Report

of

COOPERATIVE HOP BREEDING PROJECT

1936

R. E. Fore

36

Hop breed.

Report Of

COOPERATIVE HOP BREEDING PROJECT

Division of Drug and Related Plants

Bureau of Plant Industry

United States Department of Agriculture

and

Oregon Experiment Station

Corvallis, Oregon

January 1, 1936

to

December 31, 1936

By

R. E. Fore, Agent

Division of Drug and Related Plants

Bureau of Plant Industry

United States Department of Agriculture

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

The following report is submitted for the calendar year 1936 and is a summary of the year's investigations in hop breeding being carried on cooperatively between the United States Department of Agriculture, Bureau of Plant Industry, Division of Drug and Related Plants, and the Farm Crops Department of Oregon State College. The writer is continuing the investigations started by Drs. E. N. Bressman and D. C. Smith, former Agents of the Division of Drug and Related Plants.

The heavy loss to the 1936 hop crop caused by downy mildew further emphasized the need for the development of resistant varieties. Downy mildew was present in the three hop growing states of the Pacific Coast and caused considerable damage in all affected areas. Oregon was particularly hard hit, the state average yield of dry hops per acre being reduced to 435 pounds as compared to the normal state average of about 1050 pounds.

General Review of Year

The investigations on hop breeding were carried on under the direction of Dr. D. C. Smith until May 11, 1936, at which date the writer took charge. Under Dr. Smith's direction considerable hybrid seed was planted in the greenhouse, the experimental yard was replanted from the nursery and some plants were transferred from the greenhouse to the nursery. Much of the spring work in the experimental yard such as plowing, hoeing and stringing was taken care of. When the writer arrived in May the vines were being trained on the string for the first time.

During May, training in the experimental yard was completed. About 500 seedlings were transferred from the greenhouse to the nursery. Several light rains during the month hastened the development and spread of downy

mildew and infection became quite general in the experimental yard. A shipment of hop roots was received from Mr. V. E. Kovalenich, Director of Station, Scientific Research Station of Hop Growing, Box No. 10, Zhitomir, U.S.S.R. These roots arrived in good shape and were set out in the nursery. The majority of these survived and produced a fine growth during the summer.

Hybridization work in the experimental yard was started in June and completed during July. Parchment bags were used to protect the flowers from wind-blown pollen. Some of the bagged flowers were killed by the hot weather, but a fair percentage of them survived and set seed. The parchment bags seem to be better than glassine but are not entirely satisfactory. The bags prevent circulation of air and the temperature becomes much higher under them. A fine mesh cloth bag might be better for this purpose.

Mildew notes were taken on all plants in the experimental yard at three different dates. Infestation seemed to be fairly general over the yard but more damage occurred near the west side of the yard, which is near a small patch of woods and through the lower parts of the yard. This was probably due to the higher humidity in these areas.

During August, detailed plant notes were taken on all seedling and hybrid plants in the experimental yard. About one-third of these plants were discarded as undesirable types. Some were discarded because of disease susceptibility and others because of poor agronomic characters.

The period from August 12 to 14 was spent in company with Mr. Hoerner on a trip to the hop growing area near Yakima, Washington. At this time, many yards were heavily infested with the red spider mite. Many growers were spraying but most sprays were not effective. Some growers were using an oil spray which seemed to be keeping the spider partially under control, but was not entirely satisfactory.

From August 18 to 20 a trip was taken to Puyallup, Washington, in company with Mr. Hoerner. Conferences were held with Mr. A. F. Richardson, County Agent of Puyallup County, Mr. G. A. Huber, Plant Pathologist at the Western Washington Experiment Station, and with several hop growers in the locality. Nearly all growers in this section are using the Fuggles variety of hops because of its mildew-resistance. The yards in this area were formerly planted mostly to Late Clusters, but during recent years, downy mildew has become a limiting factor with this variety. Only two Late Cluster yards were seen in the area and both were completely destroyed by downy mildew.

During the last week in August the variety plots of Fuggles and Early Clusters were harvested. Early Clusters yields were reduced by approximately two-thirds because of the heavy infestation of downy mildew. Fuggles yields were also depressed somewhat but not to such a great extent.

Mr. A. F. Sievers, Senior Biochemist, Division of Drug and Related Plants, visited Corvallis from August 8 to 10.

Mr. Frank Babak, Associate Biochemist, Division of Drug and Related Plants visited Corvallis from August 30 to September 1.

During the early part of September the variety plots of Late Clusters and Red Vines were harvested. Both of these varieties gave fairly good yields in spite of the heavy infestation of downy mildew. The Late Clusters appeared to be badly damaged by mildew early in the season but made a vigorous late growth after the mildew had been checked by dry weather and consequently produced a fair yield. The Red Vine variety seems to have considerable resistance to mildew and was not seriously damaged at any stage of development.

Plants of the foreign varieties being grown in the yard were harvested and samples saved for chemical analysis. The majority of these foreign

varieties are not very desirable when considered on the basis of their agronomic characters as a whole but several of them have some individual characters which are desirable. Therefore, they are being used as breeding stock.

The more promising seedlings in the yard were harvested, yields determined, and samples saved for chemical analysis.

All hybrid seed produced by artificial pollination was harvested and threshed. Seed of several varieties produced by natural cross pollination was also saved. This seed was stored in a cold chamber to break dormancy and was planted in the greenhouse later.

About one-third of the poorer seedling plants in the experimental yard were discarded and will be replaced by seedlings from the nursery.

A cover crop of crimson clover was seeded in the hop yard on October 8. Due to the extremely dry fall, the seed did not germinate until the latter part of November. A hard freeze shortly after the seed germinated killed nearly all of the young plants.

Weather Data

Weather data for the calendar year 1936 are given in Table 1. These data are included because of the close correlation between humidity and mildew infection during the growing season. The frequent light showers during May and June were responsible for the heavy mildew infestation during those months. This is due to the fact that the mildew spores gain entrance to the plant by swimming through free moisture on the leaf surface to the stomata. They are unable to gain entrance unless there is free moisture on the surface of the leaf. During the latter part of June, the spread of mildew was checked by the dry weather. Because of the dry fall there was practically no cone infection of mildew.

Table 1. 1936 Weather Data, Corvallis, Oregon

Furnished by Soils Department
Oregon State Agricultural Experiment Station

January				February			
	Temperature				Temperature		
Date	Maximum (°F.)	Minimum (°F.)	Precipitation in inches	Date	Maximum (°F.)	Minimum (°F.)	Precipitation in inches
1	51	46	.30	1	41	25	-
2	54	46	1.15	2	39	21	-
3	47	35	.23	3	41	25	.07
4	58	46	1.02	4	44	35	.41
5	48	37	.11	5	43	33	.07
6	48	41	.51	6	46	35	.39
7	46	40	.31	7	45	34	-
8	50	45	.21	8	38	19	-
9	51	45	.36	9	45	28	-
10	53	45	1.19	10	41	25	-
11	53	40	1.25	11	41	32	.20
12	47	39	2.55	12	53	34	.10
13	47	43	.44	13	48	32	-
14	53	42	.37	14	41	24	-
15	48	41	.11	15	35	21	-
16	47	38	.42	16	36	22	-
17	47	33	.13	17	34	22	.02
18	44	36	.13	18	35	23	-
19	51	44	.03	19	36	29	.24
20	56	41	-	20	41	32	.24
21	56	35	-	21	58	37	1.36
22	48	35	-	22	53	43	.89
23	48	38	-	23	45	33	.20
24	52	39	-	24	44	32	.13
25	50	32	-	25	49	33	.48
26	46	34	-	26	49	44	.17
27	56	33	-	27	51	45	.16
28	51	37	-	28	59	44	.22
29	46	25	-	29	63	40	-
30	47	24	-				
31	48	25	-				
Total Precipitation - 10.82 inches				Total Precipitation - 5.35 inches			
Highest Temp. Jan. 4 - 58° F.				Highest Temp. Feb. 29 - 63° F.			
Lowest Temp. Jan. 30- 24° F.				Lowest Temp. Feb. 8 - 19° F.			

1936 Weather Data (Cont.)

March				April			
	Temperature				Temperature		
Date:	Maximum (°F.)	Minimum (°F.)	Precipitation in inches	Date:	Maximum (°F.)	Minimum (°F.)	Precipitation in inches
1	66	47	-	1	44	30	-
2	64	45	-	2	54	29	.04
3	60	43	-	3	49	37	.57
4	58	33	-	4	52	38	-
5	54	32	-	5	57	33	-
6	57	32	-	6	62	34	-
7	58	36	-	7	62	41	.02
8	57	46	.06	8	62	35	-
9	55	35	.03	9	67	40	-
10	55	31	-	10	76	30	-
11	59	40	-	11	76	48	-
12	59	44	.12	12	81	47	-
13	52	37	.18	13	76	43	-
14	49	35	.10	14	76	45	-
15	55	35	.08	15	72	45	-
16	67	35	-	16	74	44	-
17	60	41	-	17	77	52	-
18	60	33	-	18	64	49	-
19	67	36	-	19	71	44	-
20	67	37	-	20	71	44	-
21	52	37	.03	21	70	50	-
22	46	35	.05	22	62	50	.11
23	45	35	.06	23	67	51	.04
24	47	35	.05	24	63	51	.43
25	50	35	-	25	70	43	-
26	51	35	.02	26	65	45	-
27	47	43	.96	27	60	49	.04
28	45	34	.17	28	64	48	.14
29	44	31	.06	29	67	43	.04
30	46	25	-	30	65	50	-
31	46	31	-				
Total Precipitation - 1.97 inches				Total Precipitation - 1.43 inches			
Highest Temp. Mar. 16 - 67° F.				Highest Temp. April 12, 81° F.			
Lowest Temp. Mar. 30 - 25° F.				Lowest Temp. April 2 - 29° F.			

1956 Weather Data (Cont.)

May				June			
	Temperature				Temperature		
Date	Maximum (°F.)	Minimum (°F.)	Precipitation in inches	Date	Maximum (°F.)	Minimum (°F.)	Precipitation in inches
1	70	43	.03	1	69	51	.06
2	70	51	.03	2	62	52	.12
3	71	54	.13	3	65	53	.05
4	62	49	.51	4	72	53	.02
5	57	38	.59	5	77	54	-
6	64	42	.10	6	69	55	.15
7	68	37	-	7	64	52	.05
8	77	43	-	8	69	55	.03
9	80	46	-	9	79	50	-
10	86	52	-	10	77	54	-
11	82	55	-	11	81	55	-
12	84	51	-	12	84	61	-
13	80	52	.05	13	83	60	-
14	71	54	.69	14	77	59	.55
15	64	54	.19	15	71	59	.27
16	66	49	.03	16	72	56	.10
17	70	46	-	17	69	51	.16
18	66	47	-	18	75	47	.01
19	56	45	.28	19	79	49	-
20	54	46	.36	20	77	50	-
21	62	50	.06	21	89	51	-
22	70	51	-	22	86	59	-
23	78	52	-	23	75	52	-
24	83	54	-	24	80	55	-
25	89	53	-	25	74	47	-
26	88	57	-	26	76	47	-
27	74	49	-	27	70	53	.13
2	66	50	.03	28	76	44	-
29	63	50	.12	29	81	56	-
30	65	50	.21	30	77	54	-
31	70	50	-				
Total Precipitation - 3.41 inches				Total Precipitation - 1.70 inches			
Highest Temp. May 25 - 89° F.				Highest Temp. June 21 - 89° F.			
Lowest Temp. May 7 - 37° F.				Lowest Temp. June 28 - 44° F.			

