304-027	548	2.52	4.71	.229	26	0.54
8304-032	123	3.09	3.80	.202	26	0.81
8304-037	751	2.19	4.76	.216	29	0.46
8304-043	88	3.03	4.37	.220	29	0.69
8304-056	136	2.01	4.59	.203	25	0.44
8304-060	965	2.40	4.80	.265	31	0.50
8304-063	48	2.11	3.05	.197	26	0.69
8304-066	837	1.50	4.77	.231	30	0.31
8304-067	789	2.52	5.33	.223	31	0.47
8304-073	1154	1.88	5.46	.242	32	0.34
8304-075	957	1.00	4.55	.237	33	0.22
8304-082	536	1.56	3.52	.245	27	0.44
8304-084	136	2.82	3.65	.214	32	0.77
8305-017	1423	8.08	4.11	.270	32	1.97
8305-022	898	1.55	3.18	.252	31	0.49
8308-015	932	4.60	3.33	.256	31	1.38
8308-022	1369	3.61	3.30	.230	27	1.10
8308-042	867	5.17	4.47	.224	25	1.16
8308-044	1638	5.11	2.98	.234	26	1.71
8308-046	841	5.15	4.19	.233	28	1.23
8308-061	588	6.07	3.44	.228	29	1.76
8309-005	1348	3.02	4.84	.226	27	0.62
8309-030	1200	1.97	3.75	.237	31	0.52

Table 4. Yield and hop acid data for advanced aroma hop selections from the Prosser breeding program grown in 1987.

Selection	Yield lb/A	% Alpha	% Beta	HSI	Coh	A:B Ratio
8151-002	1076	3.46	3.63	0.222	25	0.95
8153-020	578	5.49	4.56	0.246	25	1.20
8154-212	1165	5.11	3.27	0.253	22	1.56
8154-230	1120	5.92	4.27	0.224	23	1.38
8154-237	1185	8.99	5.02	0.239	21	1.79
8154-264	1053	6.47	5.09	0.232	21	1.27
8154-274	1191	9.66	5.29	0.227	23	1.83
8154-297	1041	6.33	4.57	0.230	16	1.39
8252-115	1262	5.48	3.71	0.263	25	1.48
8252-146	1239	5.37	4.29	0.233	25	1.25
8252-155	1071	7.89	4.94	0.233	23	1.60
8253-014	492	1.30	4.11	0.216	36	0.32
8253-028	1650	4.38	3.90	0.222	22	1.12
8253-133	1906	4.42	5.38	0.234	21	0.82
8253-138	1257	4.77	4.30	0.239	24	1.11
8253-229	1115	2.11	5.80	0.212	32	0.36
8253-239	1107	4.09	3.98	0.237	23	1.03
8254-133	533	5.84	5.18	0.220	24	1.13
8254-142	453	4.90	4.62	0.220	22	1.06
8254-143	698	6.22	5.28	0.220	22	1.18
8254-146	1177	6.67	7.46	0.206	21	0.89
8254-165	934	1.02	5.44	0.204	36	0.19
8254-167	1173	6.28	6.50	0.207	17	0.97
8254-181	1326	4.84	5.75	0.210	22	0.84
8254-196	1081	7.93	6.28	0.199	23	1.26
8254-239	1575	4.20	4.30	0.189	20	0.98
8254-241	1254	6.18	6.65	0.198	20	0.93
8254-244	1793	4.74	5.33	0.208	22	0.89
8254-253	1107	2.61	4.46	0.198	22	0.59
8254-258	1510	2.65	3.26	0.254	24	0.81
8254-265	765	4.48	6.02	0.226	22	0.74
8254-267	593	4.79	6.38	0.226	23	0.75
8254-328	1109	3.73	5.38	0.232	20	0.69

Pedigree Information:
8151 [Hallertauer x OP] x Zattler Seedling#3
8153 [Hallertauer x OP] x OP
8154 Hersbrucker x OP
8252 [Hallertauer x OP] x [Cat's Tail x (Fuggle x Fuggle seedling)]
8253 [Hallertauer x OP] x Zattler Seedling#3
8254 [Hallertauer x OP] x Zattler Seedling#7
OP is open pollinated.

Table 5. Essential oil data for advanced aroma hop selections from the Prosser breeding program grown in 1987.

Selection	ml oil/ 100g	% Myr	% Cary	% Hum	% Farn	% HMEB	H:C Ratio[1]
8151-002	0.64	15.48	15.78	50.22	0.23	0.810	3.18
8153-020	1.18	28.72	11.08	35.54	2.38	1.009	3.21
8154-212	0.92	30.89	17.12	33.55	0.24	0.493	1.96
8154-230	0.87	38.67	13.84	29.00	0.16	0.311	2.09
8154-237	1.28	36.19	14.17	32.75	0.12	0.206	2.31
8154-264	1.99	43.65	13.14	26.79	0.13	0.307	2.04
8154-274	1.13	34.52	13.84	32.73	0.00	0.160	2.36
8154-297	1.40	45.66	13.76	25.36	0.35	0.187	1.84
8252-115	1.66	25.53	6.56	17.01	0.25	0.609	2.59
8252-146	1.00	13.28	17.01	47.38	0.00	1.190	2.78
8252-155	1.94	37.18	13.12	31.26	0.00	0.429	2.38
8253-014	0.73	21.11	15.04	47.76	0.09	1.314	3.18
8253-028	0.73	13.56	15.71	50.33	0.06	1.116	3.20
8253-133	1.18	18.71	14.44	46.28	0.00	1.303	3.20
8253-138	1.12	33.45	11.67	37.52	0.00	0.514	3.22
8253-229	0.70	21.89	14.67	46.37	0.00	0.908	3.16
8253-239	1.00	36.01	10.49	33.60	0.10	0.466	3.20
8254-133	0.67	9.01	15.38	50.88	3.56	1.363	3.31
8254-142	0.57	6.89	15.34	51.27	0.12	1.042	3.34
8254-143	0.74	11.99	13.85	45.81	3.27	1.106	3.31
8254-146	1.37	24.11	12.47	41.00	0.07	1.033	3.29
8254-165	0.75	23.65	13.88	44.27	0.00	2.024	3.19
8254-167	1.32	21.60	12.70	41.11	0.21	0.751	3.24
8254-181	1.19	23.62	12.38	39.58	3.07	1.037	3.20
8254-196	1.59	32.62	11.03	35.53	0.07	0.472	3.22
8254-239	0.84	13.99	15.13	48.63	0.15	1.076	3.22
8254-241	1.13	20.93	12.93	41.87	3.49	0.932	3.24
8254-244	1.26	21.96	12.78	41.37	4.26	0.876	3.24
8254-253	0.94	30.15	10.92	35.25	5.09	0.924	3.23
8254-258	0.94	24.12	12.75	41.05	3.70	0.896	3.22
8254-265	1.24	13.79	15.34	49.48	0.08	1.127	3.23
8254-267	1.64	21.84	13.78	44.58	0.07	0.920	3.24
8254-328	0.95	18.86	14.13	45.37	0.13	1.196	3.21

[1] Myr - myrcene; Cary - caryophyllene; Hum - humulene; Farn - farnesene; HMEB - humulene monoepoxide II; H:C - humulene:caryophyllene ratio.

Table 6. Isozyme banding patterns for hop cultivars.

Cultivar	MDH	PGI	PGM	PGD	AAT	CAT[1]
Brewer's Gold	B	A	C	B	C	C
Cascade	C	A	D	B	C	C
Chinook	B	A	E	B	C	A
Columbia	B	B	B	A	C	A
Comet	B	B	D	B	D	A
Eroica	C	A	C	B	C	B
Fuggle	C	D	B	A	A	A
Galena	B	A	C	A	C	B
Hallertauer	C	nt	A	A	A	B
Hersbrucker	A	D	A	A	A	D
L-1 Cluster	B	A	D	B	C	B
L-8 Cluster	B	A	C	B	C	B
Nugget	C	A	C	A	C	A
Olympic	B	C	D	B	B	B
Perle	C	A	C	A	C	D
Saaz	B	nt	B	A	A	D
Styrian	C	D	B	A	A	A
Talisman	B	A	C	B	C	A
Tettnanger	C	D	B	A	A	B
Willamette	C	A	B	A	A	A

[1] MDH - malate dehydrogenase
PGI - phosphoglucoisomerase
PGM - phosphoglucomutase
PGD - 6-P-gluconate dehydrogenase
AAT - aspartate aminotransferase
CAT - catalase
nt - isozyme not tested

Table 7. Effect of virus combinations on yield and alpha acid production of Savinja Golding, L-1 and Galena hop cultivars.

Viruses Present	Yield (lb/acre)	% Alpha Acid		Yield (lb/acre)	% Alpha Acid
Savinja Golding					
P A M	553	4.2	Virus Key:		
P A M L	560	4.3	P - Hop strain of Prunus		
P AmL L	615	4.0	necrotic ringspot virus		
P A L	629	4.0	A - Apple strain of Prunus		
P A L	647	4.0	necrotic ringspot virus		
M	660	5.2	M - Hop mosaic virus		
P A M AmL L	727	4.3	AmL - American hop latent		
M AmL	736	4.9	L - Hop latent virus		
M L	763	4.5			
AmL	776	4.6			
L	889	4.8	All plants:		
M AmL L	969	4.9	PNRV infected	618	4.1
AmL L	1059	5.0	PNRV free	932	4.9
LSD (p=0.05)	249	0.5		120	0.3
L-1					
P A M AmL L	1457	5.6			
P AmL	1458	5.7			
P A L	1465	5.1			
P AmL L	1582	5.6			
P A AmL L	1628	5.7			
P M AmL L	1782	6.2			
M AmL	1812	5.9			
P L	1873	5.7			
AmL L	1957	6.3			
M AmL L	1965	6.3	All plants:		
AmL	2146	5.6	PNRV infected	1573	5.7
M	2160	5.9	PNRV free	1866	6.2
LSD (p=0.05)	ns	ns		213	0.4
Galena					
P AmL	1027	8.4			
P A AmL L	1049	9.2			
P AmL L	1087	8.3			
P A M AmL L	1160	7.7			
L	1237	9.5			
AmL L	1248	9.6			
M AmL L	1285	13.7			
M L	1362	9.6			
AmL	1416	10.5	All plants:		
M	1447	9.8	PNRV infected	1173	8.5
M AmL	1491	10.8	PNRV free	1391	9.8
LSD (p=0.05)	ns	ns		170	0.7

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The molecular structure of hop latent viroid (HLV), a new viroid occuring worldwide in hops

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ABSTRACT

A new viroid which does not seem to produce any symptoms of disease, and is therefore tentatively named hop latent viroid (HLV) was found to occur worldwide in hops. HLV proved to be infectious when mechanically inoculated onto viroid- and virus-free hops. The viroid nature of HLV was also substantiated by sequence analysis which revealed that HLV is a circular RNA consisting of 256 nucleotides, ~~that~~ which can be arranged into the viroid-specific, rod-like secondary structure. HLV also contains the central conserved region typical for most of the presently known viroids. However HLV does not contain the viroid-specific oligo(A) stretch in the upper left part of its rod-like molecule. Because of this feature and a sequence similarity with the prototypes of the other viroid groups below 55%, HLV can be regarded as the first member of a new viroid group.

INTRODUCTION

To evaluate the status of the possible viroid infection of German hops we have made a survey in the main German hop growing region "Hallertau" which is located 80 km north of Munich. With 17.000 hectares of hop gardens it is the largest hop producing region of the world. We detected a new viroid in practically all of the hop cultivars tested. Since this new agent does not seem to produce any symptoms of disease in hops, it is tentatively named hop latent viroid (HLV). When we extended our survey to the other main hop growing areas of the world (to be published in detail elsewhere) we found that HLV occurs worldwide in most of the hop cultivars tested so far. We also found that the wellknown hop stunt viroid (HSV) (1) is, indeed, only present in Japanese hops as previously reported (2-5), and that such HSV-infected hop plants may contain HLV in addition.

Here we report on the characterization of HLV, on its primary and secondary structure and on the similarity of its sequence with the one of the other viroids presently known.

Table 2 The distribution of HLV and HSV in individual hop cultivars (cvs) of the main hop growing areas of the world as determined by dot-spot and Northern blot hybridization

Origin of sample	Index of infection[a] HLV	HSV
Europe		
Belgium	4/4	0/4
Czechoslovakia	3/3	0/3
England	15/17	0/17
France	2/2	0/2
East Germany	1/1	0/1
Hungary	4/4	0/4
Poland	1/1	0/1
Portugal	1/1	0/1
Russia	2/2	0/2
Spain	1/2	0/2
Yugoslavia	11/13	0/13
West Germany	14/14	0/14
Asia		
Japan	3/3	1/3
South Korea	1/1	1/1
China	2/2	0/2
America		
USA (Oregon)	12/12	0/12
USA (Washington)	7/7	0/7
Africa		
South Africa	1/2	0/2
Oceania		
Australia	0/1	0/1
New Zealand	0/1	0/1
Total number of samples	85/93	2/93
Total number of cultivars	73/80[b]	1/80[b]

a: The numerator gives number of viroid-infected hop cvs, the denominator the total number of the individual cvs tested.

b: The total number of samples and cvs differs because certain cultivars are grown in more than one country. In some cases a mixed commercial sample from an individual cv was used for analysis.

USA - Hopfen

Proben von Dr. Haunold, OSU, Corvallis

Alle HLV positiv

Cascade +
Nugget +
Bullion +
Eroica +
Fuggle +
Late Cluster +
Chinook +

Weitere Proben aus USA (andere Herkunft):

Alle HLV positiv

Williamette (Oregon) + (Fa. Barth Nürnberg)
Comet (Oregon) +
USDA 21055 (Oregon) +
Columbia (Oregon) +
Olympic (Oregon) +

} Hopfengarten Hüll
hop research yard Huell

von Fa. Barth Nürnberg

Cascade (Yakima) +
Chinook (Yakima) +
Eroica (Yakima) +
Fuggle (Yakima) +
Galena (Yakima) +
Late Cluster (Yakima) +
Perle (Yakima) +

alle HLV positiv

all positive

Virus Information from C. B. Skotland, Prosser, WA (Notes by Al Haunold, USDA, Corvallis, OR.) Date: 7-21-1987

Dr. Cal Skotland and Dr. Steve Kenny came for a one-day visit on July 14. We visited the five Hallertauer triploid off-station trials and also the mother plots at the OSU hop yard. Dr. Skotland took leaf and shoot samples for virus assay. In addition to the triploid experimentals other off-station plots and mother plantings were also visited and virus samples were obtained.

Hallertauer triploid seedling selections: 1 yr. old off-station plantings (first year on the string):

USDA 21455 (Herman Gosche, Silverton, Oregon). Free of all viruses except American Hop Latent Virus (HV24). About 50-100 plants showed yellow flecking on the lower leaves, which in some instances was quite severe, showing significant chlorophyll damage. The plants are growing vigorously, and yield does not seem to have been affected. No yellow flecking on the upper portions of the plant. Adjacent Nugget and Willamette plantings also showed some yellow flecking. This apparently is due to infection by Hop Virus 24 which is now officially called American Hop Latent Virus.

USDA 21457 (Robert Coleman, Gervais, Oregon). Most plants are clean, free of all viruses; a few plants showed very mild Hop Latent Virus infection as judged from ELISA testing. No visual symptoms.

USDA 21456 (Don Weathers, Salem, Oregon). Planting is essentially clean of all viruses.

USDA 21458 (Paul Serres, Woodburn, Oregon). A few plants had mild Hop Latent Virus infection as judged from ELISA. No prunus found in any of the plants. Phenotypically most plants in this yard looked strange, had weak arms and crinkled leaves that were curved downwards. However, viruses do not seem to be the reason for this strange appearance of the plants in the plot.

USDA 21459. Many plants were infected with Hop Mosaic and Hop Latent Virus; a few plants had American Hop Latent Virus. Phenotypically this is the most vigorous plot of all the five off-station Hallertauer triploid seedlings. No visual virus symptoms were found on any of the plants in the field.

Other off-station test plots in Oregon:

USDA 21180 (Frank Fobert, Hubbard, Oregon): Most plants had slight yellow flecking on lower leaves but were extremely vigorous and appeared very healthy. ELISA tests revealed that most plants were infected with Hop Mosaic Virus. No Prunus was found.

Idaho Selection 43-11 (USDA 21287). Baby planting at the Joe Annen Ranch established early May 1987. All plants sampled were O.K. and free of all viruses. Plants are growing vigorously.

Commercial Willamette planting (Paul Serres, Woodburn, Oregon). Adjacent to USDA 21458. Most plants were infected with Hop Mosaic Virus, Hop Latent Virus and American Hop Latent Virus. Prunus was found. Plants looked healthy and vigorous.

Galena (four-year-old field, Paul Serres, Woodburn, Oregon). Plants looked healthy and vigorous, all were infected with Hop Mosaic Virus, Hop Latent Virus, and American Hop Latent Virus. Prunus was found.

Plants sampled at OSU hop yards:

USDA 21490, triploid Hallertauer seedling selection with higher alpha and higher oil potential. All four mother plants were infected with Prunus, probably the apple strain. A 3-acre baby plot has now been established in Oregon and material is being increased in Prosser for Washington off-station testing.

USDA 21491: Higher alpha, higher oil triploid Hallertauer seedling from the 1984 nursery (1 year younger than preceding triploid Hallertauer seedlings). No prunus was found in this plant, a single mother plant, from which a 3 acre plot has been established in Oregon (Paul Serres, Woodburn). Selection is also being increased in Prosser at the present time.

USDA 61021, Swiss Tettnanger: This is the original mother planting from which, following heat treatment, most Tettnanger plantings in Oregon and Washington probably originated. Carries Prunus Necrotic Ringspot Virus, also Hop Mosaic and Hop Latent Virus.

USDA 21077, Saazer: This material was obtained from Czechoslovakia in 1974. It was tested earlier at which time we found no Prunus but Apple Mosaic Virus (a suspected Prunus strain), Hop Mosaic, but no Hop Latent nor American Hop Latent Virus. In the present test again no Prunus was found. This is an extremely weak genotype which barely reaches the top wire and on four hills we frequently cannot even obtain a sample large enough for all required laboratory analyses.

Original mother hills of tripl. Hallertauer seedlings (4 hills each)

USDA 21455: carries American Hop Latent Virus, no Prunus.