1936 Weather Data (Cont.)

July				August			
	Temperature				Temperature		
Date	Maximum (°F.)	Minimum (°F.)	Precipitation in inches	Date	Maximum (°F.)	Minimum (°F.)	Precipitation in inches
1	86	51	-	1	88	52	-
2	82	57	-	2	82	54	-
3	74	57	.05	3	86	55	-
4	71	59	-	4	92	56	-
5	73	56	-	5	86	58	-
6	79	54	-	6	80	54	-
7	76	51	-	7	86	53	-
8	72	56	-	8	86	51	-
9	73	59	.08	9	86	53	-
10	71	57	.07	10	80	56	-
11	79	53	.12	11	83	56	-
12	76	52	-	12	87	55	-
13	77	57	-	13	81	59	-
14	75	57	-	14	79	55	-
15	81	53	-	15	79	52	-
16	79	51	-	16	78	52	-
17	80	58	-	17	81	51	-
18	86	51	-	18	75	53	-
19	91	56	-	19	85	52	-
20	91	56	-	20	86	57	-
21	86	55	-	21	85	57	-
22	83	52	-	22	72	57	-
23	78	53	-	23	74	55	T
24	76	50	-	24	74	51	-
25	81	54	-	25	78	50	-
26	86	53	-	26	79	50	-
27	85	54	-	27	93	53	-
28	87	54	-	28	91	53	-
29	86	56	-	29	78	59	-
30	85	55	-	30	81	52	-
31	82	53	-	31	83	48	-
Total Precipitation - .32 inches				Total Precipitation - T.			
Highest Temp. July 19 - 91° F.				Highest Temp. August 27 - 93° F.			
Lowest Temp. July 24 - 50° F.				Lowest Temp. August 31 - 48° F.			

1936 Weather Data (Cont.)

September				October			
	Temperature				Temperature		
Date	Maximum (°F.)	Minimum (°F.)	Precipitation in inches	Date	Maximum (°F.)	Minimum (°F.)	Precipitation in inches
1	78	59	.11	1	72	41	-
2	70	57	.02	2	71	42	-
3	78	56	T	3	70	54	-
4	82	53	T	4	66	55	.16
5	76	54	-	5	68	49	T
6	82	52	-	6	81	49	T
7	81	57	-	7	85	45	-
8	80	48	-	8	83	46	-
9	78	46	-	9	90	48	-
10	72	42	-	10	89	47	-
11	75	41	-	11	90	48	-
12	74	49	.35	12	78	47	-
13	64	39	.23	13	77	49	-
14	64	43	.18	14	71	50	-
15	65	39	-	15	71	48	-
16	75	41	-	16	82	51	-
17	80	44	-	17	83	49	-
18	80	50	-	18	80	48	-
19	83	53	-	19	66	43	-
20	85	51	-	20	68	39	-
21	88	50	-	21	63	36	-
22	79	51	-	22	66	37	-
23	79	54	-	23	70	36	-
24	85	50	-	24	66	35	-
25	76	43	-	25	67	42	-
26	84	55	-	26	67	37	-
27	88	54	-	27	63	40	-
28	89	46	-	28	65	34	-
29	72	41	-	29	58	29	-
30	62	46	-	30	60	41	-
				31	57	41	-
Total Precipitation - .89 inches				Total Precipitation - .16 inches			
Highest Temp. Sept. 28 - 89° F.				Highest Temp. October 9 - 90° F.			
Lowest Temp. Sept. 13 - 39° F.				Lowest Temp. October 29 - 29° F.			

1938 Weather Data (Cont.)

November				December			
	Temperature				Temperature		
Date:	Maximum (°F.)	Minimum (°F.)	Precipitation in inches	Date:	Maximum (°F.)	Minimum (°F.)	Precipitation in inches
1	57	32	-	1	42	28	T
2	51	22	-	2	46	33	T
3	64	32	-	3	44	30	.13
4	61	47	-	4	43	33	.06
5	55	38	-	5	54	41	.12
6	53	44	.13	6	53	49	.64
7	58	28	-	7	54	43	.27
8	57	26	-	8	51	41	.23
9	56	28	-	9	52	42	T
10	50	27	-	10	47	36	-
11	50	25	-	11	42	35	-
12	53	23	-	12	46	34	-
13	57	22	-	13	52	40	.04
14	52	28	-	14	52	42	T
15	62	43	-	15	50	42	T
16	60	38	.05	16	50	38	.08
17	58	43	.04	17	47	42	.57
18	56	46	.01	18	57	44	T
19	50	42	.01	19	56	37	.03
20	56	44	-	20	56	39	T
21	52	40	-	21	52	48	.65
22	56	31	-	22	55	50	.06
23	64	34	-	23	55	42	1.21
24	67	34	-	24	50	40	.54
25	62	32	-	25	46	32	.02
26	58	26	-	26	45	38	.59
27	53	23	-	27	40	34	.28
28	42	20	-	28	40	32	T
29	47	32	-	29	40	30	-
30	42	28	-	30	40	33	.30
				31	41	26	-
Total Precipitation - .24 inches				Total Precipitation - 5.82 inches			
Highest Temp. November 24 - 67° F.				Highest Temp. December 18 - 57° F.			
Lowest Temp. November 28 - 20° F.				Lowest Temp. December 31 - 26° F.			

Varietal Yields

In Tables 2, 3 and 4 the yields of each plant of Late Clusters, Early Clusters, and Fuggles in the variety block are given. Individual plants varied considerably in yield. These variations are probably due to several causes, some of which were soil variations, mildew infection, and age of the plants. Several of the very low yielding plants were ones that had been replanted in the spring of 1936.

In Table 5 the average yields of the four varieties, Late Clusters, Early Clusters, Fuggles, and Red Vines are given. The low average yield of Early Clusters was due to injury by mildew. The yield in Fuggles was reduced somewhat by mildew but its comparatively low yield was largely due to the low yielding ability of the variety under the conditions of this experiment. For best results, the Fuggles variety requires a very rich soil and considerable moisture. In the experimental yard, moisture is probably a limiting factor in this variety.

Table 2. Yield of Individual Plants

Yields in Pounds

Late Clusters

Row and Plant Number	Net green weight per plant	Dry weight per plant	Row and Plant Number	Net green weight per plant	Dry weight per plant
1-14	12.5	3.36	10-14	15.2	4.10
15	10.4	2.80	15	11.7	3.15
16	9.8	2.64	16	10.3	2.80
17	5.9	1.59	17	12.5	3.36
18	9.6	2.58	18	11.2	3.01
19	10.4	2.80	19	5.5	1.48
20	12.8	3.44	20	-	-
21	-	-	21	13.2	3.55
22	9.7	2.61	22	5.9	1.59
23	3.4	.91	23	11.8	3.17
24	4.2	1.13	24	-	-
25	1.4	.38	25	11.4	3.06
26	-	-	26	-	-
27	-	-	27	13.7	3.68
28	1.2	.32	28	11.8	3.17
2-14	7.2	1.94	11-14	5.7	1.53
15	13.0	3.50	15	13.8	3.71
16	-	-	16	-	-
17	3.8	1.02	17	12.6	3.38
18	9.9	2.67	18	6.4	1.72
19	7.3	1.97	19	11.8	3.17
20	5.5	1.48	20	7.2	1.94
21	7.2	1.94	21	7.4	1.99
22	-	-	22	10.1	2.72
23	11.5	3.10	23	7.2	1.94
24	7.3	1.97	24	8.8	2.37
25	8.4	2.26	25	11.1	2.98
26	6.6	1.77	26	9.7	2.61
27	12.5	3.36	27	13.2	3.55
28	15.4	4.14	28	.9	.24
3-14	11.6	3.12	12-14	16.2	4.36
15	8.6	2.31	15	11.8	3.17
16	17.2	4.63	16	7.1	1.91
17	9.0	2.42	17	20.3	5.46
18	10.0	2.70	18	11.3	3.04
19	10.7	2.88	19	8.7	2.34
20	11.8	3.17	20	8.3	2.23
21	10.0	2.70	21	8.9	2.39
22	5.7	1.53	22	9.6	2.58
23	8.0	2.15	23	10.0	2.69
24	.8	.22	24	9.9	2.66
25	.6	.16	25	8.1	2.18
26	9.3	2.50	26	11.3	3.03
27	7.1	1.91	27	11.5	3.09
28	11.2	3.01	28	5.1	1.37

Yield of Individual Plants, (Cont.)

Row and Plant Number	Net green weight per plant	Dry weight per plant	Row and Plant Number	Net green weight per plant	Dry weight per plant
19-14	8.7	2.34	28-14	11.1	2.98
15	4.8	1.29	15	9.8	2.64
16	12.4	3.33	16	6.9	1.86
17	11.5	3.09	17	10.0	2.69
18	11.3	3.03	18	6.8	1.83
19	11.6	3.12	19	6.3	1.69
20	12.3	3.30	20	1.0	.27
21	8.5	2.28	21	6.1	1.65
22	6.8	1.83	22	8.0	2.15
23	9.5	2.55	23	5.3	1.42
24	12.9	3.47	24	10.3	2.77
25	4.1	1.10	25	9.9	2.66
26	12.3	3.31	26	8.9	2.39
27	14.1	3.80	27	9.3	2.50
28	12.8	3.44	28	9.1	2.45
20-14	15.3	4.11	29-14	13.9	3.74
15	6.9	1.86	15	-	-
16	-	-	16	12.7	3.42
17	13.7	3.68	17	8.7	2.34
18	11.7	3.15	18	.2	.50
19	4.5	1.21	19	5.3	1.42
20	5.5	1.48	20	.5	.13
21	8.1	2.18	21	3.0	.81
22	-	-	22	6.5	1.75
23	13.7	3.68	23	10.7	2.88
24	10.0	2.69	24	15.2	4.10
25	16.0	4.31	25	10.2	2.74
26	8.5	2.28	26	10.9	2.93
27	14.2	3.82	27	16.6	4.46
28	13.4	3.60	28	11.4	3.06
21-14	8.0	2.15	30-14	9.3	2.50
15	15.4	4.14	15	2.4	.64
16	13.3	3.58	16	5.4	1.45
17	9.5	2.55	17	2.3	.62
18	9.2	2.47	18	11.4	3.06
19	11.1	2.98	19	-	-
20	9.6	2.58	20	7.8	2.09
21	14.5	3.90	21	3.0	.81
22	9.2	2.47	22	6.1	1.64
23	11.5	3.10	23	6.1	1.64
24	8.9	2.39	24	7.8	2.09
25	8.6	2.31	25	11.1	2.98
26	10.7	2.88	26	12.5	3.36
27	9.2	2.47	27	9.1	2.42
28	11.4	3.06	28	12.3	3.31

Table 3. Yield per Plant in Pounds

Early Clusters

Row and Plant Number	Net green weight per plant	Dry weight per plant	Row and Plant Number	Net green weight per plant	Dry weight per plant
4-14	-	-	13-14	.4	.11
15	2.3	.66	15	.1	.03
16	.6	.17	16	.5	.14
17	1.3	.37	17	.4	.11
18	-	-	18	.3	.09
19	1.9	.55	19	1.1	.32
20	1.7	.49	20	1.2	.34
21	2.2	.63	21	2.5	.72
22	.5	.14	22	3.4	.98
23	2.2	.62	23	1.4	.40
24	.5	.14	24	.9	.26
25	.8	.23	25	1.2	.34
26	-	-	26	3.1	.89
27	3.8	1.10	27	1.6	.46
28	1.8	.52	28	5.4	1.55
Yield per row.					
5-14	.5	.14	14-14	.2	.06
15	2.5	.72	15	-	-
16	-	-	16	-	-
17	1.2	.34	17	1.2	.34
18	1.8	.52	18	.2	.06
19	.2	.06	19	.7	.20
20	.9	.26	20	1.4	.40
21	3.1	.89	21	.9	.26
22	2.2	.63	22	1.7	.49
23	.6	.17	23	5.8	1.67
24	.2	.06	24	1.6	.46
25	.1	.3	25	1.9	.55
26	4.0	1.15	26	2.0	.58
27	1.4	.40	27	.7	.20
28	1.5	.43	28	3.0	.86
6-14	.2	.6	15-14	-	-
15	1.8	.52	15	-	-
16	2.0	.58	16	.5	.14
17	1.4	.40	17	1.1	.32
18	.4	.11	18	2.1	.60
19	-	-	19	.4	.11
20	.8	.23	20	1.8	.52
21	.2	.06	21	1.0	.29
22	-	-	22	3.7	1.06
23	1.1	.32	23	2.0	.58
24	3.8	1.09	24	1.3	.37
25	-	-	25	1.4	.40
26	2.5	.72	26	2.5	.72
27	1.7	.49	27	1.3	.37
28	2.0	.58	28	1.0	.29

Yield per Plant in Pounds,(Cont.)

Row and Plant Number	Net green weight per plant	Dry weight per plant	Row and Plant Number	Net green weight per plant	Dry weight per plant
22-14	5.6	1.61	31-14	2.9	.83
15	4.1	1.18	15	3.5	1.01
16	5.5	1.58	16	2.7	.78
17	2.6	.75	17	3.6	1.29
18	2.0	.58	18	4.5	1.30
19	1.2	.34	19	2.7	.78
20	5.0	1.44	20	3.4	.98
21	1.0	.29	21	4.0	1.15
22	3.7	1.06	22	1.2	.34
23	4.4	1.27	23	2.0	.58
24	4.1	1.18	24	7.2	2.07
25	4.2	1.21	25	4.0	1.15
26	-	-	26	3.7	1.06
27	9.2	2.65	27	-	-
28	7.1	2.04	28	2.0	.58
23-14	3.9	1.12	32-14	4.6	1.32
15	1.8	.52	15	2.4	.69
16	1.9	.55	16	3.2	.92
17	4.2	1.21	17	1.0	.29
18	5.1	1.47	18	-	-
19	8.6	2.48	19	-	-
20	3.4	.98	20	2.7	.78
21	3.1	.89	21	1.8	.52
22	3.5	1.01	22	4.7	1.35
23	1.6	.46	23	6.4	1.84
24	4.8	1.38	24	-	-
25	4.0	1.15	25	2.2	.63
26	4.5	1.29	26	3.8	1.09
27	9.1	2.62	27	-	-
28	3.6	1.04	28	-	-
24-14	8.2	2.36	33-14	2.2	.63
15	5.0	1.44	15	3.0	.86
16	7.1	2.04	16	2.5	.72
17	8.4	2.42	17	2.2	.63
18	1.7	.49	18	3.2	.92
19	.9	.26	19	-	-
20	2.8	.81	20	5.0	1.44
21	2.0	.58	21	5.3	1.53
22	2.0	.58	22	-	-
23	2.8	.81	23	5.2	1.50
24	2.7	.78	24	4.3	1.24
25	3.4	.98	25	6.8	1.96
26	5.1	1.47	26	6.6	1.90
27	3.9	1.12	27	2.3	.66
28	4.4	1.27	28	1.2	.34

Table 4. Yield per Plant in Pounds

Fugglee

Row and Plant Number	Net green weight per plant	Dry weight per plant	Row and Plant Number	Net green weight per plant	Dry weight per plant
7-14	4.6	1.55	16-14	5.4	1.37
15	6.4	1.62	15	5.6	1.42
16	5.8	1.47	16	5.6	1.42
17	6.9	1.75	17	7.7	1.95
18	6.6	1.68	18	5.6	1.42
19	4.2	1.07	19	4.7	1.19
20	4.6	1.17	20	6.2	1.57
21	6.8	1.73	21	5.8	1.47
22	4.5	1.14	22	5.4	1.37
23	5.4	1.37	23	3.5	.89
24	6.8	1.73	24	4.4	1.11
25	6.6	1.68	25	6.8	1.73
26	4.6	1.17	26	6.7	1.70
27	5.4	1.37	27	5.7	1.45
28	5.3	1.35	28	5.9	1.50
8-14	1.3	.33	17-14	2.8	.71
15	4.2	1.07	15	4.4	1.11
16	5.2	1.32	16	4.1	1.04
17	7.8	1.98	17	3.9	.99
18	5.8	1.47	18	4.4	1.11
19	4.4	1.11	19	3.6	.91
20	4.8	1.22	20	5.1	1.29
21	3.8	.96	21	5.1	1.29
22	4.4	1.11	22	3.1	.79
23	2.9	.74	23	5.5	1.40
24	6.6	1.68	24	3.6	.91
25	3.1	.79	25	5.9	1.50
26	3.7	.94	26	5.1	1.29
27	5.9	1.50	27	3.3	.84
28	5.0	1.27	28	4.4	1.11
9-14	6.1	1.55	18-14	3.8	.96
15	6.5	1.65	15	3.2	.81
16	6.0	1.27	16	5.9	1.50
17	3.8	.96	17	6.3	1.60
18	4.0	1.02	18	5.0	1.27
19	4.4	1.11	19	3.3	.84
20	2.7	.68	20	4.1	1.04
21	3.8	.96	21	5.2	1.32
22	5.7	1.45	22	5.3	1.35
23	4.4	1.11	23	4.5	1.14
24	3.5	.89	24	.7	.18
25	5.6	1.42	25	9.2	2.34
26	3.2	.81	26	4.7	1.19
27	5.1	1.29	27	6.0	1.52
28	4.9	1.24	28	7.0	1.78

Yield per Plant in Pounds, (Contd.)

Row and Plant Number	Net green weight per plant	Dry weight per plant	Row and Plant Number	Net green weight per plant	Dry weight per plant
25-14	7.6	1.98	34-14	2.0	.51
15	8.7	2.21	15	4.3	1.09
16	5.3	1.35	16	1.7	.43
17	5.1	1.29	17	1.2	.30
18	4.2	1.07	18	3.7	.94
19	2.4	.61	19	4.4	1.11
20	-	-	20	-	-
21	3.9	.99	21	5.0	1.27
22	3.5	.89	22	5.4	1.37
23	-	-	23	5.6	1.42
24	6.1	1.55	24	3.7	.94
25	6.1	1.55	25	3.1	.79
26	5.0	1.27	26	5.5	1.40
27	5.4	1.37	27	6.5	1.65
28	4.8	1.22	28	1.3	.33
26-14	4.9	1.24	35-14	2.6	.66
15	1.0	.25	15	3.5	.89
16	4.9	1.24	16	3.5	.89
17	4.9	1.24	17	3.0	.76
18	4.1	1.04	18	3.4	.86
19	4.2	1.06	19	5.7	1.45
20	1.1	.28	20	5.8	1.47
21	2.8	.71	21	3.8	.96
22	2.6	.66	22	5.0	1.27
23	1.7	.43	23	5.9	1.50
24	4.4	1.11	24	-	-
25	4.2	1.06	25	-	-
26	5.7	1.45	26	5.6	1.42
27	3.6	.91	27	6.0	1.52
28	7.7	1.95	28	3.7	.94
27-14	4.6	1.17	36-14	3.0	.76
15	-	-	15	3.2	.81
16	4.8	1.22	16	5.6	1.42
17	3.9	.99	17	3.2	.81
18	3.8	.96	18	2.8	.71
19	4.5	1.14	19	4.4	1.11
20	3.9	.99	20	3.4	.86
21	2.8	.71	21	4.4	1.11
22	1.7	.43	22	4.1	1.04
23	2.7	.68	23	2.5	.64
24	2.4	.61	24	3.4	.86
25	4.1	1.04	25	3.9	.99
26	3.0	.76	26	2.7	.68
27	5.2	1.32	27	3.7	.94
28	2.2	.56	28	5.0	1.27

Table 5. Variety Yields in 1936.

	Late Clusters	Early Clusters	Fuggles	Red Vines
Total No. of Plants	167	160	176	19
Total green weight	1,563.1#	425.8#	1,095.3#	235.0#
Average green weight per plant.	9.356#	2.661#	4.475#	12.37#
Total dry weight	422.0#	122.75#	225.0#	53.5#
Average dry weight per plant	2.53#	.77#	1.27#	2.82#
% of dried hops	26.9%	28.6%	25.4%	22.7%
Average yield per acre	1,720.4#	523.6#	863.6#	1,917.6#

Mildew Notes

In Table 6, a summary of the mildew notes taken during the past three years on each individual plant in the experimental hop yard, is given. It will be noted that mildew infestation is heavier on the west side of the yard. This is probably due to the fact that the west side of the yard is on lower ground and is bordered by a wood lot. Hence, the humidity in this section of the yard is higher and conditions are more favorable for mildew infection.

Several of the plants show no mildew for the three year period covered by these notes. Some of these plants are probably resistant to mildew while others may have escaped infection. During 1937 the plants that have shown no mildew will be tested for resistance in the laboratory. In this way it will be possible to pick out those which are actually resistant.

Table 6

DOWNY MILDEW NOTES FOR 1934, 1935 AND 1936

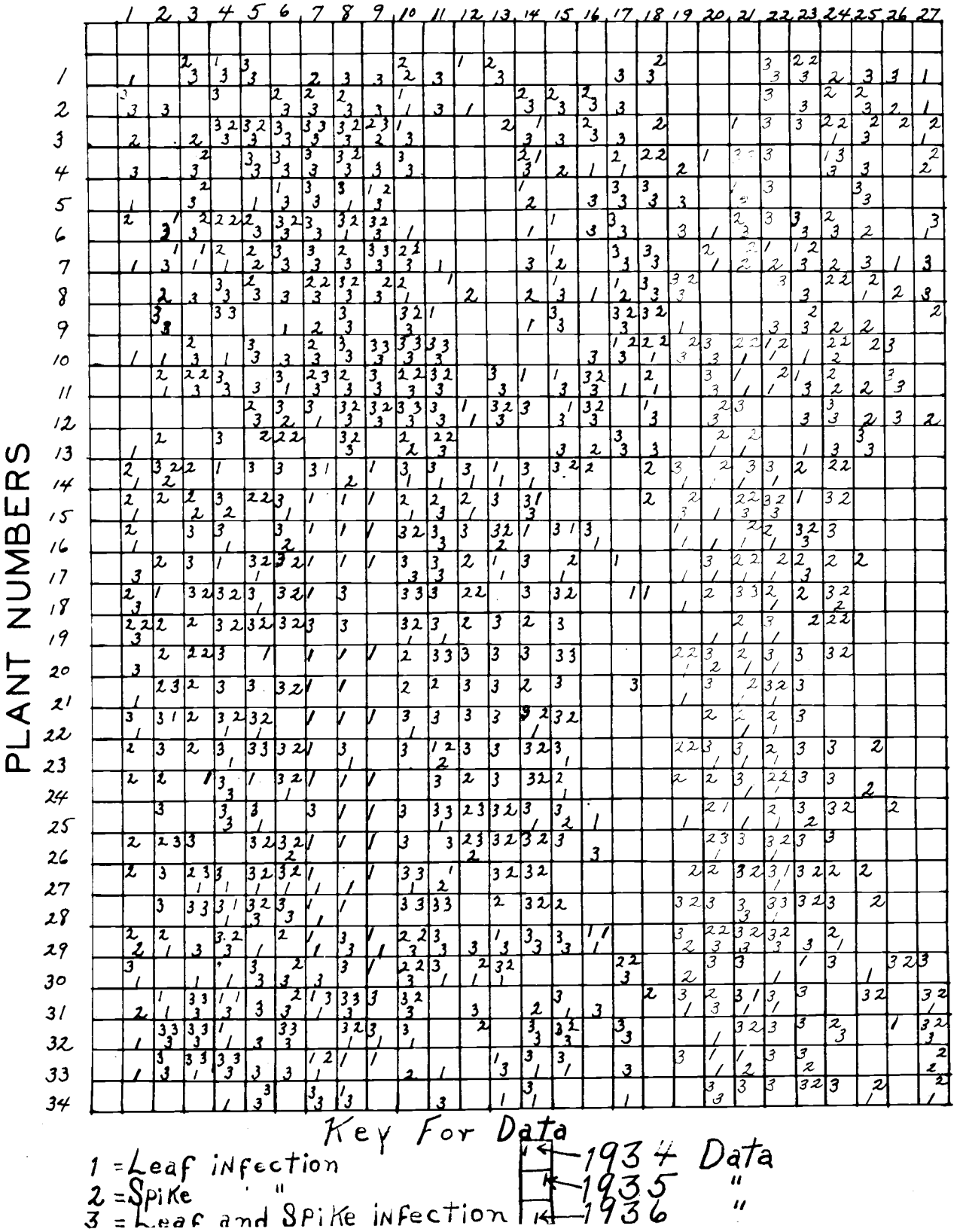
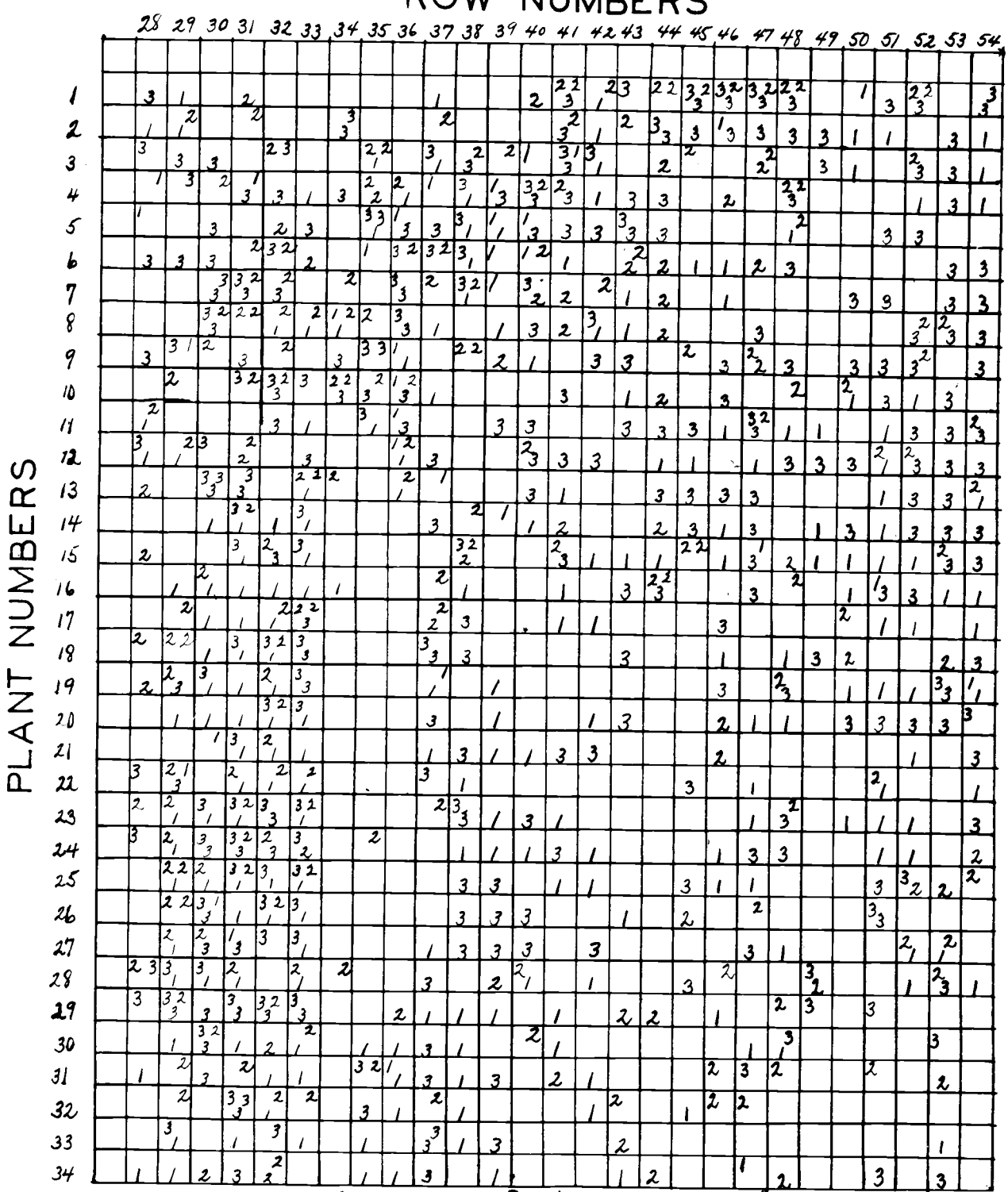