USDA 21456: free of all viruses.

USDA 21457: free of all viruses.

USDA 21458: free of all viruses.

USDA 21459: carries Hop Latent Virus, otherwise free.

These five genotypes have been grown in the same location now for four years. There are many male plants around, and many of the adjacent plants in the yard are known to be infected with one or more, in some cases all five hop viruses. Apparently the parent planting has remained essentially free of these viruses.

New Tettnanger selections obtained from Germany, May 1986: Two clones of Tettnanger, called Tettnanger A (clone No. 4) and Tettnanger B (clone No. 14) were obtained from the University of Hohenheim near Stuttgart, adjacent to the Tettnanger hop growing area. Dr. Schmütz of Stuttgart is closely associated with the Tettnanger Hop Producers Association and has performed services for them including virus monitoring. He has provided me with these two clones which he thinks are among the most promising new clones of Tettnanger. They were supposed to have been free of all viruses. ELISA tests by Dr. Skotland revealed that both clones carry Mosaic and Hop Latent Virus. In my greenhouse at this writing (July 23) softwood cuttings of both clones show pronounced pale green to greenish-yellow leaves, particularly on young shoots and young leaves. This may be an indication of the virus expression under low light intensity conditions in the artificially shaded greenhouse. Both clones are free of prunus necrotic ringspot virus. They are being increased at the present time for possible field testing in comparison with commercial Tettnangers grown in Oregon.

Additional Virus Information just received from Dr. Skotland (Aug. 11,87)

" PNRV (prunus necrotic ringspot virus) was found in certain plants that had symptoms that I regard as PNRV in certain varieties..... Tettnanger, Galena, Willamette...."

Additional virus information from Dr. Skotland (July 21, 1987).

21455: carries HV 24 (American Hop Latent Virus)
21456: free of all viruses
21457: " , a few plants tested + for HLV
21458: a few tested positive for HLV
21459: carries mosaic; a few plants positive for Amer. Hop LV and apple strain of PNRV
21490: all four plants in our plots tested positive for teh apple strain of prunus
21491: free of all viruses

21180: carries hop mosaic

commercial locations:

Willamette at Paul Serres (Woodburn): carries HMV, HLV, AmHLV
Galena " " " "

HOP VIRUSES:

ILAR type: (Spheres): PNRV, Apple strain, cherry strain, transmission unkn.
CARLA type; (rods) : HMV, HLV, AmHLV (HV 24). aphid transmitted.

WESTERN BIOCHEMICAL CONCULTING (Dave Anderson) , Beaverton, OR

Ridomil /Copper Efficacy Trials - 1987

Purpose: To evaluate Ridomil/copper prepack for downy mildew control in hops.

Procedure: Two sites were selected on a ranch where downy mildew was present and is usually an annual problem. Both sites had Nugget variety hops but each was located in a different field. One, Fld #4, had a silt-sand loam soil, while the other, Fld # 16, had a clay loam soil. Both sites were used to increase the probability of having a significant enough quantity of downy mildew to complete the efficacy trial. Twelve hills were used per treatment with two replications per site for a total 48 hills per treatment.

Soon after crowning in mid-April, the Ridomil 2E soil treatments were applied. Approximately 30 days later, at the time of training when hops were from 2 to 4 feet tall, the first foliar applications of Ridomil/CU and Kocide 101 were made. The second and final foliar application was made 7/4 - 7/10, after hops had reached the wire(18 - 20 feet) and were just beginning to flower.

Early evaluations consisted of counting hills with downy mildew infested hop shoots or "spikes" and the number of spikes per hill. Later evaluations included counting the number of vines with spikes "on the string", that is downy mildew infested branches or side arms from 6 inches to 6 feet above ground level.

Results:

	hills with spikes	spikes/12 hills	vines with spikes
I) 5/14/67			
1) Fld #4			
A) Trtmt #1			
R1	10/12	31	0
R2	9/12	57	0
B) Trtmt #2			
R1	9/12	55	0
R2	9/12	27	0
C) Trtmt #3			
R1	5/12	30	0
R2	11/12	52	0
D) Trtmt #4			
R1	9/12	43	0
R2	11/12	44	0
E) Trtmt #5			
R1	10/12	55	0
R2	11/12	129	0
2) Fld #16			
A) Trtmt #1			
R1	10/12	46	0
R2	6/12	22	0
B) Trtmt #2			
R1	11/12	75	0
R2	8/12	56	0
C) Trtmt #3			
R1	10/12	115	0
R2	12/12	45	0
D) Trtmt #4			
R1	10/12	54	0
R2	8/12	41	0
E) Trtmt #5			
R1	9/12	87	0
R2	6/12	15	0

Treatments;

#1 - Ridomil 2E at 1 qt/A followed by two superimposed applications of Ridomil/CU at 4.0 lbs/A.

#2 - Ridomil 2E at 1 qt/A as a soil applied treatment only.

#3 - Ridomil/Cu at 4.0 lbs/A as a foliar applied treatment only.

#4 - Kocide 101 applied at 2 lbs/A as a foliar treatment only.

#5 - Untreated check.

II) 6/14/87

1) Fld #4

A) Trtmt #1			
R1	2	-	0
R2	5	-	1
B) Trtmt #2			
R1	7	-	1
R2	7	-	1
C) Trtmt #3			
R1	5	-	0
R2	3	-	0
D) Trtmt #4			
R1	2	-	0
R2	6	-	0
E) Trtmt #5			
R1	4	-	0
R2	7	-	3

2) Fld #16

A) Trtmt #1			
R1	3	-	0
R2	4	-	0
B) Trtmt #2			
R1	5	-	0
R2	5	-	0
C) Trtmt #3			
R1	3	-	0
R2	3	-	0
D) Trtmt #4			
R1	7	-	0
R2	5	-	0
E) Trtmt #5			
R1	8	-	0
R2	5	-	0

III) 7/10/87

In Fld #4, treatments #1, 3 and 4 each had one hill/12 hills with one or more spikes, treatment #2 had none and treatment #5, the untreated check, had spikes in 2/12 hills. Treatment#1 had one spike on the string.

In Fld #16, only treatment #2 had any spikes - one hill /12. No spikes were found on the string in any of the treatments.

Discussion: Visual observations on 6/14, seemed to indicate greater plant vigor and the growth of more sidearms in the #1 treatment at both sites. On 7/10, at the time of the last foliar application, plants were beginning to flower and the increased number of sidearms and flowers on hop vines in treatment# 1 were even more apparent. All the plots in Fld #4 were accidently oversprayed with 2 lbs/acre of Kocide 101, yet, this was the only field trial site downy mildew spikes were seen on the string.

Differences in control of downy mildew in the hill were not apparent on 5/14, as treatment #2(a soil treatment of Ridomil 2E) had a combined total of spikes (Fld# 4 and Fld #16) greater than the combined total for treatment #4, which had no fungicide treatment until the first foliar treatment with Kocide 101. Differences did not become apparent after the foliar treatments were made as the total number of hills with spikes was the same for Treatment #1 and #3 when counted on 6/14. The untreated check, however always had the greatest number of spikes at each evaluation.

Conclusion: No great differences developed in this trial, in control of downy mildew as measured by counts of hills with spikes or spikes per hill or spikes on the string.

APPLICATION DATA SHEET

Title: Ridomil/CU Efficacy Trials - 1987 Project #: CG-87

Trial location: Near Newberg, OR

Cooperator: Riverside Hop Farm

Address: St. Paul, OR

Crop (cultivar): Hops - Nugget variety

Planting date: 1985

Plot size; replications: 12 hills/treatment; two reps.; two sites

Experimental design: Random block

Soil type: Fld#4 - sand, silt loam; Fld#16 - clay loam

Notes (fertilizer, irrigation etc.): ----

Date:	4/18/87 (soil)	5/14/87 (foliar)	7/10/87 (foliar)
Treatments: See p. 2 of "Results" section of the report.			
temperature:	48 deg. F.	65 deg. F.	80 deg. F.
%relative humidity:	60%	70 %	40%
wind speed & direction:	0	2-5 mph NW to SE	none
%cloud cover:	partly cloudy	clear	clear
dew present?:	none	slight	none
time of day:	AM	midday	AM
soil moisture:	wet	dry	wet
soil texture at surface:	smooth	----	----

Method of application: broadcast; note the two foliar applications were applied with D-2 nozzle @ 25 psi in 2 qt/12 hills(approx.30 gp
a type of sprayer: CO2 plot sprayer
carrier & volume: water @1 qt.12 hills(approx. 16 gpa)
nozzle size & type: spraying Systems 8003
pressure (psi): 30 psi

Target organism (weeds, insects, fungus etc.): Downy mildew control

Ridomil/CU Hop Yield Trial - 1987

Purpose: To determine the potential yield difference in hops treated with a soil application of Ridomil 2E and those treated with both a soil application and two later foliar applications of a Ridomil and copper combination.

Procedure: Hops from the Ridomil/CU efficacy trial were cut and transported to the hop research station at Oregon State Univ. and harvested on a small hop picker. Forty eight hills per treatment were harvested(12 hills X 2 reps X 2 locations). The total green weight of cones per treatment was recorded.

Results:

	Total Cone Green Wt. in Kilograms		
I) Field #4	untreated check	soil only	soil and foliar
Rep 1	44.6	43.8	52.6
Rep 2	41.5	44.8	51.8
Total	86.1	88.6	104.4
II) Field #16			
Rep 1	61.8	66.4	69.1
Rep 2	53.0	48.1	61.4
Total	114.8	114.5	130.5
Total All	200.9	203.1	234.9

Conclusion: Results of this trial indicate that the Ridomil soil treatment followed by two Ridomil/Cu foliar treatments yielded greater total weight of hops than the untreated check or the soil applied Ridomil only.

United States Department of Agriculture
Agricultural Research Service
Northwest Area
DEPT. OF CROP SCIENCE
OREGON STATE UNIVERSITY
CORVALLIS, OREGON 97331

Elaine Annen
OR. Hop Commission
14358 Dominic Rd.
Mt. Angel, OR. 97362

Dec. 1, 1987.

Dear Elaine,

I just ran across this method for determining Metalaxyl (ridomil) and on page 2 under "Breakdown" it states:

fungicidal activity approximately 3 weeks.

I talked to Bill Anlicker, CIBA Geigy Co. and he thinks that is a bit conservative, the activity would certainly be a bit longer.

However, the thought crossed my mind, that our growers have in the past complained that the ridomil activity runs out about training time or slightly later, at a time when they need protection most.

In talking to Anlicker, he thought there is no reason why growers could not hold off applying ridomil until slightly before training time. Then spray the hops full strength, perhaps burn a few shoots or set them back slightly since ridomil is taken up directly by green plant parts.

However, you then have the protection period that you want when you need it most.

Perhaps this should be brought up at the next grower meeting.

Sincerely,

Al Haunold
Research Geneticist

Australian Hop Marketers Pty. Ltd.
P.O. Box 203,
Scottsdale, Tasmania
Australia, 7260

3rd November, 1987

copie to C. B-Skotland
12/14-87

Al Haunold,
Dept. of Crop Science
Oregon State University,
Corvallis, Oregon, 97331

X 3695

Dear Al,

Thanks for your letter. Sorry about the delay in sending the information regarding phosphorous acid to you, however I have had a little trouble in getting it and even now it is not as complete as I would like. The company which manufactures the phosphorous acid products is :-

U.I.M. Agrochemicals (Aust.) Pty. Ltd.,
P.O. Box 72,
Brisbane Market, Queensland, 4106.

I have enclosed a photocopy of a paper from Australian Horticulture, May, 1987 which reports on the use of the injectionable form, Fos-ject 200 in curing *Phytophthora* root rot in avocados. As you will note in the article, there appears to be a legal problem with the use of phosphorous acid because of patents held, presumably by the manufacturers of Aliette, and that Australia is the only country where these rights have been overcome.

The manufacture of the product seems to be simple enough as it appears to be phosphorous acid neutralised with potassium hydroxide, thus forming monohydrogen dipotassium phosphite. Presumably this is something you could do in the lab.

I feel that the foliar product, Foli-R-Fos 200 may be more useful for hops, and thus I requested from U.I.M. literature regarding this product. Unfortunately, they replied with only a brief letter informing me of trial work with hops (see below) but providing no worthwhile information regarding the product's formulation.

A trial is being conducted at the CUB Hop Research Station in NE Victoria this season with Foli-R-Fos 200 applied at 10 and 20 L/ha, twice, in early November and early December to determine if there is . These timings are approximately pre and post training.

In Tasmania we have a problem in Cluster where a rot prevents the emergence of strap cuttings in the spring. Even older plants can be affected as the plants are consumed by a wet black rot before the shoots emerge in the Spring. When Cal was here last year he isolated a *Pythium sp.* which may be responsible. Dipping the cuttings in Fongarid (furalaxyl) seems to have improved things to some extent. I am hopeful that phosphorous acid may be useful and intend doing some trial work with it.

As I obtain more information on phosphorous acid I will send it to you.

Regarding Alex Townsend's seminars, I will arrange that copies be sent to you under separate cover.

The season has commenced here in a quite perculiar manner. Just before I arrived home record high temperatures (30oC) were experienced for September. Then followed a cool spell when even some frost damage occurred. Now we have just had record high temperatures for October (34oC). Confusing! At least most of the hops look to be growing well. Hopefully we will get a warm summer for a change although based on this year's English crop with its very high alphas high temperatures are not required for good alpha.

All that remains is for me to thank you for the very informative and pleasurable time that I spent with you in Oregan. Please tell Mary that I really enjoyed the Italian meal she cooked.

I hope it will not be too long before we meet again. I think you would be interested in what we are doing in Australia so you had better put us on you travel itinerary for the near future.

Yours sincerely,

G.

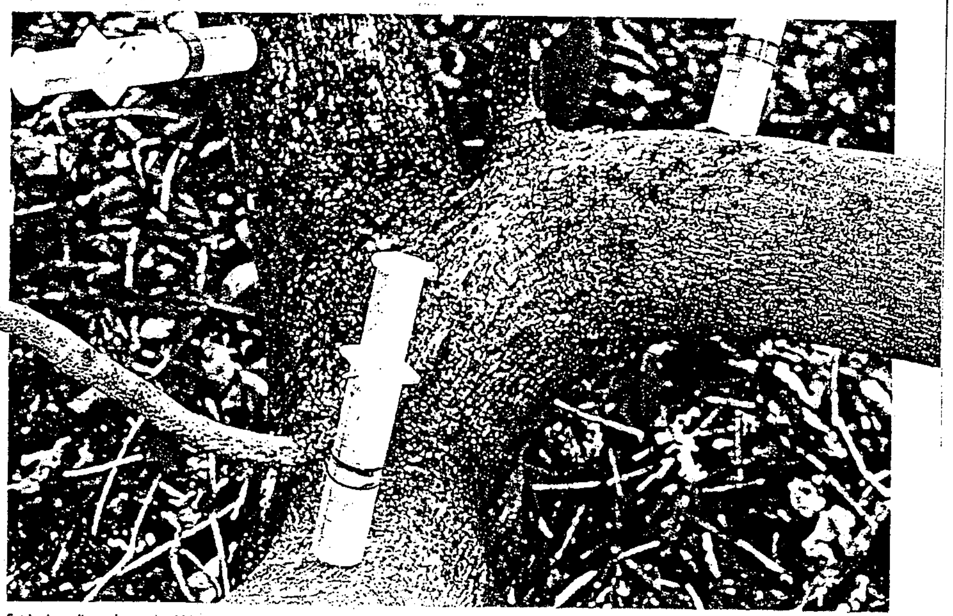
Grey Leggett.

Australian Horticulture, 5-15-1987.

Copies: [illegible]
[illegible]
Elaine Aman + [illegible] Committee

Curing Root-Rot in Avocados

M.F. Piccone, A.W. Whiley and K.G. Pegg



For best results, syringes should be space evenly around the trunk. If they cannot be placed in the main trunk itself, they should be as close to the junction of limbs as possible.

Trunk injection is a fast acting, effective and cheap method for rejuvenating root rot affected avocados. Phytophthora root rot causes extensive damage to the tree's fine feeder roots. This results in a poor supply of water and nutrients to the canopy of the tree. Progressively the disease causes deterioration of the root system and aerial parts. With loss of foliage and roots, it is extremely difficult to get fungicides into the tree by normal methods such as foliar sprays or soil applications. Trunk injection with phosphorous acid has been shown to regenerate unhealthy trees that have been severely or mildly affected by this devastating disease.

The properties of phosphorous acid as a bactericide were recognised by the medical and pharmaceutical professions in the 1930s before the development of present day antibiotics. However, it was not until the late 1970s that the potency of this chemical as a fungicide was recognised by the agricultural fraternity. Since then international research on disease control with phosphorous acid has occurred in several crops. However, commercial development of this fungicide has been frustrated by patent rights. At present Australia is the only country where these rights have been overcome, and in Queensland phosphorous acid as a potassium salt has been duly registered as a trunk injec-

table fungicide for *Phytophthora* root rot control in avocados.

Research in Queensland

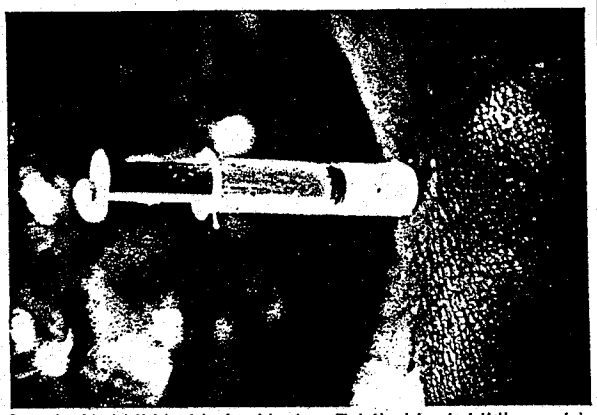
Experiments with phosphorous acid for the control of *Phytophthora cinnamomi* in avocados were first initiated in Queensland in 1983 following encouraging results from Dr. Mike Coffey in California. These results showed death of the fungus on agar plates when exposed to phosphorous acid. Our first experiments looked at soil drenches and foliar sprays of phosphorous acid on *Persea indica* seedlings, a *Phytophthora* susceptible relative of avocado, growing in pots in a glasshouse. Phosphorous acid solutions of 1 g/litre, adjusted to pH 5.8 with potassium hydroxide (KOH), were used in this experiment which demonstrated the potent fungicidal properties of this chemical against *P. cinnamomi.*

Phosphorous acid soil drenches were also used in the field under diseased 'Sharwil' trees growing on deep red basaltic soils (Tamborine Mountain). Once again the efficacy of this chemical as a fungicide was demonstrated, with drenches dramatically reducing feeder root decay. However, the effect of soil treatment proved to be short-lived, with a substantial increase in root decay occurring 11 weeks after treatment. This is thought to be due to bacterial and fungal oxidation of phosphite to phosphate in the treated soil.