Table 6

DOWNY MILDEW NOTES FOR 1934, 1935 AND 1936



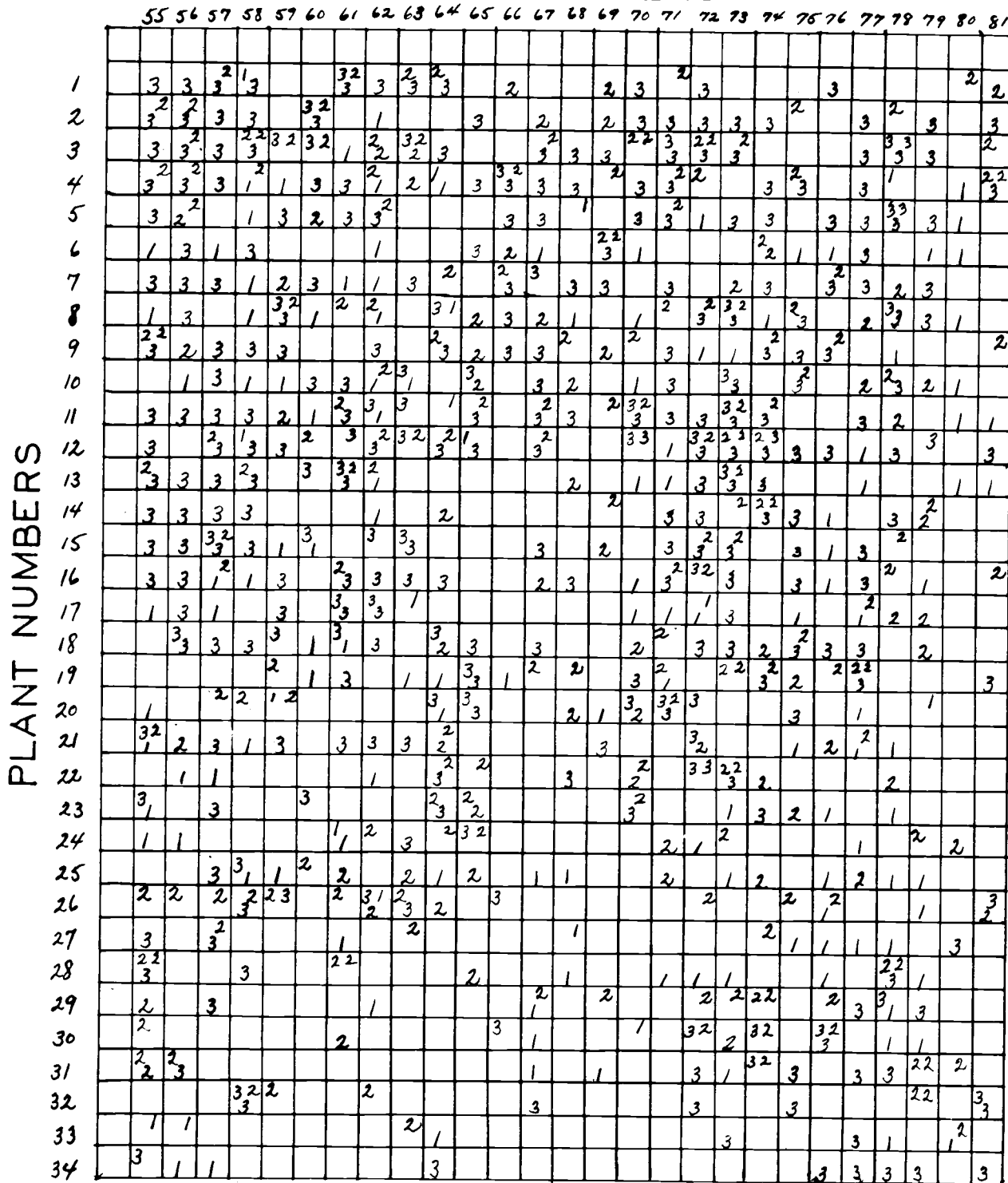
Key For Data

1 = Leaf infection
2 = Spike "
3 = Leaf and Spike infection

1934 Data
1935 "
1936 "

Table 6

DOWNY MILDEW NOTES FOR 1934, 1935 AND 1936



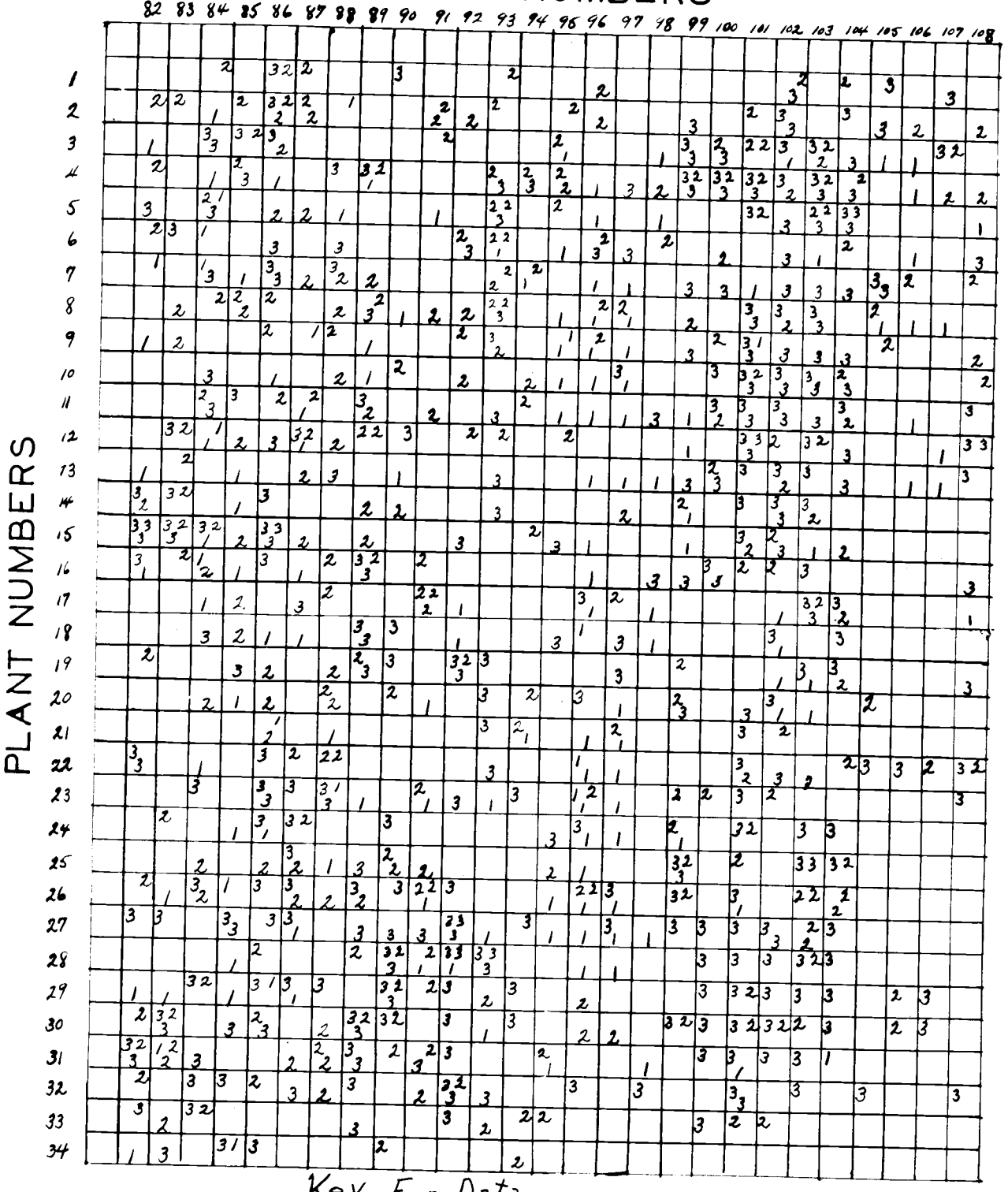
Key For Data

1 = Leaf infection
2 = Spike "
3 = Leaf and Spike infection

1 ← 1934 Data
1 ← 1935 "
1 ← 1936 "

Table 6

DOWNY MILDEW NOTES FOR 1934, 1935 AND 1936



Key For Data

1 = Leaf infection
2 = Spike "
3 = Leaf and Spike infection

1 ← 1934 Data
1 ← 1935 "
1 ← 1936 "

Seedlings Picked in 1936

In Table 7 some notes taken during the latter part of July are given. These were taken to indicate the stage of maturity of the plants at this date. These data were taken on all seedling plants in the experimental yard but only plants that were harvested are included in Table 7.

Yield data on all seedlings that were harvested as well as other data of value in determining the merit of these plants are included in Table 8. The chemical analyses of the plants that were analysed in 1935 are included so that yields can be correlated with quality. Some of the high yielding plants, as for example, plants 2-33 and 4-33, are low in quality as indicated by the chemical analysis. These plants will be used as breeding stock and an attempt will be made to combine their high yield with high quality and mildew resistance.

Table 7. Maturity Notes on Seedlings Picked in 1936

Plant and Row No.	Variety Name	Stage	Plant Note Taken	Date Notes Taken	Year Planted
2-33	F	1 to 1 in hops.	Good plant, good yield but small cones.	7/17	32
4-33	F	3	A very vigorous plant, very good yielder but light weight hops.	7/17	32
10-30	LC	1	Fairly good plant, fair yield and good even size hops.	7/17	31
14-32	F	2	Fairly good plant, fair yield and good even size hops.	7/17	32
19-33	OSC	1	Fairly good plant, fair yield and good even size hops.	7/17	32
26-12	LC	5 to 3 in hops.	Good plant and good yield, uneven size hops.	7/17	32
26-32	F	2	Has large hops, good plant, good yield	7/17	32
27-31	X	2	Very good set of hops, large plant and even size hops.	7/20	32
32-4	F	1	A very heavy yielder with long arms, rather small hops.	7/20	33
32-10	Cal	3	Good plant, good yield, fair sized hops.	7/20	33
32-30	F	1	Good plant, good yield, fair sized hops.	7/20	33
32-31	F	2	Good plant, good yield, fair sized hops.	7/20	32
35-5	F	2	Good plant, good yield, good sized hops.	7/20	32
40-13	F	1	Good plant, good yield, fair sized hops.	7/20	32
40-27	LC	0	Good plant, very good yield, small sized hops.	7/20	32
43-28	F	1	Good plant, good yield, good sized hops.	7/21	32
46-4	F	3	Good plant, good yield, good sized hops.	7/21	32
47-18	F	5 to 2 in hops.	Good plant, good yield, very large sized hops.	7/21	32
49-28	F	¼ to 2 in hops.	Good plant, good yield, large sized hops.	7/21	32
52-31	F	3	Good plant, good yield, good sized hops.	7/21	32
53-20	F	4	Good plant, good yield, large sized hops.	7/21	32
56-7	X ♂	3	Very good plant, good yield, small sized hops.	7/21	32
56-14	F	3	Fair plant, fair yield, fair sized hops.	7/21	32
56-28	F	3 & beyond.	Good plant, good yield, uneven sized hops.	7/21	32
56-31	F	3	Fair plant, good yield, good sized hops.	7/21	32
57-25	F	1	Good plant, good yield, fair sized hops.	7/21	32
57-28	F	1	Good plant, good yield, good sized hops.	7/21	33
57-30	F	1	Good plant, good yield, medium sized hops.	7/21	33
58-3	F	1	Good plant, good yield, good sized hops.	7/21	32
58-13	F	1	Very good plant, good yield, fair sized hops.	7/21	32
58-17	F	1	Fair yield, good plant, fair sized hops.	7/21	32
59-21	Cal	3	Good plant, good yield, good sized hops.	7/21	32

♂ = means has also some male flowers.

Maturity Notes on Seedlings Picked in 1936. (Cont.)

Plant and Row No.	Variety Name	Stage	Plant Note Taken	Date Notes Taken	Year Planted
60-29	LC	5	Peculiar hops, nicely bunched, fair plant, good yield	7/21	32
61-10	F	1	Good plant, good yield and good sized hops.	7/21	33
61-24	F	2	Good plant, good yield and fair sized hops.	7/21	33
62-27	LC	5 & beyond	Fair plant, good yield and good sized hops.	7/21	32
66-29	F	2	Fair plant, good yield and fair sized hops.	7/21	33
67-9	LC	1	Good plant, very good yield and fair sized hops.	7/21	32
67-17	F	3	Very good plant, very good yield and fair sized hops.	7/21	33
68-5	LC	½ to 2 in.	hops. Poor plant, good yield and good sized hops.	7/21	32
68-8	LC	3	Good plant, good yield and fair sized hops.	7/21	32
69-31	F	1	Good plant, good yield and good sized hops.	7/21	33
69-32	F	1	Good plant, good yield and good sized hops.	7/21	33
70-13	EC	5	Fair plant, very good yield, hops are somewhat rugged.	7/21	32
71-4	F	3	Good plant, good yield, fair size hops.	7/21	32
71-28	F	½ in hops.	Fair plant, poor yield, large size hops.	7/21	32
72-13	F	4	Fair plant, poor yield, large size hops.	7/21	32
74-11	F	3	Good plant, fair yield, large size hops.	7/21	33
77-13	F	4	Good plant, fair yield, fair size hops.	7/21	32
77-22	F	3	Good plant, good yield, fair size hops.	7/21	32
77-29	F	2	Good plant, good yield, good size hops.	7/21	32
80-15	F	4	Good plant, good yield, fair size hops.	7/21	34
84-11	Cal	3	Fair plant, good yield, fair size hops.	7/21	32
86-23	LC x F	3	Fair plant, fair yield, good size hops.	7/22	32
91-30	X	4	Good plant, good yield, good size hops.	7/22	34
92-23	F	5	Fair plant, fair yield, fair size hops.	7/22	33
93-18	F	3	Good plant, good yield, good size hops.	7/22	32
95-24	F	3	Good plant, good yield, good size hops.	7/22	34
97-13	F	1	Good plant, good yield, fair size hops.	7/22	32
97-21	F	3	Good plant, good yield, fair size hops.	7/22	32
97-24	F	1	Good plant, good yield, good size hops.	7/22	33
97-27	F	3	Good plant, good yield, good size hops.	7/22	33
97-31	F	3	Good plant, good yield, good size hops.	7/22	32
98-12	F	2	Good plant, good yield, good size hops.	7/22	32
98-28	F	2	Good plant, good yield, good size hops.	7/22	33

Maturity Notes on Seedlings Picked in 1936, (Cont.)

Plant and Row No.	Variety Name	Stage	Plant Note Taken	Date Notes Taken	Year Planted
98-31	F	2	Good plant, good yield, good size hops.	7/22	33
99-17	F	1	Fair plant, good yield, good size hops.	7/22	32
99-18	F	5 to 1 in hops	Fair plant, good yield, good size hops.	7/22	32
100-7	X	3	Good plant, good yield, fair size hops.	7/22	33
100-8	F	5	Good plant, good yield, good size hops.	7/22	32
100-23	F	¼ to 3 in hops	Good plant, fair yield, good size hops.	7/22	32
100-29	F	3	Good plant, good yield, fair size hops.	7/22	32
101-15	LC	3	Good plant, good yield, good size hops.	7/22	32
101-32	LC	3	Good plant, good yield, fair size hops.	7/22	32

Table 8. Seedlings Picked in 1936

Plant & Row No.	Variety	Group	Date Picked	Odor	Actual dry Weights	% of Dry Weight	1936 Mildew Notes (S & L)	1935 Chemical Analysis Total % of Soft Resins	1935 Chemical Analysis Total % of Alpha Resins
2-33	F	1	8/26	Medium	4.00	34	SL	14.18	Trace
4-33	F	3	8/27	Weak	3.80	26	S^3L	11.01	"
10-30	LC	2	9/16	Very strong	3.30	26	S^2L	14.83	2.42
14-32	F	2	8/29	Medium	3.60	26	S^2L	15.53	.46
19-33	OSC	3	9/16	Medium pleasant	2.00	29	-	14.36	Trace
26-12	LC	1	9/16	Strong pleasant	3.30	30	S^3L	-	-
26-32	F	2	9/2	Rather strong	4.00	28	-	-	-
27-31	X	2	9/16	Medium strong	3.30	32	L	-	-
32-4	F	2	9/16	Very strong, sharp	4.85	31	SL	-	-
32-10	Cal	1	8/29	Weak	3.75	27	SL	-	-
32-30	F	2	9/16	Strong, repelling	3.10	29	S^2	-	-
32-31	F	2	9/16	Strong, medium	2.20	30	L	-	-
35-5	F	1	9/16	Strong	4.10	33	L	16.80	4.26
40-13	F	2	9/2	Medium	3.10	26	$S2L$	14.80	1.21
40-27	LC	1	9/17	Weak	4.00	39	S^2L	-	-
43-28	F	2	9/17	Strong, pleasant	2.20	30	-	-	-
46-4	F	1	9/17	Weak, medium	3.40	27	S^2	15.42	3.93
47-18	F	2	9/2	Rather strong	1.95	23	-	12.72	.60
49-28	F	2	8/28	Strong	3.35	33	S	15.60	Trace
52-31	F	1	9/17	Strong, repelling	3.90	26	-	19.71	5.82
53-20	F	3	9/17	Strong, peculiar pleasant	2.10	30	S^1L	-	-
56-7	X	2	9/17	Strong	4.20	29	S^1L	-	-
56-14	F	2	9/17	Strong	2.50	32	SL	-	-
56-28	F	2	8/31	Fairly strong	2.30	27	-	12.80	Trace
56-31	F	2	9/2	Fairly strong	2.10	26	S^1L	16.00	"
57-25	F	3	9/17	Medium pleasant	3.55	32	SL	-	-
57-28	F	2	9/17	Medium repelling	3.00	30	-	-	-
57-30	F	3	9/18	Medium repelling	3.00	28	-	-	-
58-3	F	2	9/18	Rather strong	3.45	29	SL	-	-

Seedlings Picked in 1936, (Cont.)

Plant & Row No.	Variety	Group	Picked	Odor	Actual dry Weights	% of dry Weight	1936 Mildew Notes (S & L)	1935 Chemical Analysis Total % of Soft Resins	1935 Chemical Analysis Total % of Alpha Resins
97-13	F	2	9/3	Weak	3.94	28	L	-	-
97-21	F	2	9/21	Medium	1.65	25	L	-	-
97-24	F	2	9/21	Strong	4.10	26	L	-	-
97-27	F	1	8/31	Strong	2.60	29	L	-	-
97-31	F	2	8/31	Fairly strong	2.20	27	-	-	-
98-12	F	3	9/22	Very strong	1.80	32	-	-	-
98-28	F	1	9/22	Rather strong	3.00	28	-	-	-
98-31	F	1	9/22	Strong	2.90	27	L	-	-
99-17	F	2	9/22	Medium	2.00	32	-	-	-
99-18	F	1	9/23	Rather strong	1.20	25	-	-	-
100-7*	X	2	9/23	Medium strong	2.70	39	S^1L	-	-
100-8	F	2	8/28	Rather strong	1.20	28	-	12.45	4.12
100-23	F	3	8/28	Rather strong	1.35	34	-	-	-
100-29	F	2	9/1	Rather strong	2.70	26	-	-	-
101-15	LC	2	9/23	Rather strong	3.20	30	S^3L	-	-
101-32	LC	2	9/1	Medium	3.75	30	SL	17.75	5.30

* - Hops of this plant appeared to contain much lupulin.

Seedlings Picked in 1936, (Cont.)

Plant & Row No.	Variety	Group	Picked	Odor	Actual dry Weights	% of dry Weight	1936 Mildew Notes (S & L)	1935 Chemical Analysis: Total % of Soft Resins	1935 Chemical Analysis: Total % of Alpha Resins
58-13	F	1	9/18	Medium repelling	1.60	13	SL	-	-
58-17	F	2	9/18	Medium	2.30	27	-	-	-
59-21	Cal	2	9/11	Rather strong	3.70	33	SL	-	-
60-29	LC	3	8/31	Medium	1.90	32	-	13.17	Trace
61-10	F	2	9/11	Strong unpleasant	2.85	30	SL	-	-
61-24	F	2	9/18	Medium	2.90	30	L	-	-
62-27	LC	2	8/31	Fairly strong	1.70	29	-	18.12	Trace
66-29	F	2	9/18	Medium pleasant	2.00	30	-	-	-
67-9	LC	2	9/18	Strong medium	2.85	30	SL	-	-
67-16	F	2	9/18	Medium	4.90	29	S	-	-
68-5	LC	3	8/28	Strong	1.10	31	-	14.01	Trace
68-8	LC	2	9/18	Strong unpleasant	2.85	32	L	-	-
68-10	F	3	9/18	Strong unpleasant	3.60	43	S	-	-
69-31	F	1	9/19	Strong unpleasant	4.30	27	L	-	-
69-32	F	3	9/19	Medium pleasant	2.30	26	-	-	-
70-13	EC	3	8/28	Peculiar pungent	2.30	28	L	17.16	.61
71-4	F	2	9/19	Strong medium	2.80	34	SL	-	-
71-28	F	2	8/28	Strong	1.80	31	L	-	-
73-12	F	2	9/19	Very strong, unpleasant	2.30	35	S^3L	17.20	3.42
74-11	F	1	9/19	Medium strong	3.30	30	SL	-	-
77-13	F	1	9/3	Rather strong	2.90	24	L	-	-
77-22	F	2	9/19	Medium pleasant	2.60	27	-	-	-
77-29	F	1	9/9	Medium pleasant	3.45	45	SL	-	-
80-15	F	2	9/19	Medium	2.55	27	-	-	-
84-11	Cal	2	9/12	Rather strong	3.90	26	S^2L	14.10	Trace
86-23	LC x F	3	9/3	Strong	1.75	30	S^1L	13.00	2.07
91-30	X	1	9/1	Rather strong	1.80	23	-	-	-
92-23	F	3	9/4	Rose-like fragrance	2.46	30	-	-	-
93-18	F	1	8/31	Medium	2.50	26	-	-	-
95-24	F	1	9/23	Very strong	2.95	26	SL	-	-

Controlled Pollination

An extensive controlled pollination program was undertaken for the purpose of producing new improved varieties which will combine the good characteristics of the now existing varieties. The principal characters being considered are mildew resistance, quality, and yield. These characters are all inherited in a very complicated manner and therefore the task of combining them is a difficult one and one that will take a long time to accomplish. However, definite progress in this direction is being made. At present, enough crosses between hop varieties have been made to give the breeder some idea as to which ones will produce the best hybrids. With this information at hand it will be possible for the breeder to concentrate his efforts on the most promising parent stock and hence he should be able to make more rapid progress.