During our foliar and soil drench experiments, Dr. Joe Darvas in South Africa developed the trunk injection technique for *Phytophthora* root rot control in avocados with phosetyl-Al (Aliette W.P.) which was subsequently registered in that country. With his injection technology we applied phosphorous acid to diseased avocado trees and the spectacular results obtained are now history.

Trunk Injection

The first experimental use of trunk injected phosphorous acid was at Caboolture, Queensland in November 1983. Diseased 'Fuerte' trees growing on a shallow coastal sandy loam were treated with 10 and 20 per cent phosphorus acid solutions at the rate of 15 ml of solution for each metre of canopy diameter, measured from drip line to drip line. These solutions were adjusted to Ph 5.8 with potassium hydroxide, which effectively made the solution into monohydrogen dipotassium phosphite (now registered as Fos-ject 200). Without some neutralisation, the acidity of 10 and 20 per cent phosphorous acid solutions caused mild to severe burn of both wood and bark around the injection site. A commercial formulation of phosetyl-Al (Aliette-Ca) was also injected into trees at the same rate. Health ratings on a 0-10 scale, where 0 equals healthy and 10 equals dead, were given annually and the experiment has been maintained for the last 3 years.



Compression of the air behind the solution, forces it into the tree. The locking pin is used to hold this pressure during injection.

More recently experiments with injected monohydrogen dipotassium phosphite (neutralised phosphorous acid) have begun at Tamborine Mountain and Maleny, where diseased trees are growing on the deep red basaltic loams of these climatically favourable plateaus. Tree recovery on these soils has been remarkable. Some trees rating 8 on the 0-10 health scale at the time of treatment, flowered and fruited 10 months after the first injection.

At present trunk injection is the only recommended and registered technique available for the application of phosphorous acid to avocado trees. While we have demonstrated that soil and foliar applications can be effective

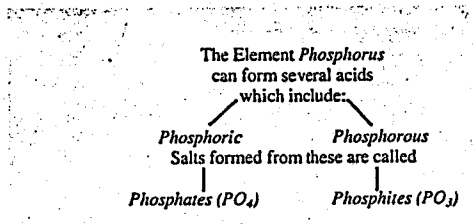


Figure 1. What the different spellings are about.

in controlling *Phytophthora* root rot, both of these methods have problems. Soil drenches are readily oxidised by some soil bacteria and fungi to phosphate which has no fungicidal properties. Limited experience has shown that foliar sprays in the presence of copper fungicide residues or within 7 days of applying dimethoate (Rogor) can cause severe leaf burn and/or drop. Also in many instances there is insufficient leaf surface on diseased trees to facilitate an effective uptake of the chemical.

The injection technique is successful with phosphorous acid because the active portion of the chemical (PO_3^-) is fully transported in the conducting elements of the tree. When first injected the chemical is absorbed by the water-carrying tissues of the tree and the initial movement is upwards towards the leaves. However, the Phosphite ion soon finds its way into the tissues carrying food reserves down the tree from leaves to roots, and is thought to give protection to roots a few days after injection.

While up-and-down movement within the tree is efficient it is thought that radial movement across trunk tissues is minimal.

Phosphorous acid moves in the xylem and the phloem. If applied to leaves or injected into the trunk it will move into the roots. This movement is aided by the high water solubility of the chemical. Phosphorous acid is apparently not metabolised by plants, but there is a suggestion that it may be exuded from the roots into the soil.

The Resistance Threat

It is highly unlikely that we will have a more effective fungicide than phosphorous acid for the control of avocado root rot for many years. We will never again have such an inexpensive chemical for root rot control. We must therefore get long term usage out of it.

Fungi such as *P. cinnamomi* are great survivors. They have the ability to change to meet changing environments and to adapt to new situations. *P. cinnamomi* now has to confront the new, highly fungitoxic material phosphorus acid in its environment. A strain of *P. cinnamomi* which is able to resist phosphorous acid will surely arise. This is likely to occur for two reasons —

1. Some growers will be so pleased with the results obtained with phosphorous acid and so grateful for having such an inexpensive chemical available, that they will use it exclusively and excessively and sometimes at the wrong rate.
2. Although not known for certain it is very likely that phosphorous acid may destroy *P. cinnamomi* by blocking only one process in its metabolism.

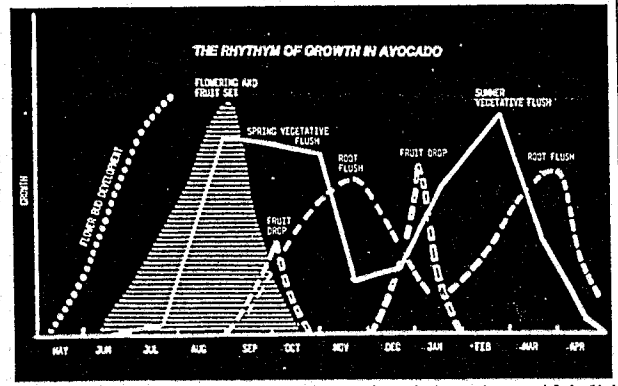
P. cinnamomi may adapt to meet this new challenge in its environment by giving rise to individuals with an alternative metabolic pathway to the one blocked by the fungicide. If the chemical is applied repeatedly, individuals without this ability are destroyed and in the absence of competition the survivors multiply rapidly. These survivors are called fungicide resistant strains. Strains of *P. cinnamomi* with resistance to phosphorous acid can be developed in the laboratory using mutagenic chemicals. Recently Dr. Imrec Vegh found a strain of *P. cinnamomi* with resistance to phosetyl-Al (Aliette), and with cross resistance to phosphorous acid, in a French nursery which had been treated regularly with phosetyl-Al for 8 years.

To avoid resistance arising in avocado orchards we must reduce the selection pressure by the chemical on the fungal population. Phosphorous acid must not be used in avocado nurseries. Besides suppressing the activity of *P. cinnamomi* and making detection impossible during ANVAS testing, a resistant strain may arise in the nursery and be disseminated over a wide area. This could have a disastrous effect on the industry.

To delay development of resistance in the orchard, repeated use of phosphorous acid must be discouraged. Fortunately, due to its strong curative activity phosphorous acid is well adapted for use in integrated control strategies.

Syringes should be placed in the main trunk of the tree and spaced evenly around the circumference of the trunk. If syringes cannot be placed in the main trunk of the tree, the injection sites should be as close to the junction of the main limbs as possible. Avoid injecting Fos-ject 200 into individual limbs at a distance from the junction as this may cause burn symptoms in foliage on that limb.

Inject trees with aerial symptoms of root rot in early spring and repeat the treatment when the spring growth flush has matured. Injections at these times coincide with the beginning of the two major annual root flushes in south



Timing of injections in September and December coincides with the beginning of major annual root growth flushes (black dotted line).

Queensland. Inject trees between 6 am and 11 am when the transpiration rate is highest and hence uptake is fastest.

At sites such as Maleny and Mt. Tamborine, elevated high rainfall coastal plateaus which previously supported subtropical rainforest, the soils are physically and ecologically ideal for growing avocados, and phosphorous acid injections should be combined with both cultural and biological control procedures. Once trees are restored to field productivity, cultural and biological techniques should be relied upon to maintain health. With good management this should be possible for several years in this cool, humid non-stressful environment. If decline symptoms do again appear the curative potential of phosphorous acid can once again be utilised. That is — don't use phosphorous acid as a protectant (insurance policy) in these soils; make full use of its curative activity only when the situation gets out of hand.

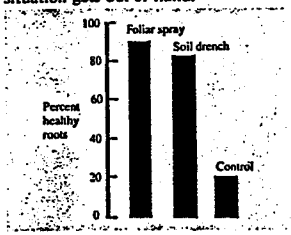


Figure 2. The control of Phytophthora root rot of P. indica with foliar sprayed and soil drenched phosphorus acid.

In sandy coastal soils where the environment is hotter, less humid and generally more stressful, the root rot hazard is much greater and a chemical may be needed every year. This does not mean that all other factors which contribute to tree health can be neglected. If a chemical is required every year the best strategy is to alternatively use two fungicides with different modes of action. Before initial injections with phosphorous acid are made in orchards on high root rot hazard soils, it is suggested that the population of *P. cinnamomi* in the soil be lowered using metalaxyl (Ridomil), which is the most effective substitute for phosphorous acid for root rot control. It may then be advisable to continue to use metalaxyl in alternate years or every third year. However, since there is an enormous cost difference between phosphorous acid and metalaxyl this will not be regarded by many as an economically feasible strategy to counteract resistance. In the longer term, such an attitude may prove to have been a case of "penny wise, pound foolish".

A resistance problem may not arise for many years. For example no resistance has yet emerged in a trial we commenced at Caboolture in 1983, where trees have been continually and exclusively treated with phosphorous acid for four years.

There is a critical need for more studies on the mode of action of phosphorous acid and its behaviour in the soil and in the tree. We know little of its internal distribution within plants. We do not really know whether it is exuded from the roots into the soil, as has been claimed. We do not know how frequently it should be administered for optimum control.

Questions such as these need to be answered if we are to prolong the usage of this most valuable industry resource.

We now have a very powerful and cost-effective tool for the control of *Phytophthora* root rot in avocado. While the sensitivity of this weapon may decline in the future with the evolution of resistant strains of *P. cinnamomi*, judicious use of this treatment from the start will assist in prolonging its effectiveness as a front line fighter.

The Injection Technique

Fos-ject 200 (monohydrogen-di potassium phosphite, or m-dKP) is a systemic fungicide registered for injection into avocado trees. The active ingredient of the registered product is **phosphorous acid (200g/L)**. Phosphorous acid has a pH of 1.9 when dissolved in water and is neutralised to a pH of between 5.7 and 6.0 in the preparation of m-dKP. At this higher pH, injection is less likely to cause burning to trunk tissue and foliage.

First, measure the diameter of the tree from one edge of the tree canopy through the trunk to the opposite side (Figure 6). For trees that are severely affected, dose each tree at a rate of 15 mls of Fos-ject 200 per metre diameter. For example, a skeletonised tree with a diameter of four metres will require a total dose per application of 60 mls. **Badly affected trees will require two injections in the first year.**

For trees showing less severe symptoms and which have some feeder roots affected, use Fos-ject 200 diluted one litre with one litre of water. Again inject trees twice in the first year for rapid remission of symptoms.

When injecting, a number of syringes should be used to get the required amount into the tree. Only use at most 25 mls in each syringe. For example where 60 mls in total is to be injected, three syringes would be used (3 × 20 mls). For reasonably sized trees, it is advisable to use at least three syringes.

Some "Don'ts" When Injecting

— Do not inject trees in cold weather.

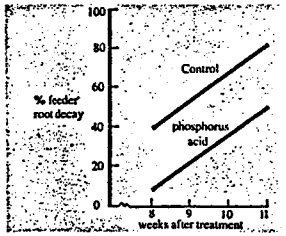


Figure 3. Percent feeder root decay under Sharwil trees soil drenched with phosphorus acid.

— Do not add any other material to the injection solution when treating trees.

— Do not inject into sites where the trunk appears damaged, e.g. by sunburn.

— Do not prune back unhealthy trees before injection as burning of new growth in the pruned area can occur.

— Do not increase rates or concentration of Fos-ject 200.

— Do not inject immediately below large crotches.

— Do not inject large quantities (more than 25 mls) in any one syringe.

— Do not inject immediately above or below previous injection sites.

The principle of the syringe operation is that the solution is forced into the tree by air compression supplied by the syringe. Hence a locking device is required. Once in the tree, the chemical moves in the transpiration stream to the foliage and then down through the conducting tissues to the roots.

Preparation of Syringes

A veterinary syringe that is calibrated to 50 mls is required. Prepare the syringe by removing the plunger. You will require a *lock* to be put through the syringe and the plunger. A nail or thick inflexible piece of wire is generally used.

1. Drill a hole, slightly larger than the diameter of the 'lock', through the barrel of the syringe, above the 50 ml mark.
2. In the plunger, drill holes through the centre of the stem at places equal to about 35 ml, 40 ml and 45 ml mark.

Note: Commercial packs of self pressurising, fully prepared injectors are now available.

To prepare an insert that fits onto the tip of the syringe and into the drilled hole in the tree, obtain vehicle brake line tubing or 4 mm nylon tubing. The tubing is used as an insert for the syringe and must have an internal diameter equal to the outside diameter of the syringe tip. The tubing is cut into lengths of 10 to 15 mm.

Injecting the Solution

1. Drill the required number of holes into the trunk of the tree to be treated. Holes should be evenly spaced around the trunk. Drill the holes about 25-50 mm into the tree at approximately a 45° angle downwards. If in doubt check the drilled hole for sawdust clog by inserting a nail quickly into the length of the drilled hole. Use approximately a 4 mm bit in the drill depending on the size of the tubing and syringe tip. The connecting insert should fit snugly into the drilled holes without any leaks during uptake.
2. Draw the Fos-ject 200 into each required syringe. By inverting the syringe and pulling the plunger draw air into the syringe back to the 50 ml mark.

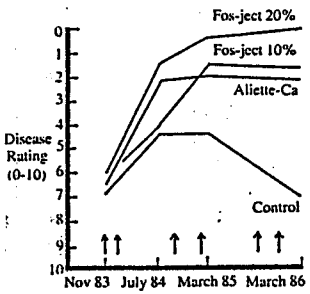


Figure 4. Improvement in health of Fuerte trees injected with Fosject and Aliette-Co over three years. Arrows indicate treatment times.

3. Insert the syringe tip covered by the plastic connecting insert into the drilled hole.
4. Depress the plunger until pressure from the air behind the plunger stops further movement. Lock the plunger into this position by inserting the lock (nail or wire) through the holes in opposite sides of the syringe and one of the holes in the plunger.
5. When all the fos-ject 200 has been drawn into the tree, remove the syringe and insert and plug up the hole with a sealing compound such as putty or silicone.

Note: Uptake will be fastest under warm sunny conditions as the solution is being drawn into the tree in the transpiration stream. If uptake is slow, syringes can be repressurised by removing the lock, forcing the plunger further in and then replacing the lock. Uptake can be complete in 15 to 20 minutes under good conditions.

Trunk injection of Fos-ject 200 needs to be done correctly to ensure best results and prevent any detrimental side effects. After trees are injected, to redevelop and maintain healthy trees you must use a management program that encourages root and shoot health and retards root rot activity. This means sound nutrition, watering, weed control and possibly the sensible use of other chemicals. It is vital to complete the job of regenerating rundown trees.

Certain low levels of infection can be tolerated by healthy trees. The best strategy to combat root rot in recovering trees is to suppress disease populations to a low level, and stimulate the development of a strong root system and a healthy, fruitful tree.

Nutrition

The number one priority is to encourage root growth. Roots require nutrients and moisture to grow and function. Concentrate on adding calcium, boron and phosphorus as these are all major requirements in root growth.

Calcium affects the activities of growing points and is of special importance in root development. Also there is evidence to suggest that high calcium levels in the soil reduce root rot. Calcium improves soil structure and therefore drainage and aeration. High soil calcium levels can be maintained by applying lime, dolomite or gypsum. Gypsum is preferred for soils

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with a low buffering capacity as there is some indication that a sudden rise of pH in these soils may aggravate root rot. Rates used are up to 10 tonnes per hectare.

Boron affects the activity of meristems in root and shoot tips. Deficiencies of this element stunt root growth. Most of the sandstone and basalt derived soils on which avocados are grown in Queensland are deficient in boron, and corrective measures should be taken. Use either Borax (8 g/m² of ground covered by the tree) or Solubor (4 g/m² of ground covered by the tree) spread evenly onto the ground under the tree canopy.

If phosphorus levels in soil are low, levels should be carefully raised and maintained. Remember excessive soil phosphate can inhibit uptake of other nutrients. Organic manure such as fowl manure aids in reducing *Phytophthora cinnamomi* populations in the soil. They also add nutrients valuable for growth of roots and foliage.

pH

Check the soil pH and adjust it to about 5.5 if this can be done without disturbing overall nutrient balances. In line with research findings, the current pH recommended is 5.0-6.0. At these lower pHs the activity of *Phytophthora cinnamomi* is reduced. Between pH 5.0 and 6.0 yield is increased and availability of nutrients is still satisfactory. Where manganese levels in the soil are high, a pH lower than 6.0 may cause manganese toxicity or induce iron deficiency. The pH should be maintained at 6.0 to 6.5 in high manganese soils.

Irrigation

The root system of the avocado is shallow. Most feeder roots are in the top 45 centimetres. It is these feeder roots that take up a larger proportion of the tree's water requirements. Since they naturally lack root hairs the tree is very susceptible to both waterlogging and drying out.

Trees recovering from Phytophthora have a reduced root system. Functional leaf area and roots are less than for healthy trees and subsequently the water taken up and required is less. As trees recover their water requirement will increase.

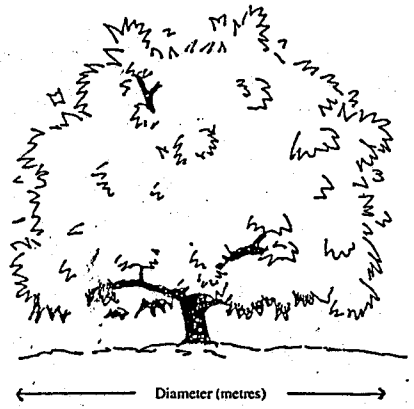

Figure 7. Measure the diameter of the tree from one edge of the tree canopy through the trunk to the opposite side.

To prevent waterlogging and drying out of regenerated feeder roots, the water use of the tree and soil water moisture must be carefully monitored. Don't guess the irrigation requirements of recovering trees. Guesswork could lead to another disaster!

Tensiometers are the most reliable, practical method that avocado growers can use to assess the water status of the soil. They are the major tool in deciding when to irrigate.