In 1936, about 390 different crosses were attempted. Six to ten clusters of flowers for each cross were bagged and pollinated, thus making a total of over 3000 clusters of flowers upon which artificial crosses were attempted. Of these attempts only about 15 per cent were successful. This low per cent of successful crosses was due principally to the fact that many of the flowers burned under the bags. Both glassine and parchment bags were tried and parchment were found to be most successful. Nearly all crosses attempted under glassine bags were unsuccessful as were also a high per cent under the parchment bags. At the stage at which they must be bagged, the flowers are very tender and the higher temperature and lack of air circulation under the bags causes them to burn quite readily.

In Tables 9, 10, 11 and 12 some data on the crosses attempted are given. The symbols used in these tables are explained below.

Symbols Used for Foreign Varieties of Hops

Symbol	Name of Variety	Symbol	Name of Variety
Cal.C.	California Cluster	Tett.	Tettnonger Frlih
E.K.G.	East Kent Golding	G.	Golding
M.R.	Millers Resistant	V (J)	Verte (Jagger)
Cal.	California seedling	T.B.	Tige Blanche
El.	Elsasser	A.R.	Auscher Rote
E.G.	Early Green	E.K.	East Kent
S.	Spalter	-R	Obtained from a root cuttin
S(U)	Spalter (Urbann)	-S	" " " seed "
S(R)	Spalter (Rhomer)	X	Unknown seedling
S(S)	Spalter (Simon)	F($\frac{n}{2}$	Fuggles (New Zealand)
L.G.	Late Grape	OSC-S	Oregon State College seedin
Ba	Bavarian	F	Fuggles
K.G.	Kent Golding	LC	Late Clusters
A(U)	Alsace (Urbann)	R.V.	Red Vine
Sam(S)	Sambling (Salmon)	E.C.	Early Cluster
L(S)	Landhopfen (Simon)	M.G.	Muhlvertler Grune
Sp(U)	Spalt (Urbana)		
B(S)	Bergunder (Simon)		

Table 9. Foreign Varieties

Successful Crosses Made in 1936

Female	Variety	X	Male	Variety	Date Bagged	Stage	Date Pollinated	Total Seed Produced
12-1	(EG-R)	X	61-29	(X-S)	6/27	0	7/7	451
30-11	(L(S)-R)	X	(Shattered seed)	-	7/8	0	7/23	323
30-11	(L(S)-R)	X	63-30	(EKG-S)	7/8	0	7/23	9
29-2	(LG-S)	X	89-26	(F(NZ)-S)	7/2	0	7/23	30
98-30	(S(R)-R)	X	19-8	(OSC-S)	7/9	0	8/4	6
12-1	(EG-R)	X	8-13	(LC-R)	6/27	0	7/7	221
95-29	(G-R)	X	93-13	(F-S)	6/29	3	7/1	172
91-9	(S-R)	X	(Shattered seed)	-	6/27	1-3	7/1	192
91-9	(S-R)	X	93-14	(F-S)	6/27	1	7/1	76
91-9	(S-R)	X	107-21	(R-R)	6/27	3	7/1	87
94-19	(Tett-R)	X	34-8	(EKG-S)	7/8	0	7/28	54
94-19	(Tett-R)		(Check)		7/8	0	-	4
96-6	(B(S)-R)	X	31-6	(F-S)	7/9	0	7/29	50
21-5	(A(U)-R)	X	44-13	(X-S)	6/23	0	6/30	3
21-5	(A(U)-R)	X	71-16	(FCXF-S)	6/23	0-1	6/30	19
21-5	(A(U)-R)		(Check)		6/23	0-1	-	143
96-30	(G-R)	X	107-21	(F-R)	6/29	1	7/1	83
96-30	(G-R)	X	29-8	(RV-S)	6/29	0	7/7	369
96-7	(B(S)-R)	X	10-13	(LC-R)	7/9	0	8/4	53
35-10	(L(S)-R)	X	63-26	(LC-S)	7/8	0	7/26	34
94-6	(E1-R)		(Check)		7/8	0	-	12
27-8	(Sam(S)-R	X	86-15	(RU-S)	7/7	0	7/23	74
27-8	(Sam(S)-R	X	89-26	(F(NZ)-S)	7/7	0	7/23	70
95-28	(G-R)	X	93-14	(F-S)	6/29	1-3	7/1	756
95-28	(G-R)	X	107-21	(F-R)	6/27	1-2-3	7/1	455
28-9	(Sam(S)-R)	X	13-33	(F-S)	7/8	0	8/1	13
37-16	(S(U)-R)		(Check)		7/8	0	-	210
37-16	(S(U)-R)	X	73-10	(EC-S)	7/8	0	8/3	10
96-21	(B(S)-R)	X	73-10	(EC-S)	7/9	0	7/29	94
96-21	(B(S)-R)		(Check)		7/9	0	-	3
96-21	(B(S)-R)	X	39-4	(Cal-S)	7/9	0	7/29	126
28-7	(MR-S)	X	63-26	(LC-S)	7/7	0	7/23	32
39-17	(L(S)-R)	X	13-33	(F-S)	7/8	0	8/3	9
41-6	(Sam(U)-R)	X	13-33	(F-S)	7/8	0	8/3	15
41-6	(Sam(U)-R)	X	17-30	(LC-R)	7/8	0	8/3	3

Table 10. Foreign Varieties

Unsuccessful Crosses Made in 1936

Female	Variety	X	Male	Variety	Date Bagged	Date Pollinated
29-30	(LG-S)	X	89-26	(F(NZ)-S)	7/8	7/23
29-30	(LG-S)	X	63-30	(EKG-S)	7/8	7/23
30-11	(L(S)-R)	X	89-26	(F(NZ)-S)	7/8	7/23
35-10	(L(S)-R)	X	86-15	(RV-S)	7/8	7/23
37-16	(Sp(U)-R)	X	1-30	(LC-R)	7/8	8/3
37-24	(Sp(U)-R)	X	13-33	(F-S)	7/8	8/3
37-24	(Sp(U)-R)	X	1-30	(LC-R)	7/8	8/3
37-25	(Sp(U)-R)	X	1-30	(LC-R)	7/8	8/3
37-25	(Sp(U)-R)	X	13-33	(F-S)	7/8	8/3
39-17	(L(S)-R)	X	1-30	(LC-R)	7/8	8/3
40-25	(Sam(U)-R)	X	17-30	(LC-R)	7/8	8/3
40-25	(Sam(U)-R)	X	73-10	(EC-S)	7/8	8/3
40-32	(Sam(U)-R)	X	89-26	(F(NZ)-S)	7/2	8/3
42-24	(L(S)-R)	X	17-30	(LC-R)	7/8	8/3
42-24	(L(S)-R)	X	73-10	(EC-S)	7/8	8/3
42-28	(L(S)-R)	X	89-26	(F(NZ)-S)	7/8	7/23
42-28	(L(S)-R)	X	63-30	(EKG-S)	7/8	7/23
63-2	(Cal.C-R)	X	104-11	(MG-R)	7/8	7/25
65-5	(Cal.C-R)	X	104-11	(MG-R)	7/8	7/25
65-5	(Cal.C.-R)	X	29-8	(RV-S)	7/8	7/25
69-12	(EKG-S)	X	104-11	(MG-R)	6/27	7/25
69-12	(EKG-S)	X	29-8	(RV-S)	6/27	7/25
91-7	(S-R)	X	104-11	(MG-R)	7/8	7/25
91-7	(S-R)	X	29-8	(RV-S)	7/8	7/25
92-13	(S-R)	X	8-13	(LC-R)	6/27	7/25
93-10	(El-R)	X	31-6	(F-S)	7/8	7/28
93-10	(El-R)	X	8-8	(LC-R)	7/8	7/28
93-10	(El-R)	X	34-8	(EKG-S)	7/8	7/28
93-10	(El-R)	X	73-10	(EC-S)	7/8	7/28
94-5	(El-R)	X	19-4	(X-S)	7/8	7/28
94-5	(El-R)	X	31-6	(F-S)	7/8	7/28
94-5	(El-R)	X	39-4	(Cal-S)	7/8	7/28
94-12	(El-R)	X	34-8	(EKG-S)	7/8	8/4
94-12	(El-R)	X	10-13	(LC-R)	7/8	8/4
94-12	(El-R)	X	19-8	(OSC-S)	7/8	8/4
94-13	(El-R)	X	72-11	(X-S)	7/8	8/4
94-13	(El-R)	X	10-13	(LC-R)	7/8	8/4
94-19	(Tett-R)	X	39-4	(Cal-S)	7/8	7/28
95-29	(G-R)	X	107-21	(F-R)	6/29	7/1
92-13	(S-R)	X	29-8	(RV-S)	6/27	7/7
92-13	(S-R)	X	8-13	(LC-R)	6/27	7/7
92-13	(S-R)	X	63-34	(F-S)	6/27	7/7
63-23	(EKG-S)	X	29-8	(RV-S)	7/2	7/7
63-23	(EKG-S)	X	8-13	(LC-R)	7/2	7/7
63-23	(EKG-S)	X	61-29	(X-S)	7/2	7/7
12-1	(EG-R)	X	29-8	(RV-S)	6/27	7/7
12-1	(EG-R)	X	63-34	(F-S)	6/27	7/7
1-12	(EG-R)	X	30-31	(LC-S)	7/6	7/20

Unsuccessful Crosses Made in 1936, (Cont.)