A pair of tensiometers are placed about 0.5 metres in from the dripline. At each site, one should be installed at a depth of 15 centimetres and another at a depth of 45 centimetres. When do you irrigate? It's the right time to irrigate when the reading on the dial of either tensiometer is around 30 centibars on sandy loam soils. Commence irrigating at a reading of 40 on clay loam soil types. Stop irrigating when the needle drops to between 0 and 10 centibars.

Ensure that irrigation emitters cover the entire root area. This promotes better root development and an even distribution of feeder roots.

Mulching

For your trees' sake, apply fibrous mulches such as wheat or barley straw and sorghum stubble. They encourage growth of new roots and prevent them drying out, increase soil organic matter and stimulate micro-organisms that prey on the *Phytophthora* fungi.

Mulch is best used where trees have recently suffered from root rot and natural leaf mulch is sparse. It should be applied to a depth of 10-15 centimetres in late winter or early spring. Keep mulches about 10-15 cm away from the trunk to reduce the risk of collar rot. Mulch also reduces weed growth which competes with the avocado roots for water and fertiliser.

N.B. Avoid mulching avocados with any materials that become overwet or gluggy after heavy rain or irrigation. Materials that surface seal and do not allow penetration of water should also not be used.

Reduced foliage also lets extra light through to the ground under sick avocado trees. This stimulates excessive growth of weeds. Weeds should not be allowed to grow under the tree canopy or around the dripline of recovering trees. Weeds in this area compete with avocado roots for moisture and nutrients. Spot spray with herbicides and spread mulch to control detrimental weeds.

Canopy Regrowth

The organic fertilisers applied to suppress root rot organisms and promote root growth will also act as a gradual supply of nutrients to feed the newly expanding canopy.

If soil levels and leaf levels of nitrogen, potassium, magnesium and zinc are low they should be corrected with soil applications, and perhaps in the case of zinc with a trunk injection of zinc nitrate (100 g/l at a rate of 15 ml of this solution per metre canopy diameter).

Avoid applying fertilisers that contain nitrates or chlorides to the soil as these anions can stimulate Phytophthora activity. Chlorides can cause symptoms of chloride burn in leaves on trees still recovering from root rot.

It will pay to take a soil sample initially and then a leaf sample during the first April or May after refoliation or recuperation has started. This will give you some facts on which to base fertiliser applications.

When the tree is fully recovered and looks healthy, any main branches or limbs and twigs that have not regenerated new shoots can be pruned out. Paint any major pruning wounds with white plastic paint.

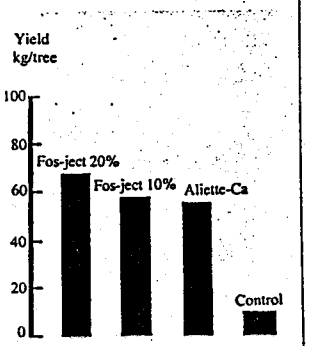

Figure 6. Fruit yield on Fuerte trees three years after injecting with Fos-jeci and Aliette-Ca.

Further use of chemicals may be necessary in conjunction with the control and prevention methods outlined in this article. However it is important to stress that use of chemicals alone will not give the best results.

To redevelop and maintain healthy trees you must use a management program that provides optimum conditions for growth and vigour and retards *Phytophthora* activity. It is vital to complete the job of regenerating. Don't be foolish and believe that injection alone is the total solution. It is in fact only the start.

M.F. Piccone and A.W. Whiley are with the Horticulture branch of the Q.D.P.I. at the Nambour research station and K.G. Pegg is with the Plant Pathology branch at Indooroopilly, Queensland.

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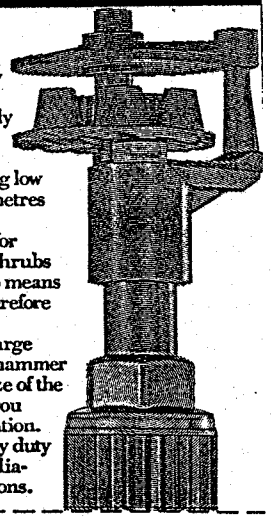

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~¼ cost of Alliette. 1.

info to Australian Hop Marketers
from: UIM Agrochemicals Ltd. Brisbane, Australia 38 - 5 cit. e
obtained from Grey Leggett Nov. 1987
Austral. hop marketers

2. SUMMARY OF CROP PROTECTION

CROP	DISEASE CONTROLLED	APPLICATION RATE	CRITICAL COMMENTS
TREES			
Avocado	Phytophthora Cinnamomi	Trunk Injection 1 syringe of 15 ml. Foli-R-Fos or Fos-Ject 200 per 1 metre diameter of canopy. FoliarApplication 1 litre Fol-R-Fos in 200 litres water.	See pamphlet "M-d KP method of Tree Injection" Apply early spring then every six weeks until end of Autumn. About 5 litres per mature tree.
Citrus	Phytophthora Parasitica Citrophthora	4 litres Foli-R-Fos in 200 litres water	Apply by spray early November and early February. About 8 litres per mature tree.
Almond Walnut Misc.Nuts	Phytophthora Cambivora Cinnamomi	1 litre Foli-R-Fos in 200litres water	Apply by spray early in spring then every six weeks until end of Autumn. 5 to 8 Litres per mature tree
Cherry	Phytophthora	Trunk Injection 1 syringe cf 15 ml. Foli-R-Fos or Fosject 200 per 1 metre diameter of canopy Foliar Application 1 litre Foli-R-Fos in 200 litres water	See pamphlet "M-d KP Method of Tree Injection" Apply by spray early in Spring then every six weeks until end of Autumn. Approx. 5 litres per mature tree.

CROP	DISEASE CONTROLLED	APPLICATION RATE	CRITICAL COMMENTS
Stone Fruit Trees Pome Fruit Trees	Phytophthora Cactorum P. Speciea	Trunk Injection 1 syringe of 15 ml. Foli-R-Fos or Fosject 200 per 1 metre diameter of canopy Foliar Application 1 litre Foli-R-Fos in 200 litres water	See pamphlet "M-d KP Method of Tree Injection" Apply by spray early in Spring then every six weeks until end of Autumn. Approx. 5 litres per mature tree.
Trees General	Phytophthora Species	See Technical note	
ORNAMENTALS AND FLOWERS			
Ornamentals General	Phytophthora Species	See Technical note	
Protea	Phytophthora Cinnamomi and Sp.	1 litre Foli-R-Fos in 200 litres water	For trees 1 m. high and 1 m. diameter use 500 ml. solution. Smaller trees will require less and larger trees more spray solution
Geralton Wax	Phytophthora Cinnamomi	1 litre Foli-R-Fos in 40 litres water	Trees 1 m high and 1 m. diameter use approx. 300 ml. of fine spray solution. Smaller trees will require less and larger trees more spray.
Orchid	Phytophthora Palmivora Nicotianae Var. Parasitica	1 litre Foli-R-Fos in 200 l. water	Preventative Treatment Apply spray solution once per month Curative Treatment Apply once per week until health restored Treatment of Divisions Dip in solution of spray solution strength

CROP	DISEASE CONTROLLED	APPLICATION RATE	CRITICAL COMMENTS
VINES			
Grapevine	Downy Mildew Plasmopara Viticola	600 ml. Foli-R-Fos in 100 litres water	Apply early October and then once monthly until March
Passionfruit	Phytophthora Nicotianae var. Parasitica	1 litre Foli-R-Fos in 200litres water	Apply Spring thence every six weeks until Autumn
Blueberry	Phytophthora Sp.	1 litre Foli-R-Fos in 200 litres water	In warm climates apply early spring thence every six weeks until Autumn. Cooler climates may require less sprays per annum
Kiwi Fruit			
Strawberries	Phytophthora Sp.	1 litre Foli-R-Fos per 200 litres water	Dipping at planting: Dip plants in application solution Foliar Application: Apply solution at rate 1000 l./Ha for young plants; 1500 l./Ha for older plants, approx. every 6 weeks. Trickle Irrigation: Apply at rate 2 ltrs. per 400 ltrs. irrigation water.

CROP	DISEASE CONTROLLED	APPLICATION RATE	CRITICAL COMMENTS
Capsicum	Phytophthora Stem Rot	1 litre Foli-R-Fos per 200 litres water	Foliar Application: Apply every six weeks during crop life. Rate 1000 ltrs. to 1500 lts. per Ha. Trickle Irrigation: Apply 5 ltrs. Foli-R-Fos/Ha for young plants and 7.5 to 8 litres Foli-R-Fos/Ha for larger plants in irrigation water
Cucurbits	Downy Milder Pseudoperonospora Cubenis	Foliar Spray: 600 ml Foli-R-Fos per 100 l. water Ground Drench 1 litre Foli-R-Fos per 200 lt. water	Apply solution at rate 1000 to 1200 l./Ha. Apply every three weeks of plant life. Apply at the rate of 5 litres per M^2 ground surface
Onions	Downy Mildew Peronospora Destructor	Foliar Spray: 600 ml. Foli-R-Fos per 100 l. water Ground Drench: 1 litre Foli-R-Fos per 200 lt. water	Apply solution at rate 1000 to 1200 l/Ha.Apply every three weeks of plant life. Apply at the rate of 5 litres per M^2 ground surface.
Lettuce	Downy Mildew Bremia Lactueae	Ground Drench: 1 litre Foli-R-Fos per 200 lt. water Foliar Application 600 ml. Foli-R-Fos per 100 lt. water	Apply at the rate of 5 litres/M^2 at seed sewing and again before trans-planting Apply 1000 to 1200 lt/Ha every 3 weeks during crop life.
Tomato			

CROP	DISEASE CONTROLLED	APPLICATION RATE	CRITICAL COMMENTS
Potato			
Vegetables General	Phytophthora Sp.	Soil Drench: 1 litre Foli-R-Fos per 200 lt. water Dipping; 1 litre Foli-R-Fos per 200 lt. water Foliar Spray: 1 litre Foli-R-Fos per 200 lt. water	Apply at rate 5 litres/ M^2 soil surface. Dip plants in solution at transplanting. Apply at the rate of 1000 l/Ha for young plants increasing to 1500 l/Ha for advanced plants. For Trickle Irrigation apply 5 to 8 litres Foli-R-Fos per Ha. as plants grow
Vegetables General	Downy Mildew	600 ml. Foli-R-Fos per 100 lt. water Soil Drench: 1 litre Foli-R-Fos per 200 lt. water	Apply at the rate of 1000 to 1200 ltrs. spray solution per Ha. Apply every 3 weeks after plant emergence. Apply at the rate of 5 ltrs./M^2 of soil surface

SCIENTIFIC COMMISSION OF THE INTERNATIONAL
HOP GROWERS' CONVENTION

COMMISSION SCIENTIFIQUE DU COMITE INTERNATIONAL
DE LA CULTURE DU HOUBLON

WISSENSCHAFTLICHE KOMMISSION DES INTERNATIONALEN
HOPFENBAUBÜROS

Dr. H. Th. KREMHELLER, Sekretär

Bayer. Landesanstalt für
Bodenkultur und Pflanzenbau
Institut für Hopfenforschung
D-8069 Wolnzach-Hüll
BUNDESREPUBLIK DEUTSCHLAND
Telefon 0 84 42 - 20 71
14. April 1987

Außerordentliche Sitzung der Wissenschaftlichen Kommission des Internationalen Hopfenbaubüros

Auf der Vorstandssitzung des Internationalen Hopfenbaubüros am 14. März 1987 in Paris wurde beschlossen, eine außerordentliche Sitzung der Wissenschaftlichen Kommission des IHB abzuhalten. Diese Sitzung wird sich mit den aufgetretenen Problemen beim Hopfenexport in verschiedene Länder auf Grund unterschiedlicher Pflanzenschutzmaßnahmen in den Erzeugerländern und deren Lösungsmöglichkeiten befassen.

Nach Rücksprache mit dem Präsidenten der Wissenschaftlichen Kommission des IHB, Herrn Dr. Kisgeci, und dem Direktor des Hopfenforschungsinstitutes, Herrn Mag. Ermenc in Zalec wurde als Tagungsort das Hopfenforschungsinstitut (Institut za Hmeljarstvo) 63 310 Zalec, Jugoslawien, Tel. 063/711 221, festgelegt. Termin Donnerstag, 7. Mai 1987, Tagungsbeginn 11,00 Uhr, voraussichtliches Tagungsende später Nachmittag des 7. Mai 1987.

Zur Besprechung ist es notwendig, von allen hopfenexportierenden Ländern eine genaue Übersicht in Händen zu haben, die über die nachfolgenden Punkte Auskunft gibt:

1. Verwendete und zugelassene Pflanzenschutzmittel
   - Indikation
   - Aufwandmenge pro Hektar
   - Zeitpunkt der Anwendung
   - Häufigkeit der Anwendung
   - Wartezeit vom letzten Einsatz des Mittels bis zur Ernte
   - Höchstmengen an Rückständen des Pflanzenschutzmittels oder dessen Metaboliten auf Trockenhopfen

2. Gesetzliche Vorschriften für die Zulassung, den Vertrieb und Anwendung von Pflanzenschutzmitteln.

3. Gesetzliche Vorschriften für den Import von Hopfen.

Falls es Ihnen nicht möglich sein sollte, an dieser kurzfristig einberufenen Sitzung teilnehmen zu können, bitten wir Sie für Ihr Land die vorstehende Übersicht fertigzustellen und dem Sekretär der Wissenschaftlichen Kommission, H.Th. Kremheller, bis zur Sitzung zuzusenden.

Bitte setzen Sie sich wegen eventuell notwendiger Hotelreservierung direkt mit Herrn Mag. Ermenc in Zalec in Verbindung.

Mit freundlichen Grüßen

H. Th. Kremheller
Sekretär

J. Kisgeci
Präsident

United States Department of Agriculture
Agricultural Research Service
Northwest Area

DEPT. OF CROP SCIENCE
OREGON STATE UNIVERSITY
CORVALLIS, OREGON 97331

April 24, 1987.

To: Dr. H. Th. Kremheller
Sci. Commission, Int. Hop Growers' Convention
Inst. fuer Hopfenforschung
D-8069 Wolnzach, BR. Deutschland

From: Dr. Alfred Haunold
Research Geneticist, USDA ARS
Corvallis, OR. 97331 USA

Subject: Registered pesticides for use on hops in the United States

I am in no position to anwer the questions of your 14. April 1987 letter in detail, partly because I lack the authority to speak for the US hop industry and also, because I am only familiar with the few compounds that are presently used by Oregon hop growers.

I enclose a list that was summarized by one of our chemists last year that gives tolerances for compounds that currently have or previously had a label for use on hops with the tolerances in each case. Many compounds on this list are no longer in use or such as DDT are no longer manufactured in the United States. Other compounds such as Zineb were voluntarily withdrawn and although legal under present regulations are no longer used. Others again such as Dyrene were recently cancelled by the EPA.

The only agency in the United States that has legal authority to answer the questions in your letter is the US Environmental Protection Agency, Washington DC which would have to be contacted specifically.

From my own experience Oregon growers use the following compounds:

Fungicides: Ridomil, as recommended by the manufacturer
Copper containing compounds such as Kocide and copper-oxy-chloride

Insecticides: Disystox
Omite
Diazinon

Herbicide: Paraquat (only occasional use if absolutely required)
Des-i-cate (very limited use because of cost)

To my knowledge no other compounds are used on US hops in the major hop growing areas in significant amounts.

Dr. H. Th. KREMHELLER, Sekretär

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BUNDESREPUBLIK DEUTSCHLAND
Telefon 0 84 42 - 20 71

Protokoll der außerordentlichen Sitzung der Wissenschaftlichen Kommission des Internationalen Hopfenbaubüros vom 7. Mai 1987 im Hopfenforschungsinstitut in Zalec, Jugoslawien

1. Eröffnung der Sitzung durch den Gastgeber, den Direktor des Instituts für Hopfenforschung in Zalec, Herrn Ermenc.

2. Der Präsident der Wissenschaftlichen Kommission, Herr Dr. Kisgeci, leistete den 1. Beitrag mit einem Überblick über das Sitzungsthema "Pflanzenschutz im Hopfenbau 1987 unter Berücksichtigung der Vorschriften beim Hopfenexport in die USA".

3. Bei der Sitzung waren die Länder vertreten, die einen höheren Anteil ihrer Hopfenproduktion in die USA exportieren: Bundesrepublik Deutschland, Tschechoslowakei und Jugoslawien.

   Teilnehmer: Jugoslawien: Direktor Ermenc,
   Dr. Kisgeci, Präsident der Wissenschaftlichen Kommission des IHB und Mitarbeiter,
   Mag. Dolinar und Mag. Zolnir
   Dr. Cetina, Generalsekretär des IHB

   Tschechoslowakei: Ing. Bures, Präsident des IHB

   Bundesrepublik Deutschland: Dr. Kremheller

4. Die Teilnehmer berichteten über den Ablauf des Hopfenexports 1986 in die USA, der nach Festlegung der Importtoleranzen durch die US-Behörden in den vertretenen Ländern ohne Beanstandung von Rückständen abgewickelt werden konnte.

5. Die Pflanzenschutzmittel, für welche in USA für Hopfen bereits Höchstmengen festgelegt sind oder für die Ausnahmeregelungen bestehen, wurden besprochen (Liste ist als Anlage beigefügt). Mit diesen Pestiziden kann der für USA bestimmte Exporthopfen behandelt werden, sofern es die gesetzlichen Bestimmungen des Erzeugerlandes zulassen.
   Es wurde weiterhin festgestellt, daß für die Mittel Lannate (Methomyl), Saprol (Triforine) und Ridomil plus (Metalaxyl + Kupfer) noch vor dem Export des Hopfens der Ernte 1987 in die USA die Bekanntgabe der Importtoleranzen durch die US-Behörde erwartet wird (voraussichtlich im Juni oder Juli). Da in der Bundesrepublik Deutschland zur Blattlausbekämpfung die in USA zugelassenen Pflanzenschutzmittel nicht zur Anwendung zugelassen sind, wird dort für die Blattlausbekämpfung des für den Export nach USA bestimmten Hopfens Lannate vom Hopfenpflanzer-Verband, Hopfenhandel und der amtlichen Beratung empfohlen.

6. Alle Sitzungsteilnehmer waren sich einig, daß im Interesse des US-Exports nur die von den US-Behörden genehmigten Präparate unter Einhaltung der dort festgelegten Importtoleranzen verwendet werden können.

7. Es bestand unter den Teilnehmern Einigkeit, daß die Wissenschaftliche Kommission des IHB das geeignete Gremium ist für den Informationsaustausch und die Kooperation in Fragen des Pflanzenschutzes zwischen den Mitgliedsländern. Die gegenseitige Information soll fortgesetzt werden.

8. Es bestehen Befürchtungen, daß gegen Lannate nach großflächigem Einsatz im Jahre 1987 die Resistenz der Blattläuse schnell ansteigen wird. Daher ist die Festlegung von US-Importtoleranzen für weitere Insektizide in den kommenden Jahren notwendig. Die Sitzungsteilnehmer beschlossen durch Versuche im Jahre 1987 zu klären, welches der zur Blattlausbekämpfung verwendeten Insektizide in den jeweiligen Ländern die beste Wirkung hat.
   Die Wissenschaftliche Kommission wird sich nach Abschluß dieser Versuche an die betreffenden Pflanzenschutzmittelhersteller wenden mit der Bitte für die wirkungsvollsten Mittel bei den US-Behörden Importtoleranzen zu beantragen.

9. Es wurde festgestellt, daß zum derzeitigen Zeitpunkt alles getan wurde, was möglich ist, um den US-Export nicht zu gefährden. Es wurde der Dank an die Pflanzenschutzmittelindustrie und die Bundesrepublik Deutschland wegen ihrer Bemühungen in dieser Angelegenheit ausgesprochen.

10. Der Präsident des IHB, Ing. Bureš, gab bekannt, daß die nächste Sitzung der Wissenschaftlichen Kommission im Jahre 1988 in der Tschechoslowakei stattfinden kann. Der Präsident der Wissenschaftlichen Kommission Dr. Kisgeči, dankte Herrn Bureš im Namen aller Mitglieder für diese Einladung und im voraus für alle damit verbundenen Arbeiten.

11. Den Abschluß der Sitzung bildete ein gemeinsames Abendessen aller Teilnehmer. Besondere Anerkennung und Dank wurde dem Direktor des Hopfeninstitutes in Zaleč, Herrn Ermenc, für die hervorragende Organisation der Sitzung und die herzliche Aufnahme aller Teilnehmer im Institut ausgesprochen.

Wolnzach, den 14. Mai 1987

Dr. H.Th. Kremheller

Lieber Herr Hannold, anbei das Protokoll. Herzlichen Dank für die Zusendung der US-Pestizid-Listen. Mit den besten Grüßen für Sie und Ihre Familie

H. Kremheller

Established U.S.A. tolerances for pesticide residues on hops produced.

Source: The Pesticide Chemical News Guide

Compiled: April 9, 1987

Ingredient	Tolerance, ppm
Bacillus thuringiensis (B.T.)	Exempt
copper as metallic/cuprous and cupric oxide	Exempt
copper hydroxide (Kocide 101)	Exempt
copper metallic	Exempt
copper oxychloride sulfate (COCS)	Exempt
copper sulfate basic	Exempt
copper sulfate pentahydrate	Exempt
cyhexatin (Plictran)	90.0 dried, 30.0 green
demeton (Systox, Di-Syston)	1.25
diazinon	0.75
dicofol (Kelthane)	30.0
endothall mono n,n-dimethyl alkylamine (Des-I-Cate)	0.1
gibbrellic acid	0.15 (negligible residue)
malathion	1.0
metalaxyl (Ridomil)	0.05 green
methyl parathion	1.0
naled (Dibrom)	0.5
norflurazon (Solicam)	1.0
oil/aromatic petroleum	Exempt
oil/aromatic petroleum distillate	Exempt
oil/petroleum distillate	Exempt
oil/petroleum solvent	Exempt
oil/xylene	Exempt
oil/xylene range hydrocarbon solvent	Exempt
paraquat (Gramoxone)	0.1 (0.5 bines)
parathion	1.0
phorate (Rampart, Thimet)	0.5
propargite (Omite)	15.0
suffur	Exempt
trifluralin (Treflan)	0.05 (negligible residue)
zineb	60.0

Zineb is rarely used for the control of hop downy mildew.

RECEIVED AUG 28 1986

PESTICIDES ON HOPS

We have attempted to provide an accurate list of pesticides with tolerances on hops. There are occasionally pesticides on such lists which are no longer registered for use. DDT is an example. Tolerances exist for such pesticides because they persist and residues show up for many years after the registration has been cancelled. Section 18 Exemption means a petition for full federal registration is pending. In such cases, an exemption is requested each growing season. To obtain Section 18 Exemption status, progress toward full registration must be demonstrated as well as a clear statement of need -- meaning that there are no suitable registered alternatives.

Two fungicides frequently discussed are Ridomil and Aliette. Ridomil has a tolerance and is registered. Aliette does not have a tolerance and, therefore, is not registered. A petition for a tolerance has been submitted but questions about its oncogenicity are holding up the petition.

Some compounds, such as the copper salts, show up on lists of registered pesticides which do not have tolerances. These compounds historically have been "generally recognized as safe" and, therefore, are on the GRAS list. Tolerances for such chemicals are not needed.

Since this table was assembled, the EPA has conditionally cancelled registration of dicofol and pesticides containing dicofol because of high concentrations (10%) of DDT present. Usage of this chemical, however, may continue until March 31, 1989, under the following conditions:

1) Existing stock of dicofol may be used according to the label until depletion.
2) New purchases must contain less than 2.5% DDT.
3) After June 30, 1987 dicofol with DDT between 0.1-2.5% may be used according to label until March 31, 1989.

From Max Deinzer (OSU). Aug. 11, 1986

PESTICIDES WITH TOLERANCES ON HOPS

Insecticides (common name)	Trade Names	Tolerances (ppm)
Cyhexatin	Plictran	30.00
DDT	Gesapon, Gesarol, Neocid, Didamac, Dedetane	20.00
Demeton	Systox, Systemox	1.25
Diazinon	Basudin, Neocidol, Exodin, Diazitol, Nucidol, Spectracide, Sarolex, Dizaol, Diagran	0.75
Dicofol	Kelthane, Acarin, Hilfol, Mitigan, Cekudifol	30.00
Disulfoton	Disyston, Dithiosystox, Di-Syston, Frumin AL, Solvirex	0.50
Malathion	Malathion, Cythion, Fyfanon, Malmed, Calmathion, Sumitox, Zithiol, MLT, Malaphele, Celthion	1.00
Naled	Dibrom, Bromex, Flibol, Hibrom	0.50
Parathion	Folidol E-605, Niran, Fosferno 50, Rhodiatox, Thiophos, Eftol, Vitrex, POX, Bladan, Paramar	1.00
Phorate	Thimet, Rampart, Agrimet, Geomet, Granutox	0.50
Propargite	Omite, Comite	15.00
Tetradifon	Tedion V18	30.00

Herbicides (common name)	Trade Names	Tolerances (ppm)
2,4-D	2,4-D	0.10
Dalapon	Dowpon, Radapon, Basfapon, Gramevin	0.20
Dinoseb	Premerge, Gebutox, Basanite, Hivertox, Butyl-Gelb, Caldon, Subitex	0.10
Diquat	Reglone, Reglox	0.02
Endothall	Des-I-Cate, Aquathol, Pennout	0.10
Fluridone	Sonar, Pride, Brake	0.10
Glyphosate	Roundup, Sting	0.10
Paraquat	Gramoxone, Dextrone X, Ortho Paraquat CL, Pillarxone	0.10
Trifluralin	Treflan, Trefanocide, Digermin, Elancolan, Triflurex	0.05

Fungicides (common name)	Trade Names	Tolerances (ppm)
Copper Hydroxide		(GRAS List)
Copper Metallic		"
Copper Oxychloride		"
Copper Sulphate	Triangle, Ebenso	"
Metalaxyl	Ridomil	0.50
Zineb	Dithane Z 78, Phytox, Parzate, Tritoftorol, Tiezene, Lonacol, Zinosan, Aspor	60.00

Plant Growth Inhibitor (common name)	Trade Names	Tolerances (ppm)
Gibberellic Acid	GA3, Berelex, Activol, Grocel, Gibrel, Brellin, Pro-Gibb, Cekugib	0.15

SECTION 18 CRISIS EXEMPTION

Insecticide (common name)	Trade Names	Tolerances (ppm)
Acephate	Orthene, Ortran	1.00
Carbofuran	Furadan, Curaterr Yaltox, Pillarfuran	2.00
Formetanate Hydrochloride	Dicarzol, Carzol	150.00
TEPP	Vapotone, Nifos T, Bladan	0.10

REGISTERED PESTICIDES USED EXTENSIVELY ON HOPS IN NORTHWEST

Demeton (Systox)

Diazinon

Disulfoton (Disystox)

Propargite (Omite)

Copper Oxychloride

Ridomil (metalaxyl)

RECEIVED MAR 24 1987

FDA WARNS 7 COUNTRIES ABOUT ILLEGAL PESTICIDES IN IMPORTED HOPS

The Food and Drug Administration has written to the embassies of seven countries, expressing concern that hops being grown for export to the U.S. may contain residues of pesticides for which there are no U.S. tolerances or tolerance exemptions.

In a March 5 letter to the embassies of Canada, Czechoslovakia, France, Israel, Poland, United Kingdom and Yugoslavia, FDA's Director of the International Affairs Staff, John F. Harty, said if hops are being grown which contain illegal residues, and alternative pesticides having U.S. tolerances or exemptions cannot be substituted for use in hops intended for U.S. export, then the country should seek, through the manufacturers or registrants of the pesticide, U.S. tolerances or exemptions for such uses.

Harty noted that last year, FDA found residues of a pesticide in imported hops for which there was no established U.S. tolerance. Without mentioning that the country was West Germany (See FOOD CHEMICAL NEWS, Feb. 2, Page 2), FDA noted that the government subsequently agreed to use only those pesticides having established U.S. tolerances or tolerance exemptions for hops grown for U.S. export.

"The government officials were informed that hops from their country's 1987 crop and beyond must not contain residues of pesticides for which there are no U.S. tolerances or tolerance exemptions, otherwise shipments of the hops will be refused entry into the United States," Harty said, adding that the Environmental Protection Agency and FDA "fully expect the country to comply with this requirement."

Pledging the agencies' assistance, Harty said as an initial step, EPA in the near future "will send you a list of the pesticides that currently have established tolerances in the United States for hops. EPA will also provide upon your request information and guidance for seeking a U.S. tolerance or tolerance exemption."

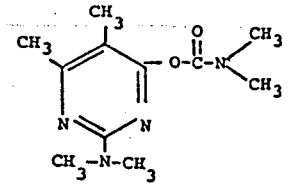
hands. Do not apply by aircraft. Do not use in or around homes or home gardens. Do not graze treated areas. On ornamental usage it should be applied only by trained professionals.

ADDITIONAL INFORMATION: Residual control of up to 10 weeks can be expected due to systemic activity. Very effective on soil nematodes such as the spiral, ring, leison, dagger, root-knot, and stubby species. Due to the toxicity, the granules are covered with a water-soluble coating. Relatively non-toxic to fish. Soil type or pH does not affect the activity. Systemic activity is upward only in the plant. Fast acting with effects noticeable in 48 hours. Effective in all types of soil.

Aphicide (England) on hops

NAMES

PIRIMICARB, PIRIMOR, APHOX, FERNOS



5, 6-dimethyl-2-dimethylamino-4-pyrimidinyl-dimethylcarbamate

TYPE: Pirimor is a carbamate compound used as a selective insecticide. Effective on contact, and by fumigation activity

ORIGIN: 1969 - ICI of England (Plant Protection, Ltd.)

TOXICITY: LD_{50} - 147 mg./kg.

FORMULATIONS: 50% WP, 5% EC, .1% aerosol.

PHYTOTOXICITY: Non phytotoxic when used at the recommended rates.

USES: Chrysanthemums and potatoes in the U.S. Being used on many vegetable, ornamental field and fruit crops outside of the U.S.

IMPORTANT PESTS CONTROLLED: Aphids, flies and many others.

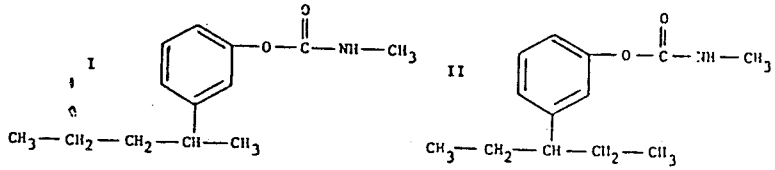
RATES: Being used at a 2-4 oz. active/acre.

APPLICATION: Apply when insects appear and repeat as necessary. Being experimented with as a soil drench.

ADDITIONAL INFORMATION: Fast acting. Relatively short residual. Very selective. Does not harm lady bugs or lacewings. Not translocated extensively from foliar applications. Has a quick knockdown effect. Ideal for use in greenhouses. Low bee toxicity so it may be applied to the open chrysanthemum flower. May be applied with other pesticides.

NAMES

BUFENCARB, METALKAMATE, BUX



I: m-(1-methylbutyl) phenl methylcarbamate. Mixed in a 1:3 ratio.
II: m-(1-ethylpropyl) phenyl methylcarbamate.

TYPE: BUX is a carbamate compound being used as a soil insecticide.

ORIGIN: Chevron Chemical Company, 1968.

TOXICITY: LD_{50} - 87 mg./kg. Absorbed through the skin.

FORMULATIONS: 10% granules, 2 EC.

PHYTOTOXICITY: Soil applications have not caused any crop injury.

USES: Corn and rice.

IMPORTANT PESTS CONTROLLED: Corn rootworms and rice water weevils.

RATES: Applied at ¾ - 4 lbs. active/acre.

APPLICATION: Applied immediately after planting in a band over the covered seed row, or at lay by on each side of the row. Incorporate the material slightly with press wheels, covering discs or chains. May be applied prior to planting, incorporating into the top one inch of soil.

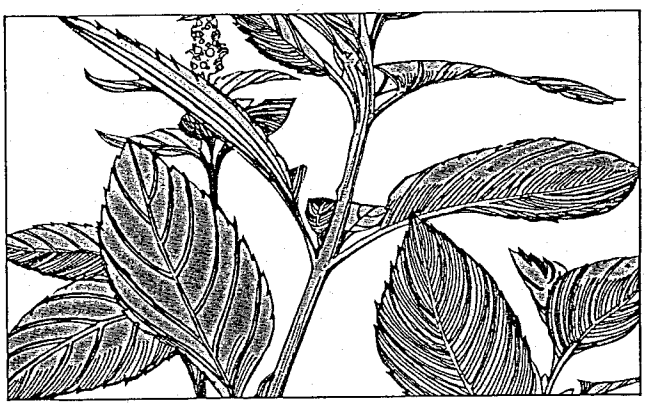
PRECAUTIONS: Hazardous to fish and wildlife. Avoid drift. Do not apply propanil to rice after treatment.

ADDITIONAL INFORMATION: May be applied either broadcast or band. Shallow incorporation has given the best results. Soil residual is considered to

Devrinol® 50-WP

Selective Herbicide

Now labeled for control of weeds in established mint in the Pacific Northwest.



Weed control, especially annual grass control, is vital to continued good yields of mint. Devrinol provides long-lasting weed control with one application.

How to use Devrinol 50-WP

Apply 8 pounds of Devrinol 50-WP per broadcast acre to the surface of your mint fields. Apply from November to February before weeds emerge. If no rain falls within two weeks of application, irrigate Devrinol in. Irrigation should wet the soil to a depth of 2 to 4 inches.

If Devrinol is used from March through October, it must be rained in or irrigated in within 24 hours after application.

See your Stauffer supplier

Weeds Controlled

Annual Grasses:

Annual Bluegrass
Barnyardgrass (Watergrass)
Bristly Foxtail
Guineagrass
Johnsongrass Seedlings
Sandbur
Texas Panicum
Large (Hairy) Crabgrass
Ripgut Brome
Southwestern Cupgrass
Wild Barley
Wild Oats

Annual Broadleaf Weeds:

Chickweed
Common Fiddleneck
Prostrate Knotweed
Little Mallow Seedlings
Common Purslane
Annual Sowthistle
Filaree
Groundsel
Horse Purslane
Lambsquarters
Pineappleweed
Prickly Lettuce
Redroot Pigweed

Advantages

- Assures long-lasting weed control.
- Controls important grass weeds, including watergrass.
- Controls important broadleaf weeds, including groundsel.
- Easy to incorporate by rain or irrigation.
- Easy on your crop—favors fast growth for high yields.

ALWAYS READ AND FOLLOW THE LABEL!

Since the product use recommendations and precautions are subject to revisions, the instructions on the actual container label and any supplemental label should always be carefully read and followed. While the information contained in this literature was current at publication, it does not replace the product label.

NOTICE: Stauffer Chemical Company makes no warranty, express or implied, including the warranties of merchantability and/or fitness for any particular purpose, concerning this material, except those which are contained on Stauffer's label attached to the product container. All sales are subject to the conditions of sale stated on the product container or label.

Stauffer Chemical Company
Agricultural Chemical Division
Westport, Connecticut 06881-0850

Printed in U.S.A. FS-0582-R Obsolete 3/84

DEVRINOL® 50-WP

Selective Herbicide

EPA Reg. No. 476-2108

SUPPLEMENTAL LABELING

® Trademark of Stauffer Chemical Company

GENERAL DIRECTIONS FOR USE

It is a violation of federal law to use this product in a manner inconsistent with its labeling.

DIRECTIONS FOR USE OF DEVRINOL 50-WP SURFACE APPLICATION

NOTE: All rates are given on a broadcast basis. Reduce rates proportionately for band or strip treatment.

For control of all weeds listed, apply 8 pounds DEVRINOL 50-WP per broadcast acre to the soil surface. Apply in the fall through early spring prior to weed emergence. Do not apply DEVRINOL 50-WP to frozen ground. For best results, the treatment must reach the zone of weed seed germination. If rainfall does not occur the treatment must be shallowly incorporated or irrigated-in following application (sprinkler or flood) with sufficient water to wet the soil to a depth of 2 to 4 inches. In the Western and Pacific Northwest Regions treatment made in November through February must be incorporated-in or irrigated-in if no rainfall occurs within two weeks of application. For treatments made other than in November through February in these regions, and for all treatments applied in the Northern, Southwestern and Southeastern Regions regardless of season, the treatment must be incorporated-in or irrigated-in within 24 hours if no rainfall occurs.