Female	Variety	X	Male	Variety	Date Bagged	Date Pollinated
1-12	(EG-R)	X	34-33	(F-S)	7/6	7/20
3-9	(EG-R)	X	37-33	(LC-S)	7/6	7/20
3-9	(EG-R)	X	61-29	(X-S)	7/6	7/20
16-6	(Ba-R)	X	30-31	(LC-S)	7/6	7/20
16-6	(Ba-R)	X	34-33	(F-S)	7/6	7/20
17-2	(Ba-R)	X	61-29	(X-S)	7/6	7/20
17-2	(Ba-R)	X	37-33	(LC-S)	7/6	7/20
17-12	(EG-R)	X	63-26	(LC-S)	7/7	7/23
17-12	(EG-R)	X	63-30	(EKG-S)	7/7	7/23
20-4	(A(U)-R)	X	34-33	(F-S)	7/15	7/20
20-4	(A(U)-R)	X	30-31	(LC-S)	7/15	7/20
23-13	(Sam(S)-R)	X	13-33	(F-S)	7/2	8/1
23-13	(Sam(S)-R)	X	17-30	(LC-R)	7/2	8/1
24-12	(Sam(S)-R)	X	13-33	(F-S)	7/2	8/1
24-12	(Sam(S)-R)	X	17-30	(LC-R)	7/7	8/1
24-13	(Sam(S)-R)	X	1-30	(LC-R)	7/7	8/1
24-13	(Sam(S)-R)	X	13-33	(F-S)	7/7	8/3
28-7	(MR-S)	X	63-30	(EKG-S)	7/7	7/23
28-8	(MR-S)	X	63-26	(LC-S)	7/7	7/23
28-8	(MR-S)	X	89-26	(F(NZ)-S)	7/7	7/23
28-9	(Sam(S)-R)	X	73-10	(EC-S)	7/8	7/30
28-9	(Sam(S)-R)	X	102-15	(X-S)	7/8	7/30
28-30	(LG-S)	X	89-26	(F(NZ-S)	7/8	7/23
28-30	(LG-S)	X	63-26	(LC-S)	7/8	7/23
29-2	(LG-S)	X	63-26	(LC-S)	7/2	7/23
29-12	(L(S)-R)	X	86-15	(KV-S)	7/2	7/23
29-12	(L(S)-R)	X	63-30	(EKG-S)	7/2	7/23
95-16	(V(J)-R)	X	8-8	(LC-R)	7/2	7/29
95-16	(V(J)-R)	X	73-10	(EC-S	7/2	7/29
95-17	(V(J)-R)	X	31-6	(F-S)	7/2	7/29
95-17	(V(J)-R)	X	39-4	(Cal-S)	7/2	7/29
95-19	(Tett-R)	X	10-13	(LC-R)	7/9	8/4
95-19	(Tett-R)	X	72-11	(X-S)	7/9	8/4
95-20	(S(S)-R)	X	31-6	(F-S)	7/9	8/4
95-20	(S(S)-R)	X	34-8	(EKG-S)	7/9	8/4
95-21	(S(S)-R)	X	10-13	(LC-R)	7/9	8/4
95-22	(S(S)-R)	X	72-11	(X-S)	7/9	8/4
95-22	(S(S)-R)	X	19-8	(OSC-S)	7/9	8/4
95-30	(S(S)-R)	X	8-8	(LC-R)	7/9	7/29
95-30	(S(S)-R)	X	34-8	(EKG-S)	7/9	7/29
95-30	(S(S)-R)	X	39-4	(Cal-S)	7/9	7/29
96-31	(S(S)-R)	X	19-8	(OSC-S)	7/9	7/29
96-31	(S(S)-R)	X	31-6	(F-S)	7/9	7/29
96-31	(S(S)-R)	X	73-10	(EC-S)	7/9	7/29
96-3	(TB-R)	X	39-4	(Cal-S)	7/9	7/29
96-4	(B(S)-R)	X	72-11	(X-S)	7/9	8/4
96-4	(B(S)-R)	X	10-13	(LC-R)	7/9	8/4
96-7	(B(S)-R)	X	19-8	(OSC-S)	7/9	8/4
96-13	(B(S)-R)	X	31-6	(F-S)	7/9	7/29

Unsuccessful Crosses Made in 1936, (Cont.)

Female	Variety	X	Male	Variety	Date Bagged	Date Pollinated
96-13	(B(S)-R)	X	34-8	(EKG-S)	7/9	7/29
96-13	(B(S)-R)	X	89-4	(Cal-S)	7/9	7/29
96-15	(B(S)-R)	X	10-13	(LC-R)	7/9	8/4
96-15	(B(S)-R)	X	72-11	(X-S)	7/9	8/4
97-2	(V(J)-R)	X	10-13	(LC-R)	7/9	8/4
97-2	(V(J)-R)	X	72-11	(X-S)	7/9	8/4
98-7	(S(R)-R)	X	10-13	(LC-R)	7/9	8/4
98-7	(S(R)-R)	X	72-11	(X-S)	7/9	8/4
98-10	(S(R)-R)	X	10-13	(LC-R)	7/9	8/4
98-10	(S(R)-R)	X	19-8	(OSC-S)	7/9	8/4
98-19	(S(R)-R)	X	72-11	(X-S)	7/9	8/4
98-19	(S(R)-R)	X	19-8	(OSC-S)	7/9	8/4
98-20	(S(R)-R)	X	10-13	(LC-R)	7/9	8/4
98-21	(S(R)-R)	X	72-11	(X-S)	7/9	8/4
104-6	(AR-R)	X	73-10	(EC-S)	7/9	7/30
104-6	(AR-R)	X	102-15	(X-S)	7/9	7/30

Table 11. Common Varieties and Seedlings

Successful Crosses Made in 1936

Female	Variety	X	Male	Variety	Date Bagged	Stage	Date Pollinated	Total Seed Produced
2-4	(F(W)-R)	X	(Check)		7/1	1-2-3	-	197
11-8	(F-R)	X	31-34	(RV-S)	6/18	0-1	6/22	359
13-7	(F- R)	X	(Check)		6/23	0	-	9
32-29	(EC-R)	X	31-34	(RV-S)	6/23	0-1-2	6/30	854
11-8	(F-R)	X	(Check)		6/18	0-1-2-3	-	18
32-29	(EC-R)	X	44-13	(X-S)	6/23	0-1	6/30	126
13-7	(F-R)	X	71-16	(LCXF-S)	6/23	0-1-2	6/29	144
26-12	(LC-S)	X	(Check)		7/1	0-1-2	-	176
31-29	(EC-R)	X	31-34	(RV-S)	6/23	0	6/30	228
3-3	F(W)-R)	X	(Check)		7/1	0-1-2-3-4	-	98
13-8	(F-R)	X	31-34	(RV-S)	6/23	0-1-2	6/29	840
31-29	(EC-R)	X	20-34	(OSC-S)	6/23	0	6/30	1605
13-4	(F-R)	X	14-16	(EC-R)	6/23	0	6/29	40
13-4	(F-R)	X	31-34	(RV-S)	6/23	0-1	6/29	179
13-4	(F-R)	X	(Check)		6/23	0	-	60
13-9	(F-R)	X	20-34	(OSC-S)	6/23	1-3	6/29	462
13-9	(F-R)	X	31-34	(RV-S)	6/23	1	6/29	135
13-9	(F-R)	X	(Check)		6/23	2-3	-	34
12-2	(F(S)-R)	X	31-34	(RV-S)	6/17	0-1-2-4	6/29	459
11-2	(F-R)	X	71-16	(LC X F-S)	6/26	2-3-4	6/30	201
11-2	(F-R)	X	20-34	(OSC-S)	6/26	2	6/30	165
11-6	(F-S)	X	31-34	(RV-S)	6/18	2-3-4	6/22	6
11-6	(F-S)	X	107-21	(F-R)	6/18	2-3	6/22	2
11-6	(F-S)	X	19-31	(4-33-S)	6/18	1-2-3	6/22	56

Symbols

3012 = Seedling from 4-33.
OSC = Oregon State College
F(W) = Puggles from Woods yard
E.C. = Early Cluster
L.C. = Late Cluster
R.V. = Red Vines
EKG = East Kent Golding
-R = Root cutting
-S = Seedling

Table 12. Common Varieties and Seedlings

Unsuccessful Crosses Made in 1936

Female	Variety	X	Male	Variety	Date Bagged	Date Pollinated
75-17	(EC-S)	X	19-31	(RV-S)	6/17	6/22
11-8	(F-R)	X	19-31	(3012-S)	6/18	6/22
14-29	(EC-R)	X	15-31	(F-S)	6/18	6/22
24-29	(EC-R)	X	19-31	(3012-S)	6/18	6/22
13-7	(F-R)	X	14-16	(EC-R)	6/23	6/29
11-5	(F-R)	X	84-15	(LC-S)	6/23	6/29
11-5	(F-R)	X	20-34	(OSC-S)	6/23	6/29
22-29	(EC-R)	X	93-14	(F-S)	6/18	6/29
22-29	(EC-R)	X	71-16	(LC X F-S)	6/18	6/29
24-29	(EC-R)	X	44-13	(X-S)	6/22	6/30
24-29	(EC-R)	X	45-30	(F-S)	6/26	6/30
25-31	(EKG-S)	X	45-30	(F-S)	6/27	6/30
25-31	(EKG-S)	X	44-13	(X-S)	6/26	6/30
25-31	(EKG-S)	X	20-34	(OSC-S)	6/27	6/30
12-5	(F-R)	X	71-16	(LC X F-S)	6/23	6/30
12-5	(F-R)	X	44-13	(X-S)	6/23	6/30
53-9	(F-S)	X	44-13	(X-S)	6/23	6/30
53-9	(F-S)	X	71-16	(LC X F-S)	6/23	6/30

For each cross attempted, unpollinated checks were left. The clusters of flowers left as checks were bagged at the same time as those to be pollinated and were treated in exactly the same manner except that no pollen was applied. These checks were left so that the effectiveness of the bagging method could be determined. A total of 541 checks were left and only 12 or 2.22% of these set seed. The probable explanation of the seed produced on these 12 checks is that the flowers were bagged at too late a stage or that the bags did not fit tight enough around the stem to exclude wind blown pollen. Some workers have reported parthenogenesis in hops, but the author is of the opinion that seed is rarely if ever produced without fertilization in the common varieties of hops. Data on the checks producing seed are given in Tables 13 and 14.

Table 13. Common Variety Check Data

Checks that Produced Seed

Row and Plant No.	Variety Name	Check	Date Bagged	Stage or Stages	Total No. of seed produced
2-4	F(w)-R	Check	7/1	1-2-3	197
26-12	LC-S	"	7/1	0-1-2	176
3-3	F(w)-R	"	7/1	0-1-2-3-4	98
15-7	F-R	"	6/23	0	9
11-8	F-R	"	6/18	0-1-2-3	18
13-4	F-R	"	6/23	0	60
13-9	F-R	"	6/23	2-3	34

Total No. of checks that produced seed - - - - 7
Total No. of checks that did not produce seed - 105
% of checks that produced seed- - - - - - - - - 6.7%
% of checks that did not produce seed - - - - - 93.3%

Table 14. Check Data on Foreign Varieties

Checks that Produced Seed

Row and Plant No.	Variety Name	Check	Date Bagged	Stage or Stages	Total No. of seed produced
21-5	Alsace(Urbanm)-R	Check	6/23	0-1	143
37-16	Spalter(Urbanm)-R	"	7/8	0	210
94-6	Elassar-R	"	7/8	0	12
94-19	Tettnonger Fruh-R	"	7/8	0	4
96-21	Bergunder(Simon)-R	"	7/9	0	3

No. of checks producing seed - - - 5
No. of checks that produced seed = 1.5%

Foreign Varieties Picked for Analysis

In Tables 15 and 16 some plant notes and picking data on the foreign varieties which were picked for analysis, are recorded. These notes were taken to determine what the characteristics of these varieties are as this information is valuable in determining the varieties to use as parent stock in the breeding program.

Pollen Shedding Period of Males

Table 17 gives the period over which pollen was shed by each of the males used in crosses in 1936. The majority of these males are seedlings. These seedlings were used as pollen parents because they appeared to have better characteristics than the males of the common hop varieties.