RECOMMENDATIONS

Pacific Northwest:
Established mint

Where recommended for use on established crops, apply DEVRINOL 50-WP only to stands that have been established for at least one year.

SPECIMEN

GENERAL USE PRECAUTIONS

To avoid injury to crops not specified on the label, do not plant until 12 months after the last Devrinol application.

Before using Devrinol 50-WP, read and observe the precautionary statements, and all other information appearing on the product label.

This label must be in the possession of the user at time of pesticide application.

NOTICE — READ CAREFULLY

CONDITIONS OF SALE: Stauffer (and seller) offer(s) this product for sale subject to, and buyer and all users are deemed to have accepted the following conditions of sale and warranty which may only be varied by written agreement of a duly authorized representative of Stauffer.

WARRANTY LIMITATION: Stauffer warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the directions for use on the label subject to the inherent risks referred to below. Stauffer makes no other express warranties; THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY and there are no warranties which extend beyond the description on the label hereof.

INHERENT RISKS: The directions for use of this product are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks associated with use. Buyer assumes all risks associated with use or application of this product contrary to label instructions or resulting from extraordinary weather conditions.

LIMITATION OF LIABILITY: In no case shall Stauffer be liable for special, indirect, or consequential damages resulting from the use or handling of this product and no claim of any kind shall be greater in amount than the purchase price of the product in respect of which such damages are claimed.

EPA Reg. No. 476-2108

A-7 Supplemental

Made in U.S.A. by

STAUFFER CHEMICAL COMPANY

WESTPORT, CT. 06881

184

United States Department of Agriculture
Agricultural Research Service
Northwest Area
Irrigated Agriculture Research and Extension Center
P.O. Box 30
Prosser, Washington 99350

November 24, 1987

Dr. Arnold P. Appleby
Dept. of Crop Science
Oregon State University
Corvallis, Oregon 97331

Dear Arnold:

I have submitted an IR4 Pesticide Clearance Request Form for Fusilade 2000 use on hops. We will put out a test near Prosser using 0.375 and 0.75 lb a.i./acre on about July 15, 1988, allowing for a six week harvest interval. I'll have to check with IR4 to see what plant parts or fractions are needed for residues.

I propose the following label based on the current Fusilade 2000 label and the perceived need:

For the control of annual and perennial grasses:
Apply a directed postemergence spray with ground application equipment at the rate of 0.375 lb a.i. per acre for perennial grass weeds and 0.25 lb a.i. per acre for annual grass weeds when weeds are 1-4 inches tall. Sprays may be applied from the time of weed emergence through July 15. Apply only one application per year. Do not harvest within 6 weeks after last application.

Always add one of the following:
Crop oil concentrate - add a nonphytotoxic crop oil concentrate or once refined vegetable oil concentrate containing 15-20% approved emulsifier, at 1% (1 qt per 25 gal) of the finished spray volume.

or

Nonionic surfactant - add nonionic surfactant containing at least 75% surface active agent, at 0.25% (½ pint per 25 gal) of finished spray volume.

Please comment on the proposed label or changes needed in the protocol.

Sincerely,

RICK A. BOYDSTON
Research Plant Physiologist

United States Department of Agriculture
Agricultural Research Service
Northwest Area
DEPT. OF CROP SCIENCE
OREGON STATE UNIVERSITY
CORVALLIS, OREGON 97331

Nov. 20. 1987.

To: Elaine Annen
Oregon Hop Commission
14358 Dominic Rd., Mt.Angel OR. 97362

From: Al Haunold, USDA-ARS
Crop Science Dept. OR. State Univ.,

Subject: Testing of Fusilade for control of grasses (esp. quackgrass).

Dr. Arnold Appleby called this moring as a follow-up of an earlier conversation regarding work towards registration of Fusilade for control of grasses in hop yards.

ICI America, the manufacturer, would be interested in obtaining registration and putting hops on the label.

We would cooperate with Dr. Appleby in field testing, harvesting of hops and arranging of trial brews with treated and untreated hops. Mr. Rick Boydsen, Prosser, WA would do similar field trials in Prosser and the Yakima Valley. Residue analyses of both hops and beer would be done by the OSU AG Chemistry department. (Mr. Marvin Montgomery).

Costs would be as follows (approximate):

$ 1,000.- for Appleby (field testing, application etc)

$ 4,000.- chemical residue analyses (OSU Ag. Chemistry)

No charge for my trial plots, harvesting, drying etc.

I will arrange for trial brews (costs-- if any-- would be minimal). I will make arrangements through Sam Likens and the Hop Research Council.

Registration will be pursued through IR-4 , a federal-state cooperative activity to work towards registration of pesticides for minor crops. Costs, if any, would again be minor.

Please discuss this proposal with the OR. Hop Commission.
We anticipate testing of Fusilade during the 1988 growing season.
Dr. Appleby thinks that one year's field trials will probably be sufficient.

cc. S.T. Likens
A.P. Appleby
Marvin Montgomery

United States Department of Agriculture
Agricultural Research Service
Northwest Area
DEPT. OF CROP SCIENCE
OREGON STATE UNIVERSITY
CORVALLIS, OREGON 97331

Fred Crowe, Superintendent
Central OR. Experiment Station
PO Box 246
REdmond, OR 97756

April 13, 1987.

From: Al Haunold
Research Geneticist

Subject: Verticillium cultures from C.E. Horner

I talked to Jack this morning and as far as he is concerned, you could have the cultures.

Jack is concerned however about your objectives and the pathogenicity of the cultures. Unless you are studying Verticillium per se, you might be better off to start with fresh material according to Jack.

The cultures in my refrigerator have been transferred repeatedly and there might have been a loss of pathogenicity. Mary Powelson (Botany Dept, OSU) is studying verticillium on potatoes. She probably has the best cultures and you could probably get starts from her.

Please let me know whether you still want Jack's cultures, they are available and I would gladly transfer them to you.

cc. C.E. Horner

I also contacted Dr. Mary Powelson, Plant Pathologist, OSU Botany Dept. She has no interest in these cultures, has most important verticillium strains already.

Central Oregon
Experiment Station

Oregon State University

P.O. Box 246
Redmond, Oregon 97756

April 9, 1987

MEMO TO: Al Haunold

FROM: Fred Crowe, Superintendent
Central Oregon Experiment Station

SUBJECT: Verticillium Cultures

Al, someone left me a message several weeks ago that you were looking to get rid of some Horner's verticillium cultures. If so, might we have them? What condition are they in?

Horner: don't know what his objective is
CEH talked to him 2 mo. ago.
Unless he is studying vert. per se - start with
fresh material. (path. genicity decreases after repeated transfers)
Mary Powelson (vert of potatoes) has prob.
the best set of cultures around.
(former CEH grad student isolated many Vert.
cultures - John McIntyre.)

Copy for Dr. Haunold

U. S. Department of Agriculture
Agricultural Research Service
Virology Laboratory
Dept of Botany & Plant Pathology
Oregon State University
Corvallis, Oregon 97331 U. S. A.

9 April 1988

Dr. Paul H. Hoskins
Senior Research Manager
Busch Agricultural Resources, Inc.
12855 Flushing Meadow Drive
St. Louis, Missouri 63131

Dear Paul,

Enclosed is a report on my 1987 Humulus-collecting trip in Kentucky, West Virginia, and North Carolina. The report is indeed long overdue. I have looked forward to this particular Saturday, for completing and sending the report.

The trip was strenuous (some 800 miles; long, hard days; 90 to 100 F; 70 to 90% RH), but very enjoyable. As usual, information from land-grant-university herbarium curators had been gathered, months ahead of the trip. The trip route, accordingly, was based on botanical records of Humulus observations or collections in the 3-state area.

As you will note from the report, native hops collected on Tug Fork of the Sandy River (Kermit, W.V.; Warfield, KY) turned out to be H. japonicus, the first ever collected/propagated in the history of the Corvallis hop program. These plants were so robust and typical of H. lupulus that we had no idea they were japonicus (i.e., annual plants) until they began producing an abundant seed crop followed by plant senescence/death! From some 20 plants collected and sent by express mail for propagation at the Repository, we obtained some 150 seeds. I believe these seeds should give adequate genotypic representation of the sampled population. This germplasm will be preserved very conveniently in the form of seeds. At present, there may be no feasible way of utilizing H. japonicus genes in the hop breeding program. However, they are a unique gene pool for possible future use.

I expect to conclude pressing research/writing tasks important to our current work, in the next 2 or 3 years, and would be willing at that time to give consideration to further exploration into native Humulus habitats, with the possibility of compiling

Dr. P. H. Hoskins, 9 April 1988, cont.

several years of data into a Busch-sponsored publication. The activity would be a distinct pleasure. In the meantime, I will still explore occasionally, as time/occasion permits (e.g., annual leave).

By far the most impressive natural population of Humulus that I observed between 1980 and 1987 is that of N.-central North Dakota, which reportedly also extends well into southern Manitoba. According to E. Small (Systematic Botany 3:37-76), this population is a mixture of H. lupulus var. neomexicanus and H. lupulus var. lupuloides. This vast habitat, I suspect, represents the greatest genotypic diversity of H. lupulus in North America, and deserves careful study and germplasm collection.

At the same time, natural populations in severely disturbed habitats elsewhere in North America need to be explored before they are completely extinguished. As indicated in a previous report, the once-abundant populations of central Iowa are now virtually eliminated.

Sincerely,

R. O. Hampton
Research Plant Pathologist

Humulus Exploration Trip 25 July - 2 August, 1987
Kentucky, West Virginia, Virginia, North Carolina

R. O. Hampton

25 July:
Departed Portland Airport 715 hr; arrive Cincinnati Airport 1430 hr; departed Cincinnati on Humulus search 1500 hr. Explored along Licking River (Kentucky), south of Cincinnati; then across northern Kentucky, exploring Ohio River watershed. No trace of Humulus observed before dark; overnight at Portsmouth, Ohio. Ticks abundant in this area; removed from body several times during day and days-end bath (this, I learned, would be a common occurrence throughout the trip).

Several reports of Humulus observations on the Licking River. The projected trip schedule did not permit careful search of the upper portion of the river, southwest of Vanceburg, KY.

26 July:
Explored lower Tygarts Creek, south of Portsmouth. Access to habitat very difficult, through privately owned land. Habitat seemed ideal. No Humulus observed in thorough search along creek bottom and creek-border areas. Abundant plant species encountered throughout this region included: morning glory, American ivy, wild grape, Virginia creeper, poke weed, sumac, sycamore, basswood, yellow birch, witch-hazel, maple, black and red oak, yellow buckeye, black walnut, black locust, and white pine.

Entered West Virginia W. of Huntington; proceeded south along Big Sandy River, stopping often along Hwy 52 to scan river-border habitat for vines/bines of any type. Very large population of Humulus observed along both sides of Tug Fork, in vicinity of Kermit, WV and Warfield, KY. Softwood cuttings taken from some 20 plants, over a north-south distance of 1,500 meters on W. side of river (private ownership of land on E. side made access difficult). Cuttings were carefully packed for express shipment to Corvallis. Overnight at Bluefield, WV.

Beginning in this area and continuing over much of the trip, heavy, tangled growth of kudzu-vine [Pueraria lobata (Willd.) Ohwi] completely covered habitats that would have seemed ideal for Humulus. The extent to which this plant could "choke out" and eliminate Humulus stands is unknown.

27 July:
Shipped Humulus cuttings to Corvallis Repository from Bluefield, via Express Mail; proceeded across SW Virginia and into North Carolina. Explored entire length of Cotton Creek, near Danbury, NC, to the Dan River; very thorough search of mouth area of Cotton Creek. Explored accessible points of Dan River in the Pine Hall area. In spite of prior reports of Humulus in this

area of numerous favorable habitats, none were observed. Working day ended at 2200 hr. Overnight at Winston-Salem, NC.

28 July:
Explored Yadkin River watershed SW to Hickory and NW to Boone. Explored Lewis Fork and Stony Fork; explored New River drainage system and Blue Ridge Parkway. Bottom lands appear to be excellent Humulus habitat. No Humulus observed. Overnight at Boone, NC.

29 July:
Searched literature at local college library, Boone; traveled N. to Damascus, VA and W. to Jonesville, with brief search along Powell River; travel to SW tip of Virginia. No Humulus observed. Overnight at Cumberland Gap, VA.

30 July:
Traveled N. to Pineville, KY; W. to Williamsburg and Hollyhill, KY; intensively searched Marsh Creek drainage area for 4 hr, between Hollyhill and Strunk, an area in which Humulus plants had been fairly recently observed by botanists. Habitat seemed ideal, but no Humulus plants were located.

Traveled N; explored crossings of the Cumberland River and Buck Creek. Overnight at Mt. Vernon.

31 July:
Explored N. along Dix River. Explored a very interesting, undisturbed habitat, along Copper Creek; observed several tree species of exceptional age, including an ancient sycamore that would have measured almost 5 meters in base circumference. Any natural stands of Humulus in this beautiful little area, I reasoned, would surely have survived to the present day. However, no Humulus was observed. Traveled N., reaching Lexington at day's end.

1 August:
Searched literature at University of Kentucky library. Traveled to Cincinnati area; searched briefly for Humulus near the confluence of the Licking and Ohio Rivers. Overnight at Erlanger, Ky. Concluded working trip and terminated expenses charged to hop-research funding (Ag. Research Found. Acc't 44.87).

Comments: Plants collected along the Tug Fork, in eastern Kentucky turned out to be H. japonicus, to the surprise of everyone. The cuttings rooted effectively. In some cases, secondary cuttings were also established. The plants produced abundant flowers, August-September, facilitating identification of male and female plants. All female plants bore seeds, which were carefully collected, November-January. All plants, because of their annual habit, had senesced and died by 31 January, 1988. Some 150 seeds, presently stored as a germplasm resource, at the National Clonal Germplasm Repository, Corvallis, were produced by these plants.

Appreciation is expressed to Busch Agricultural Resources, Inc., for payment of expenses associated with this trip.

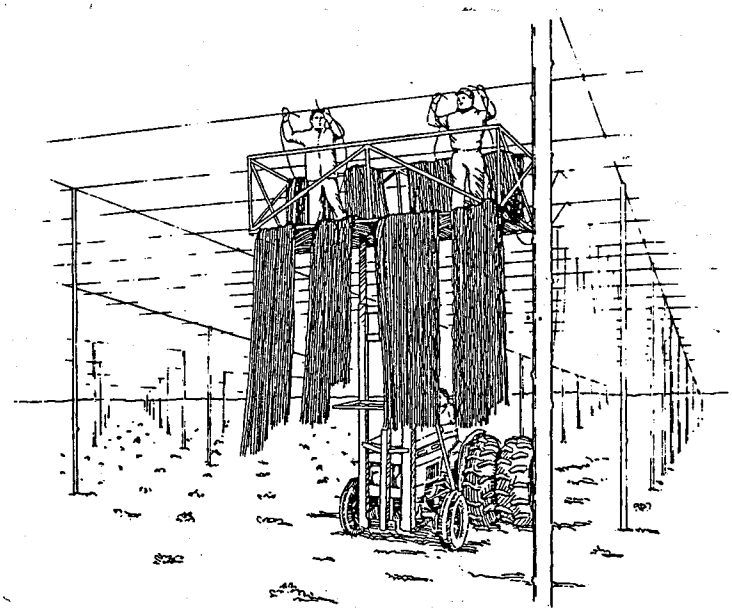
Additional notes of R.O. Hampton Native Humulus collection trip--1987.
communicated by telephone, Nov. 18, 1987.

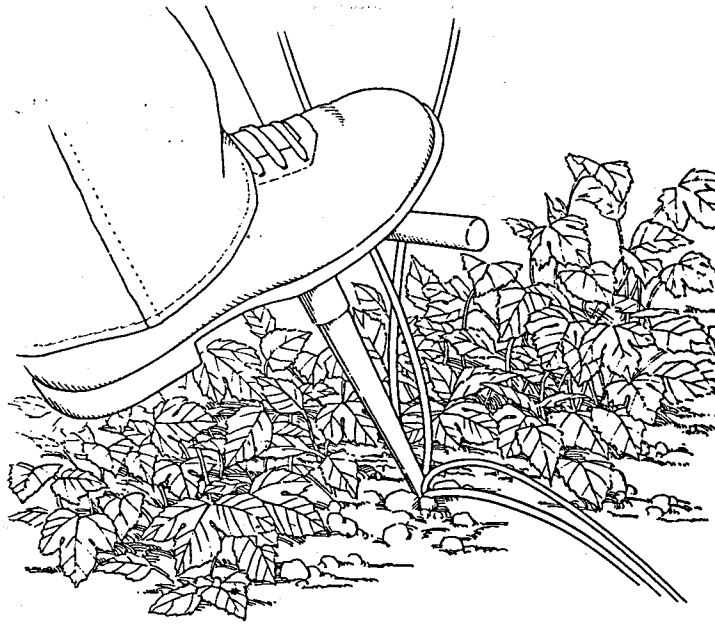
Most material was collected in eastern Kentucky in late July-early Aug. 1987. Two large boxes were shipped to the USDA Germplasm Repository near Corvallis (Jim Chandler). Poor propagation job--90% was lost. Remainder: both males and females; latter produced seeds when plants were 4-6" tall, males still shedding pollen in mid November. He has now 20-30 seeds. Plants are now under light, have not yet gone dormant.

I (A. Haunold) personally inspected the remaining plants in the Germplasm repository greenhouse on Nov. 23. Some plants were very weak, some have died already. They are most likely Humulus japonicus, the annual ornamental which is a different species and of no interest to the brewing industry or hop breeding and genetics. R. O. Hampton said, most plants were at least 14 ft tall in their native habitat when they were collected in July 1987.

Recommendations: put the seeds obtained into cold storage, let the plants go dormant and die, do not waste too much efforts in keeping them alive. They are annuals and propagate from seed. Do not make any more efforts to collect H. japonicus in the future.

Strong. Easy-to-handle. Biodegradable. Fast becoming the first choice of hop producers throughout the world.



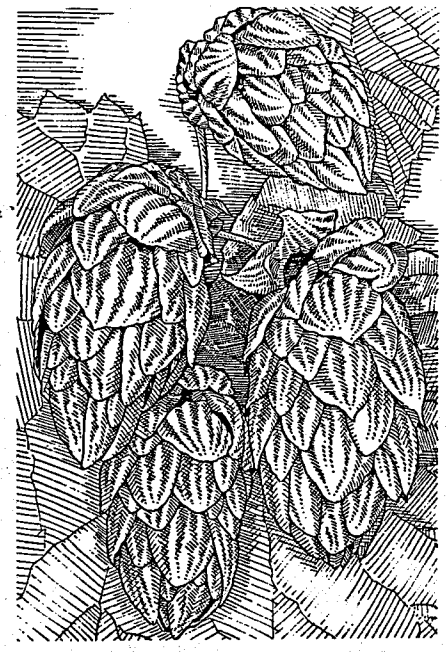


"Paper Twine is so easy to handle, once we're ready to begin, we can start stringing in 20 minutes. We've eliminated the 24-hour lag period needed to soak coir. We've eliminated one piece of equipment in our operation. And we've significantly increased the number of acres we can string in a day."

Ted Durfey, manager
Emerald Acres
Yakima Valley, Washington

"Portco Paper Twine deteriorates in the ground after a season. Coir got into the equipment, increased our down-time, and was generally a nuisance."

Frank Fobert, owner
Fobert Brothers Inc.
Willamette Valley, Oregon



"Last year I used Paper Twine on 65 acres. This year, I'm using it on 188 acres. I've found paper to be very strong, and the vines cling to it well."

Ray St. Mary, hop grower
Yakima Valley, Washington

"Once we twine our fields, we can forget all about it—even at harvest time. There's simply less tendency for paper to wrap up in the picking machine."

Mike Kerr, partner
Capitol Farms Inc.
Salem, Oregon

Strong and effective

Portco Paper Twine is composed of twisted paper specially treated to maintain its strength, even when wet. The fibrous nature of Paper Twine ensures that vines will readily cling to it. And Paper Twine has been proven to effectively support vines throughout the growing season in a variety of weather conditions.

Consistent

Growers can expect uniformity with every order of Portco Paper Twine. Manufacturing of the product is carefully monitored throughout our automated facility, ensuring that there are no weak spots—and that every string meets customer expectations.

Completely biodegradable

Portco Paper Twine quickly decomposes and is completely absorbed into the soil within a season. There are no remnants of twine left cluttering the field; no strings to wrap or clog your equipment. Hop growers are reporting significant labor savings in spring yard preparation, alone.

Easy-to-handle

Portco Paper Twine is field ready, easy to transport and easy to handle because the product comes on pallets, not in bales. Presoaking of Paper Twine is not necessary prior to twining. And the need for mechanical lifting of bales or removing of chains is eliminated. Crews are loading more product on their twining sleds and, due to fewer stops and starts, increasing daily productivity.

Easy-to-tie

The smooth texture of Paper Twine is easy to tie, easy on hands, and tangles less during twining. Growers are reporting a significant increase in the number of acres their crews can twine in a day.

Higher density

The density of Paper Twine allows twining crews to continue working in almost any weather, including windy or gusty conditions. Managers can plan specific days for twining, *knowing* they can proceed right on schedule.

Readily available

Portco manufactures Paper Twine all year round, ensuring steady supplies to all hop growing regions of the world. Portco's prime location on the Columbia River in Vancouver, U.S.A., means that pallets of product can be readily shipped by container to any destination.

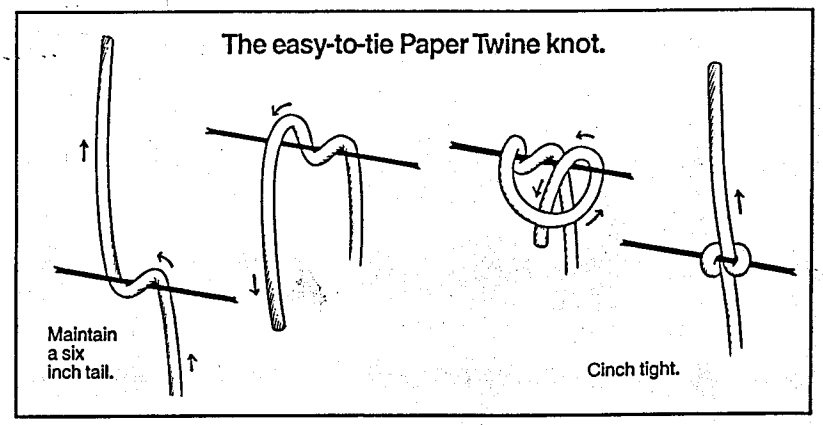
Every pallet of Portco Paper Twine meets strict quality control standards. One pallet consists of 44 hanks; one hank being 300 strings. Product yield is 200 ft. per pound.

Portco also produces Paper Hop (arch) Ties in any customer specified length. Product yield is 500 ft. per pound.

TYPICAL TENSILE TEST ON VARIOUS HOP TWINES AND WIRE*

	Strength in lbs. force			
	DRY		WET	
	Range	Ave.	Range	Ave.
Coir (England)	40- 73	55	30- 38	34
Coir (U.S.A.)	68-100	82	54- 83	66
Steel Wire (Germany)	105-107	106	105-107	106
Portco Paper Twine	110-130	120	90-120	105

*Tests conducted at Portco testing facility on Dillon Dynamometer. Portco routinely conducts tests on competitive samples submitted by customers. Based on these tests and individual customer needs, Portco can recommend a paper twine substitution for every hop application.



PORTCO

4200 Columbia Way
Vancouver, WA 98661
(206) 696-1641
FAX# 206-695-4849

United States Department of Agriculture

Agricultural Research Service

Quarterly Report of Selected Research Projects

April 1 to June 30, 1987

CONTENTS

Report on hops prepared by Howard Sherman, ARS Research Reporter. USDA-ARS Info. Staff, 800 Buchanan st. Albany, CA 94710

New & Improved Products

- New European-type hops, based on the Hallertauer mittelfrueh hop, prized for its Old World beer flavor and aroma, may be available to U.S. brewers by 1990. Over the past 20 years in Germany, the original hop has fallen victim to verticillium wilt, a fungal disease. Acreage dropped about 80%, and the hop virtually disappeared from world markets. As a result, many European hop growers were forced to switch to higher yielding, healthier varieties. Now, after 12 years of breeding and genetics research, an ARS plant geneticist has successfully crossed a genetically modified Hallertauer mittelfrueh with other European hops. U.S. hop growers will have a choice of three to five flavorful new selections that are high-yielding and disease-resistant. The new hop could bring growers in Oregon, Idaho, and Washington $15 million or more a year.
Horticultural Crops Research Lab, Corvallis, OR
Alfred Haunold, (503) 757-4424

US brewers may get European hops

Associated Press

WASHINGTON — An Agriculture Department plant geneticist says a European-type hop, prized for its ability to impart Old World flavor and aroma to beer, may be available to U.S. brewers by 1990.

Alfred Haunold, with the department's Agricultural Research Service in Corvallis, Ore., said the original hop, called Hallertauer mittlefrueh, has a rich aroma and many other desirable traits.

"Over the past 20 years, this superior hop has fallen victim to verticillium wilt, a fungal disease," Haunold said in an agency report. "Acreage has dropped about 80 percent in Germany, and the hop has virtually disappeared from world markets. As a result, many European hop growers have been forced to switch to higher-yielding, healthier varieties."

But Haunold has successfully crossed a genetically modified Hallertauer mittelfrueh with other European hops, resulting in five flavorful new selections that are high-yielding and disease resistant, the report said.

Within three years, U.S. hops growers may be harvesting one or more of the new varieties. Haunold said at least three major U.S. brewers are interested in the new selections, and at least two Japanese companies are interested.

THE FRESNO BEE Sunday, May 24, 1987

B6 3M May 27 - 1987

The Oregonian

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WEDNESDAY, MAY 27, 1987

New hope for hops

American farmers have been losing some of their markets abroad, but research at Corvallis holds the promise of reversing the trend in at least one commodity. The beneficiaries would be the hop growers of Oregon and Washington, plus perhaps the brewers and beer drinkers who consume their products.

Additional varieties of hops are far enough along in their test plots that one or two, conceivably as many as five, will be ready for commercial production in 1990 or 1991. They are intended to complement the hops now grown, and compete with European strains now imported. Foreign as well as domestic brewers have expressed interest, so they might even develop into an export crop.

Indeed the new varieties come from old European-style hops. They are the results of the research of Alfred Haunold of the U.S. Department of Agriculture's research service in Corvallis. He has taken a German hop, rich in flavor and aroma but ravaged by disease, and linked it genetically to hardier stock.

Indications are of a product with a proven Old World flavor, a bountiful yield and resistance to disease.

While the new strains might not expand acreage substantially, they could provide stability and broader markets for growers left with uncertain circumstances since the Department of Agriculture more than a year ago dropped a marketing order that set rigid limits on production.

When possible to achieve, an expanding market offers a solution for U.S. productivity much to be preferred to a restricting marketing order.

The Idaho Statesman

1200 NORTH CURTIS ROAD
P.O. BOX 40, BOISE, IDAHO 83707

Farm Sunday, May 31, 1987

USDA hopes to add hop to U.S. growing options

A European-type hop called *Hallertauer mittelfrueh*, prized for the Old World flavor and aroma it gives beer, may be available to U.S. brewers by 1990, according to a U.S. Department of Agriculture geneticist.

"American companies import about 15 million pounds of hops a year," said Alfred Haunold, of the USDA's Agricultural Research Service in Corvallis, Ore. "Homegrown *Hallertauer* could cut this figure in half and bring hop growers in Oregon, Idaho and Washington an additional $15 million or more a year."

Over the last 20 years, Haunold said, *Hallertauer* has fallen victim to verticillium wilt, a fungal disease. Acreage has dropped about 80 percent in Germany, and the hop has virtually disappeared from world markets. Consequently, many European hop growers have switched to higher-yeilding, healthier varieties.

But after 12 years of work, Haunold has crossed modified *Hallertauer* with other European hops and come up with five varieties that are high-yeilding and disease-resistant. They will be available to American growers within three years, he said.

Haunold
754-2962
503

Old-World Beer Flavor: Lost and Found

A European-type hop, prized for its old-world beer flavor and aroma, may be available to U.S. brewers by 1990, according to a U.S. Department of Agriculture plant geneticist.

"The original hop, called Hallertauer mittelfrueh, has a rich aroma and many other desirable traits," said Dr. Alfred Haunold, with USDA's Agricultural Research Service in Corvallis, OR.

"Over the past 20 years," Haunold said, "this superior hop has fallen victim to verticillium wilt, a fungal disease. Acreage has dropped about 80% in Germany, and the hop has virtually disappeared from world markets. As a result, many European hop growers have been forced to switch to higher yielding, healthier varieties.

Now, however, Haunold has successfully crossed a genetically modified Hallertauer mittelfrueh with other European hops and come up with five flavorful new selections that are high yielding and disease resistant. Within three years, U.S. hops growers may be harvesting one or more of these.

The five new hops are the result of 12 years of breeding and genetics research. Haunold said they have "the aroma and flavor of their Hallertauer mittelfrueh parents and twice their yield."

He added that at least three major brewers in this country are interested in the new Hallertauer selections.

"American companies import about 15 million pounds of hops a year," he said. Home-grown Hallertauer could cut this figure in half and bring hop growers in Oregon, Idaho and Washington an additional $15 million or more a year.

"Our new Hallertauer selections could also boost exports of U.S. hops," he said. Of the $100 million worth of hops grown in this country each year, half are exported.

"At least two large Japanese brewing companies are also interested," he said. "Beer drinkers there like an aromatic brew with Hallertauer's herbal, spicy, hoppy, slightly bitter taste."

American brewers," he said, "want a hoppy flavor that blends well with other flavor components in the beer. These new selections will do that for them."

THE REGISTER-GUARD, Eugene, Oregon, Sunday, July 26, 1987 Page 5B

There's new hope for hops

Disease-resistant strains could revitalize industry

By The Associated Press

SALEM — A promising new strain of hops scheduled to make its first appearance in 1990 could put a new kick into Oregon's sagging hop-growing industry.

"Conditions looked so bad a few years ago that lots of fields were idle," said Herman Goschie, who has been growing hops near Silverton since 1941. "In some cases, the fields were taken out completely."

Brewery giant Anheuser-Busch Inc. of St. Louis, Mo., gave the industry a boost last spring by offering hops growers lucrative new five-year contracts.

A U.S. Department of Agriculture researcher has now perfected a new breed of hops that could mean as much as $15 million to the hops industries of Oregon, Washington and Idaho.

Dr. Paul Hoskins, president of the Hops Research Council and an Anheuser-Busch spokesman, called the experiment one of the industry's most important developments in a decade.

Interest in the experiment "grew much faster than I ever expected," said geneticist Dr. Alfred Haunold. Almost every major brewery in the country is involved in the project, he said.

Haunold spent 10 years developing five new varieties of disease-resistant hops that mature quickly and produce a high yield.

The new breeds have been planted on five different Oregon farms in four-acre plots. The first harvest of the European-style hops is expected in about a month, with the first full harvest planned for 1990.

Increased brewery efficiency and more potent hops have decreased the need for the plant, putting some farmers out of business and forcing others to reduce their acreage. Deregulation in 1985 also caused the traditionally stable industry to become more cyclical.

The contract price for hops dropped to about 50 cents a pound during the recession years of the early 1980s. The top price now is about $2.40 a pound, while farmers' production costs run between $1.50 and $2 a pound.

Patrick Leavy, chairman of the Oregon Hop Commission, said the new hops could find a market with domestic producers that import their hops from West Germany.

Corvallis Gazette Times B

Sunday, July 26, 1987

New variety boosts ailing hop industry

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At one time there were 40,000 acres of hops growing in the Willamette Valley, Haunold said. Now, about 30 farmers grow an estimated 7,500 acres of hops in Oregon, most of them in Marion County. Oregon remains the nation's second largest producer of hops.

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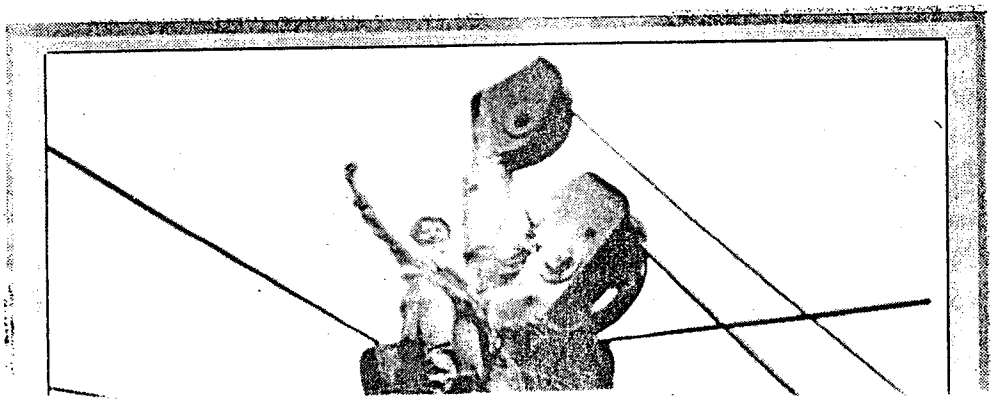
Producers also could make a dent in the export market with the new varieties.



CAPITAL PRESS (weekly)
Ontario, Oreg.

7/31/87

HOP TOPIC — Researcher Al Haunold briefed participants of a Oregon hops field day about new varieties being tested at the Herman Goschie Farm near Silverton. (Photo by Francis Dairy)

Variety tests highlight hops day

By FRANCIS DAIRY
For the Capital Press

SALEM, Ore. — Approximately 75 growers, dealers, bankers and others invaded fields at several hop farms at a recent tour.

For many it was hard not to wander into the hop field, pluck off hops, crush them between their fingers and take in the aroma.

The tour started at Don and Carol Weathers' farm northwest of Salem in the Mission Bottom area and ended at Stauffer Farms Inc. located in Hubbard, said Elaine Annen, executive secretary for the Oregon Hop Commission.

The purpose of the tour was to educate people within the industry area, said Steve Colman, president of the Oregon Hop Growers Association.

The new plants are being developed and studied by Dr. Al Haunold, a researcher for the USDA who is stationed at Oregon State University.

Presently there are five different cross-breed plants being studied on three-acre test plots in Oregon, Washington and Idaho, he said.

The plants are of the Hallertau Hop variety. At this time they are being identified by numbers only. The new hop is of low alfa, or is less bitter. Two breweries are looking at the hop for experimental brewery trials, he said.

The same type of hop is grown in Germany but production is declining by 10 percent a year. The hop does not produce well in Germany, so farmers are not replanting that particular variety, explained Coleman.

Once the plant is put into the ground it takes two years before it can be harvested.

Last year the test crops got off to a bad start due to weather conditions, he said.

This year the weather has caused some varieties to bloom too soon, cutting production, added Annen.

Later maturing crops have been less affected by the weather and are expected to have a good to average year. The tour ended with a crawfish feed and refreshments.

D6 THE SUNDAY OREGONIAN, AUGUST 9, 1987

Hops make heady work for U.S. growers

Complex and costly, 'unique' crop is a source of pride in the West

By WARD SINCLAIR
LA Times-Washington Post Service

MOXEE, Wash. — The scene is arresting, moving from the arid sagebrush desert east of the Cascades into the lush, irrigated foothills, as Leslie Roy's intricate contraptions loom on the horizon.

Acres and acres of heavy fir poles rise 18 feet, crisscrossed on top by taut wires and linked to the ground by strands of hand-spun Indian coconut-fiber yarn (seven miles of it to the acre).

Roy's crop twines around the strands and spirals upward toward the sun, forming golden buds that soon will go to market.

There is nothing comparable in American agriculture, in complexity or capital investment or hand-labor demands. This is a world center of hops production, and Roy, with 750 acres covered with trellises, is one of the world's larger growers.

Roy is one of about 150 U.S. farmers who grow hops, a rough, twining vine whose flowers give beer flavor and aroma, preserve the brew and stabilize foam. Yakima Valley "yaks" — as they are known in the brewing trade — account for roughly two-thirds of the 33,000-acre U.S. crop and are prized worldwide for their quality. Oregon and Idaho grow most of the rest of the crop.

> Hops growing is "so expensive that it's hard for someone to get into the business."

A question arises. Given the heavy start-up costs (a custom-built harvesting machine goes for $750,000), why would farmers bother with hops when they could grow other crops with much more ease and possibly just as much profit?

Roy's answer — that "it's unique" — is another way of saying that he and his hop-growing colleagues take pride in knowing they are among the country's few producing a crop as important in its own way to satisfying the palate as exotic herbs or durum wheat.

"It's a way to make a living," Roy said. "It can be as profitable as any agricultural commodity if the market is right. But then, the returns really don't justify the investment. ... It's very capital-intensive, very labor-intensive, so expensive that it's hard for someone to get into the business."

Which says it all. Roy, an agricultural economist, inherited a family-farming tradition that goes back to the turn of the century, when his grandfather came to the Yakima Valley from Quebec and began growing hops.

Roy's father, who oversees the family's vast operations here, carried on the hops tradition and expanded the plantings. Roy now is the major-domo of the hops, and three brothers tend to other aspects of the family's apple and cherry growing, marketing and management.

The Roy farm produces 11 varieties of hops, each of which has a different demand cycle and a different use in the brewing process. A large greenhouse is maintained for root propagation of new and hard-to-find varieties that the Roys speculate will be in demand.

"A lot of new varieties are coming on," Roy explained, "but it takes 10 years to develop a new one. We grow them because we want to stay ahead of the others. ... For example, we're now trying to raise more aromatic hops. We used to do only the bitters, and the Europeans raised the aromatics. Now they're doing more of the bitters."

New York was the top hops producer in the early 1900s, but the industry was drawn west by the appeal of dry climate (preventing mildew), long hot summer days and cool nights, and ample water for irrigation.

The Yakima Valley's primacy as a growing zone has brought major dealers, processors and shippers here to handle each fall's crop.

Work on this year's crop began late last winter as field hands strung new twines, braced trellis poles and put in new plants. As the hop plants begin to grow, they must be trained by hand onto the twines, and since chemical companies have not developed a weed-killer suitable for hops, the crowded rows between the poles must be cultivated by hand.

When the harvest begins late this month, the Roys' picking machines will work around the clock until the crop is in — probably at the end of September. The vines will be picked clean of the hop flowers, which will then be moved into drying rooms to reduce moisture content and sealed into 200-pound bales ready for the brewery.

> "We grow (new varieties) because we want to stay ahead of the others."

Last year was one of the best in a long time for Washington hops growers, with an average price of $1.62 a pound for a crop that averaged 2,000 pounds an acre. A Washington State University study in 1985 found that a price of $1.52 was necessary to turn a profit.

Despite the better fortune last year, all is not well in the hops industry. Although beer production increases, the hopping rate has declined steadily for two decades as nationally marketed brands turn to more blandness and uniformity.

The pressures of subsidized competition from Common Market growers and a large world surplus in recent years have pushed some U.S. growers out of the business in what Bill Harris of the Hop Growers of America calls "a terrible wringing-out process."

While its growers' tracts are much smaller than those here, West Germany continues to lead the world in hops production and commands a certain market share based simply on the German reputation for making high-quality brew.

"We feel our potential is greater for capturing markets because of the consistency and quality and varieties that we grow here," Harris said. "We're certain that production will be larger in the years ahead; we think markets will increase. And we hope many farmers who were pushed out will be back as the markets improve."

CAPITAL PRESS (Salem, OR): Sept. 11, 1987.

Corvallis researcher breeds 5 hop strains

WASHINGTON (UPI) — Beer connoisseurs, take heart!

A government scientist has recaptured the Old World flavor and aroma of beer by breeding new varieties of a European-type hop that fell victim over the years to a fungal disease.

Brewers have been using flowers of the hop vine to impart character to beer for at least 1,200 years, but some of that quality has been lost over recent decades.

By combining the best from the past and the present, modern genetic research techniques are expected to make new flavorful varieties available to American brewers by 1990.

The original hop, called Hallertauer mittelfrueh, has been lost over the last 20 years to a fungal disease called verticillium wilt. With acreage down about 80 percent in Germany, it has virtually disappeared from world markets and European hop growers have been forced to switch to higher-yielding, healthier varieties.

Flavor can have a high priority once again now that Alfred Haunold, a plant geneticist with the Agriculture Department's Horticultural Crops Research Laboratory in Corvallis, Ore., has successfully crossed a genetically modified Hallertauer mittelfrueh with other European hops.

Haunold produced five flavorful new hops selections that are both high-yielding and disease-resistant. The hops, the result of 12 years of breeding and genetics research, have the "aroma and flavor of their Hallertauer mittelfrueh parents and twice the yield," he said.

Haunold's lab is in the hops-growing region of the United States. Growers, mostly in Washington, Oregon and Idaho, produced 49 million pounds of hops in 1986. Washington's production was 35.5 million pounds.

Compared with 1985, harvested area declined 11 percent to 25,000 acres while the average yield per acre increased by 11 percent to 1,958 pounds.

BREWERY GIANT SWALLOW HUELL: (translation on following pages):

Wolnzacher Anzeiger, April 2, 1987.

Seite 18 / Nummer 77
Donnerstag, 2. April 1987

WOLNZACHER ANZEI
Amtsblatt für den Markt Wolnzach

Überraschende Neuigkeit:

Brauerei-Riese verleibt sich Hüll ein

Anheuser-Bush und Deutsche Gesellschaft für Hopfenforschung fast handelseinig

Wolnzach/München. Ein Gerücht gärte in den letzten Tagen in den Köpfen vieler Hallertauer Landwirte: „Stimmt es, daß das Hopfengut in Hüll an Anheuser-Bush verkauft wird?" In der Mitgliederversammlung der Deutschen Gesellschaft für Hopfenforschung im Münchner Spatenhaus ließ der Vorsitzende Dr. Beer die Spekulationen zur offiziellen Mitteilung werden: „Die Firma Anheuser-Bush hat uns großes Interesse für das Gut bezeugt". Bis auf Kleinigkeiten bestehe weitgehende Übereinstimmung mit dem amerikanischen Brauerei-Giganten. Bedenken gegen den Verkauf des Gutes äußerte Josef Schrag, stellvertretender Vorsitzender des Hopfenpflanzerverbandes: „Diese Entscheidung sollte nicht nur von finanzieller, sondern auch von ideeller Seite beleuchtet werden".

Mit einer leichten zeitlichen Verzögerung – die Diskussionen in der vorausgegangenen Sitzung des wissenschaftlich-technischen Ausschusses der Gesellschaft hatten sich etwas länger als geplant hingezogen – eröffnete Dr. Beer die traditionelle Mitgliederversammlung der Deutschen Gesellschaft für Hopfenforschung in München. Zahlreiche Mitglieder, darunter Vertreter aus der Brauwirtschaft, vom Landwirtschaftsministerium, von der Europäischen Gemeinschaft sowie etlicher weiterer Gremien waren der Einladung der Gesellschaft gefolgt.

Rückblickend auf die Hopfenjahre 1985/86 schnitt der Vorsitzende der Gesellschaft die hinlänglich bekannten Probleme an, die dem deutschen Hopfenbau auch in diesen Tagen noch zusetzen. Sein Dank galt allen Gremien, die im letzten Jahr durch ihren Einsatz mitgeholfen haben, für die 86er Ernte eine Ausnahmeregelung herbeizuführen. Keine rasche Entspannung erwartet Dr. Beer für die momentan prekäre Situation, in der den deutschen Hopfenpflanzern noch kein Mittel zur Blattlausbekämpfung zur Verfügung steht.

Die aktuelle Mißlage würde bestätigen, was die Gesellschaft über Jahre hinweg gepredigt habe: „Wir arbeiten nur dann wirtschaftlich, wenn wir höchste Ansprüche an die Qualität stellen", so Dr. Beer. Hinsichtlich der Importgenehmigung für ausländisches Bier, das nicht dem deutschen Reinheitsgebot entspricht, setze die Gesellschaft auf die Schlagkraft des reinen deutschen Bieres: „Das Reinheitsgebot ist für uns kein Gesetz, sondern eine Selbstverständlichkeit".

Nach dieser Stellungnahme zur aktuellen Situation ließ Dr. Beer die Katze aus dem Sack. Die Mitteilung, daß die Gesellschaft hinsichtlich eines eventuellen Verkaufs des Hüller Hopfengutes in Verhandlungen mit der größten Brauerei der Welt, Anheuser-Bush, stehe, kam für einige Mitglieder recht überraschend. Schon seit mehreren Monaten, so Dr. Beer, seien Gespräche mit Anheuser-Bush im Gange. Die US-Brauerei habe ihr großes Interesse für das Hopfengut in Hüll bekundet. Im Interesse der Hopfenforschung sei sie an dem Gut interessiert. „Zwar sind noch einige weitere Gespräche notwendig, im großen und ganzen sind wir uns über den Verkauf jedoch schon einig geworden. Außer dem Grundbucheintrag würde sich in Hüll absolut nichts ändern. Der Präsident der Landesanstalt für Bodenkultur und Pflanzenbau Dr. Melian fügte hinzu, Staatsminister Dr. Hans Eisenmann stehe einem Verkauf positiv gegenüber, falls die Sacharbeit in Hüll nicht negativ beeinflußt werde.

Nicht so recht einverstanden mit dem Verkauf des Gutes ist Josef Schrag, der im Auftrag des Vorsitzenden des Hopfenpflanzerverbandes Georg Seebacher sprach. Dieser „weittragende Schritt" wolle doch eingehend überlegt sein. Ihm persönlich täte es sehr leid, wenn das Gut „amputiert" würde. Trotz seiner Bedenken äußerte Schrag Verständnis aus ökonomischer Sicht, aus der Sicht der Landwirte hätte das Gut aber immer zu Hüll gehört. „Daß ausgerechnet unser bester Aromakunde die Hand nach Hüll ausstreckt, ist ein wirkliches Dilemma", meinte Schrag. „Ich bin jedoch sicher", meinte er an den europäischen Einkaufschef der Brauerei Willy Buholzer gewandt, „daß Ihre Brauerei auch ein anderes Gut in der Hallertau finden wird".

Anfangs sei er auch „total gegen einen Verkauf gewesen", gestand Geschäftsführer Hermann Schlicker. „Gefühle und Emotionen passen aber nicht in eine Gewinn- und Verlustrechnung". Als ihm der eventuelle Kaufpreis und der wesentliche Beitrag für die Forschung bewußt wurde, seien all seine Bedenken verschwunden. Im Statut der Gesellschaft sei eine Aufgabe klar verankert, die Leitlinie für alle Entscheidungen sein müsse: „Wir betreiben keine Landwirtschaft, sondern dienen einzig der Forschung". Daß ein Verkauf des Gutes einen Beitrag zur Forschung leiste, sei unbestritten.

„Es gibt kein besseres Tandem als Anheuser-Bush und Hüll", meinte Willy Buholzer. Einzige Motivation der US-Brauerei für einen Kauf sei der Gedanke gewesen, gemeinsam mit Hüll der Forschung zu dienen. Überrascht zeigte sich der Einkaufschef, daß gerade von der Pflanzerseite her durch Josef Schrag Bedenken geäußert wurden. „Haben Sie keine Angst vor dem Giganten Anheuser-Bush", wandte er sich an Schrag. Durch ihre unmittelbare Nähe zur Hallertau und Forschung wolle die Brauerei dem Hopfen nur etwas Gutes tun und die Handelsbeziehungen zwischen den USA und Deutschland wieder verstärken.

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WOLNZACHER ANZEIGER, Official Newspaper for Wolnzach Markt

Page 18 / No. 77
Thursday, April 2, 1987 - Translated by Alfred Haunold, USDA, Corvallis, OR

Surprising News:

Brewery Giant Swallows Hüll

Anheuser-Busch and German Society for Hop Research Near Agreement

Wolnzach/Munich. A rumor was circulating the last few days among many Hallertauer farmers: "Is it true that the Hop Research Farm in Hüll is being sold to Anheuser-Busch?" During the membership meeting of the German Society for Hop Research in the Spatenhaus Restaurant in Munich the president Dr. Beer confirmed the speculation and made it official: "The Anheuser-Busch company has expressed great interest in the farm." With exception of details there is wide ranging agreement with the American brewery giant. Concerns against the sale of the farm were expressed by Josef Schrag, the assistant president of the Hop Growers Association: "These decisions should not only be looked at from the financial but also from the ideological side."

With a slight time delay - the discussions of the previous meeting of the Scientific-Technical Committee of the Society took somewhat longer than planned - Dr. Beer proceeded with the official opening of the traditional member meeting of the German Society of Hop Research in Munich. Many members, among them also representatives of the brewing industry and, the Ministry of Agriculture, the European Economic Community and other trade associations had accepted the invitation.

Looking back to the hop production years 1985/86 the president touched on some well-known problems which are still plaguing the German hop industry these days. He expressed thanks to all the trade associations which helped during the past year with their influence in order to achieve an exemption regulation for the 1986 crop. Dr. Beer does not expect a rapid lessening of the tensions, particularly with regard to the present critical situation when the German hop growers find that they do not have an acceptable chemical control for aphids.

The present critical situation confirms what the Society has talked about for years: "We are only then able to work economically when we put the highest demands on quality", according to Dr. Beer. With regard to the

import licenses for foreign beer which does not conform to the German purity law (Reinheitsgebot) the Society relies on the effectiveness of the pure German beer: "The purity law is not a law for us but a common sense situation."

After these statements regarding the actual situation Dr. Beer let the cat out of the bag. The announcement that the society has been in discussions regarding a possible sale of the Hop Research Farm at Hüll to the largest brewery of the world, Anheuser-Busch, came as a surprise for many members. For many months already, according to Dr. Beer, discussions have been going on between Anheuser-Busch and the Society. The U.S. brewery expressed their keen interest for the hop research farm in Hüll. It is the interest in hop research above all that stimulated their attraction to this research farm. "Some more discussions are still necessary, but overall we have reached an agreement regarding the sale. In addition to the official transaction which has to be recorded in the proper documents, there would not be any change in Hüll." The president of the Bavarian Institute for Soil Culture and Plant Production Dr. Melian added that agriculture minister Dr. Hans Eisenmann also views the sale as a positive development, provided the actual research work in Hüll is not affected in any negative fashion whatsoever.

Josef Schrag, however, is not quite pleased with the sale of the research farm and he expressed his opinion in the name of the president of the Hop Growers Association Georg Seebacher. This "far-reaching step" should be considered in much greater detail. Personally he would be very sorry if the research farm would be "amputated". Despite his concern Schrag expressed understanding from an economic point of view, but from the view of the farmers the research farm always was an integral part of Hüll. "The fact that especially our best aroma customer has reached for Hüll is a real dilemma", said Schrag. "I am certain, however", and he addressed these comments to the head of the Purchasing Department of the brewery Mr. Willy Buholzer, "that your brewery would be able to easily find another hop farm in the Hallertau area."

In the beginning he also was "totally against the sale" according to the managing director Hermann Schlicker. "Feelings and emotions, however, do not fit a win-loss balance." When he became aware of the possible purchase price and the substantial contribution to hop research, all his

concerns disappeared. The statutes of the Society make it quite clear what the guidelines for all decisions would have to be: "We do not run a farming operation but we are only serving research." There can be no doubt that the sale of the research farm is a contribution to research in itself.

"There is no better team than Anheuser-Busch and Hüll" according to Willy Buholzer. Some motivation of the U.S. brewery for the purchase was the thought to serve hop research in cooperation with Hüll. The head of the Purchasing Department was surprised that especially from the side of the hop growers concerns were expressed through Mr. Josef Schrag. "Do not be afraid of the giant Anheuser-Busch" - and he addressed this remark to Schrag. The brewery is only concerned to do a good deed for hops, particularly through its immediate proximity to the Hallertau area and hop research and is primarily interested to strengthen the trade connections between the United States and Germany.

Additional comments by A. Haunold

I have recently learned from additional sources in Germany that this sale apparently covers only the 40 hectare (100 acre) research and production farm associated with the Hans Pfuelf Institute for Hop Research at Huell, but not the Research Institute itself. The German Society, a semi-private organization, together with the German Brewery Association, the State of Bavaria and the German Federal Government, has supported the Research Institute since its creation in the early 1920's. Most of the 40 professionals and support workers at the Institute as well as the operation of the Hans Pfuelf Institute *per se* may not be affected directly by the sale. There can be no doubt, however, that the association of Anheuser Busch Inc. and Huell will have a substantial impact on German hop research.

Excerpt from the Ilmgaukurier: Jan. 25, 1988.

Hop Asparagus, a new delicacy from the German hop industry:

spring shoots resemble asparagus, taste delicious, bring 130 Marks/ kilogram, about $ 40.-/ lb.

cut hop shoots about 3" long, about 1/4 inch diameter, eat with various dressings.

Belgian and French connosseurs are enthusiastic about the new vegetable.

Note of caution for the hopgrowing industry. One acre of hops would go a long way to satisfy consumer demands.

Bayerische Gourmets entdecken Hopfensprossen als Schmankerl

Das seltene Produkt kostet 130 Mark pro Kilogramm

Weihenstephan (lb) Hopfen als eine der Grundsubstanzen für das nach dem Reinheitsgebot gebraute Bier soll schon bald ein Leckerbissen in der bayerischen Schmankerlküche sein. Professor Dietrich Fritz vom Lehrstuhl für Gemüseanbau der Technischen Universität (TU) München in Weihenstephan will Ende Januar die ersten Hopfensprossen aus institutseigenen Anbauversuchen als exklusivstes aller Gemüse auf dem bayerischen Markt anbieten.

In Belgien und Frankreich erfreuen sich Hopfensprossen nach einer Mitteilung der TU vom Samstag schon seit längerem großer Beliebtheit. Das Gemüse werde dort mit einem durchschnittlichen Preis von 130 Mark pro Kilogramm über die Versteigerung gehandelt, denn nur rund zehn Gramm Hopfenspitzen können in zwei Ernteperioden jährlich von einer Pflanze geerntet werden.

Beim Anblick der etwa sechs Zentimeter langen und einen halben Zentimeter dicken bleichen Hopfenspitzen denke man zwar unwillkürlich an Miniaturspargel. „Der andersartige, aromatische Geschmack und die feine Textur belehren den Feinschmecker jedoch eines Besseren", so Fritz, der die Zubereitung für die sündteuren Spitzen gleich mitliefert: gegessen werden sie in gekochtem, spargelähnlichem Zustand.

Ilmgaukurier 25. I. 88