Table 15. Maturity Notes on Foreign Varieties Picked 1936

Plant & Row No.	Variety Name	Year Planted	Condition of Plant	Dates Notes Taken	Stage of ♀
3-9	EG	33	Good plant, large hops and a good yielder.	7/17	2
16-6	Bav	31	Many spikes but fairly good plant.	7/17	2
16-8	EG	33	Good plant and good yield.	7/17	2
17-2	Bav	31	Fair plant and good yield.	7/17	3
20-4	A(U)	33	Fair plant and fair yield.	7/17	1
23-6	Sam(S)	33	Good large plant, large hops and good yield.	7/27	2
28-7	MR	33	Rather poor plant with low yield.	7/20	4
28-30	LG	33	Fairly poor plant with low yield.	7/20	2
37-24	Spa(U)	33	Fairly poor plant with a fair yield.	7/20	1
39-17	L	33	Fairly poor plant with a fair yield.	7/20	1
41-24	Som(U)	33	Fair plant with a fair yield.	7/21	1
63-31	EKG	33	Fair plant, fair yield hops up to 3/4 in.long.	7/21	3 and beyond.
88-8	GC	35	Poor plant with poor yield.	7/22	3
89-7	GC	35	Poor plant with poor yield.	7/22	3
94-13	Sl	32	Good plant, good yield and fair size hops.	7/22	2
94-17-19-22	Tett	35	Poor plants, poor yields and fair size hops.	7/22	3
95-14-19	Tett	35	Fair plant, poor yield, and fair size hops.	7/22	4
95-13	Sem	32	Fair plant, fair yield and fair size hops.	7/22	1
95-16-17	V(J)	33	Fair plant, fair yield and fair size hops.	7/22	3
95-22	Spg(S)	33	Fair plant, poor yield and fair size hops.	7/22	2
95-28-29	G	32	Fair plant, fair yield, and fair size hops.	7/22	½ in.to 2 in. hops
96-3	TB	33	Fair plant, fair yield and good size hops.	7/22	3
96-27	Berg	33	Good plant, good yield and good size hops.	7/22	3
96-30	G	32	Fair plant, poor yield, some cones are mature at this date.	7/22	Beyond stages
98-30	Spa(R)	33	Good plant, good yield, good sized hops	7/22	2
104-6	AR	33	Fair plant, poor yield, fair size hops.	7/22	3
104-12	MG	33	Fair plant, fair yield, fai r size hops.	7/22	3

Table 16. Foreigns Picked in 1936

Row and Plant Number	Variety	Date Picked	Odor of Cones	Actual dry wt.	% Dry	1936 Mildew notes (S & L)	1935 Chemical Analysis Total % of soft resin	Total % of Alpha resin
3-9	EG	9/2	Medium	3.3	24	-	16.66	5.12
16-6	Bav	9/11	Weak pleasant	2.5	27	SL	19.17	5.02
16-8	EG	9/8	Strong	4.0	29	L	16.66	5.12
17-2	Bav	9/11	Weak, pleasant	2.4	27	SL	19.17	5.02
20-4	A(U)	9/8	Strong sweet	2.3	35	-	18.60	5.21
23-6	Sam (S)	9/11	Medium peculiar	4.5	28	S^2L	16.65	6.91
28-7	MR	9/8	Strong oily	1.1≠	25	-	16.20	1.53
28-30	LG	9/10	Medium rather sweet	2.1	35	-	16.72	3.07
37-24	Spa(U)	9/8	Strong	3.6	29	-	16.20	4.47
39-17	L	9/8	Strong sweet pleasant	2.5	28	-	20.88	6.66
41-24	Som(U)	9/8	Medium strong	3.2	28	SL	17.37	8.06
63-31	EKG	9/8	Very strong	2.1	34	-	-	-
88-8	G.C.	9/9	Rather strong)	1.6	28	S^2	-	-
89-7	GC	9/9	Rather strong)			S	-	-
94-13	El	9/10	Medium strong	2.5	23	-	17.54	6.73
94-17-19-22	Tett)	9/19	Onion like	1.6	37	-	-	-
95-14-19	Tett)					-	-	-
95-13	Sem	9/19	Medium	1.1≠	25	-	14.09	2.72
95-16-17	V(J)	9/9	Medium	2.8	31	-	17.21	3.25
95-22	Spa (S)	9/9	Weak pleasant	1.3	30	-	17.54	7.50
95-28-29	G*	9/9	Very strong	.3	60	-	15.43	3.48
96-3	TB	9/9	Rather strong	1.7	30	-	15.16	3.68
96-27	Berg	9/10	Medium	2.3	30	L	19.92	6.09
96-30	G*	9/9	Very strong (with other golding)	-	-	S	15.43	3.48
98-30	Spa(R)	9/10	Rather weak	3.5	25	-	16.92	6.44
104-6	AR	9/10	Rather mild	1.0	28	-	12.53	.95
104-12	MG	9/10	Rather strong peculiar	1.1	33	S^3L	14.67	2.30

L = Means that it is a leaf infection.
S - Means that it is a stem or spike infection.
* - Means hops were overripe.
≠ - Means 25% of green weight was method used in deriving the dry weight.

Symbols Used in Table 18

EG - Early Green

Bav - Bavariana

A(U) - Aleave (Urbann)

Sam(S) - Sambling (Solmon)

MR - Millers Resistant

LG - Late Grape

Spa(U) - Spalter (Urbann)

L - Landhopfen

Sam(U) - Sambling (Urbann)

EKG - East Kent Golding

GC - Golden Clusters

El - Elsasser

Tett - Tettnanger

Sem - Semsch

V(J) - Verte (Jagger)

Spa(S) - Spalter(Simon)

G - Golding

TB - Tige Blanche

Berg - Bergunder

Spa(R) - Spalter (Rhemer)

AR - Auscher Rote

MG - Mittelfrüher Grüne

Table 17. Pollen Shedding Period of Males Used in Crosses 1936

Row and Plant Number	Variety	First Pollen Shed	Last Pollen Shed
1-30	LC-R	7/27	7/31
8-8	LC-R	7/21	8/10
8-13	LC-R	7/12	8/26
10-13	LC-R	7/29	8/13
13-33	F-S	7/29	8/21
14-16	EC-R	6/25	8/1
15-31	F-S	6/15	7/12
17-30	LC-R	7/26	8/12
19-8	OSC-S	7/25	8/5
19-31	(4-33)-S	6/17	7/1
20-34	OSC-S	6/22	7/12
29-8	RV-S	7/5	8/4
30-31	LC-S	7/5	8/4
31-6	F-S	7/12	7/28
31-34	RV-S	6/17	7/10
34-33	F-S	6/27	7/30
37-33	LC-S	7/10	8/17
39-4	Cal-S	7/20	8/6
44-13	X-S	7/10	7/24
45-30	F-S	6/19	7/21
61-29	X-S	7/1	8/9
63-26	LC-S	7/10	8/1
63-30	EKG-S	7/6	7/27
63-34	F-S	7/1	7/30
71-16	LCXF-S	6/18	8/9
72-11	X-S	7/21	8/12
73-10	EC-S	7/15	8/12
84-15	LC-S	7/10	7/30
86-15	RV-S	7/15	8/8
89-26	F-S	7/12	7/28
93-14	F-S	6/25	7/28
102-15	X-S	7/20	8/3
104-11	Mul.G-R	7/12	8/9
107-21	F-R	6/21	8/2

Variety Trial Plot on the Horst Ranch

In 1935 a variety trial plot was established on the Horst Ranch near Independence, Oregon. The planting plan of this yard is given in Figure 1. Tables 18, 19, 20 and 21 give the notes that were taken on this variety plot at various dates during the summer of 1936. In Table 22, a comparison of the amount of mildew infection on the foreign varieties being grown both in the Horst yard and in the experimental yard at Corvallis is given. At the time these notes were taken mildew infection was slightly heavier in the Horst yard than it was in the Corvallis yard. This was likely due to the fact that the plot at the Horst Ranch is on low ground and is surrounded by trees, and hence the humidity in the area is usually high. High humidity favors the spread of downy mildew. None of the varieties grown in this plot were immune to mildew although some of them seemed to be more resistant than Late Clusters.

No yield data were obtained from this plot due to the fact that the manager of the ranch failed to let us know when these hops would be picked. All varieties were picked on the same day although they varied by as much as two to three weeks in their date of maturity. It would be desirable to have one man in charge of this plot so that data could be taken on each variety at the proper time. If this can be done, much valuable information can be secured from this plot.

Fig. 1. Diagram of Variety Trial Plot - Horst Yard - Independence, Oregon
Planted 1935

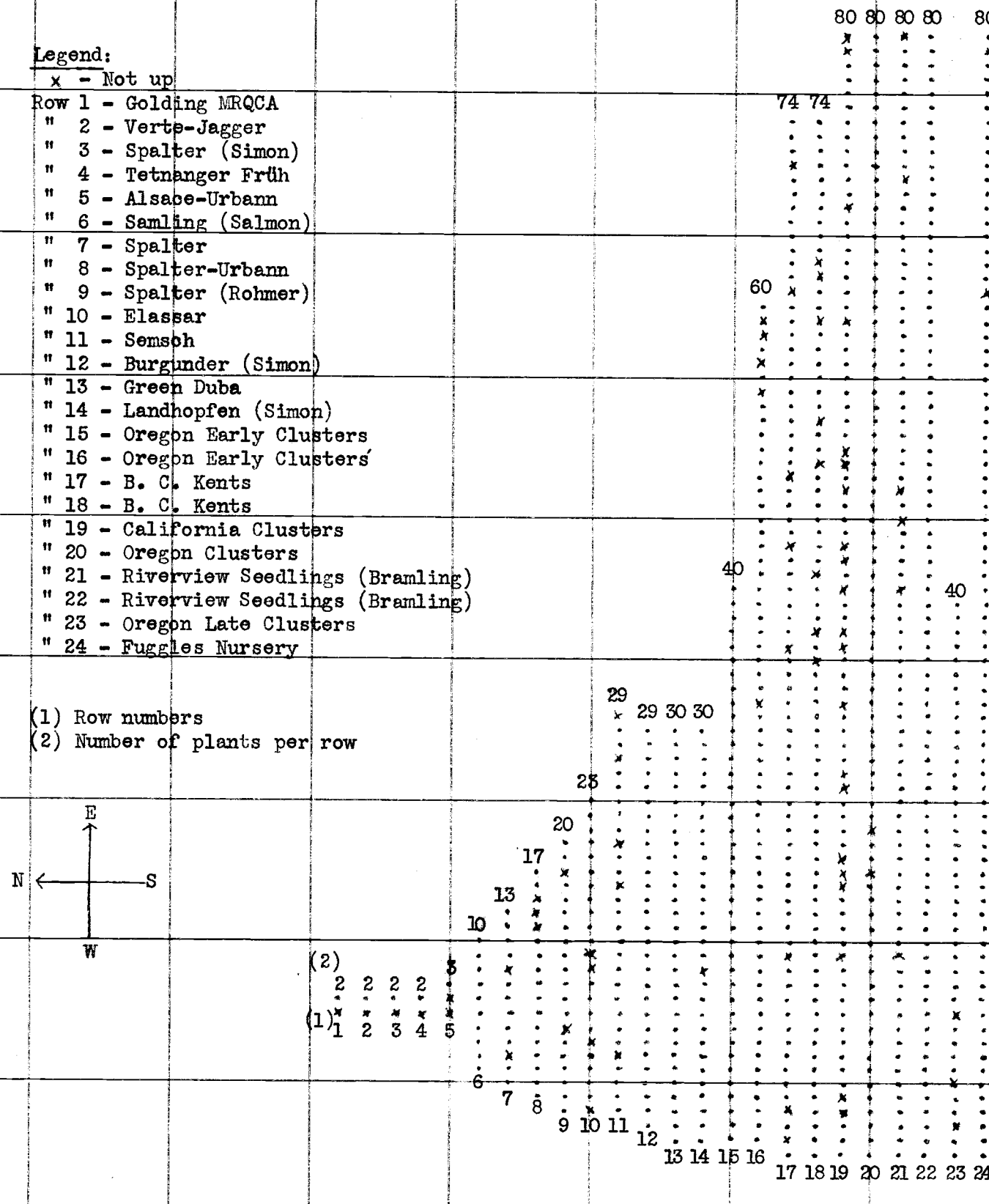


Table 18. Variety Trial Plot, Horst Yard, Independence

Row 1. Golding MRPQCA - 2
" 2. Verte Jagger - 2
" 3. Spalter (Simon) - 2
" 4. Tettnanger Früh - 7
" 5. Alsace (Urbanm) - 6
" 6. Samling (Salmon) - 11
" 7. Spalter - 15
" 8. Spalter (Urbanm) - 17
" 9. Spalter (Rolmer) - 20
" 10. Elassar - 21
" 11. Semsch - 29
" 12. Burgunder (Simon) - 29
" 13. Early Green Duba - 30
" 14. Landhopfen (Simon) - 30
" 15. Brewer's Favourite 12; Oregon Early Clusters - 48
" 16. Brewer's Gold 12; Oregon Early Clusters - 48
" 17. B. C. Kent Goldings - 74
" 18. B.C. Kent Goldings - 74
" 19. California Clusters - 80
" 20. Oregon Fuggles - 80
" 21. Riverside Seedlings - 80
" 22. Riverside Seedlings - 80
" 23. Oregon Late Clusters - 41
" 24. Fuggles Nursery

Notes Taken 6/8/36

Vines already suckered and stripped and some spiking done when counted.

Legend: bs = blind spikes. O = out.
S = spikes.
LI = leaf infection.

Row 1: Hills 1, 2 = LI
Hills, 1, 2= bs
Row 2: Hills 1, 2 = LI
Row 3: Hills 1, 2 = LI
Hill 1 = S
Row 4: Hills 3, 4 = O
Hills 1, 2, 5, 6, 7 = LI
Hill 5 = S
Row 5: Hills 1, 6 = O
Hills 4, 5 = LI
Hills 2, 3 = 3
Row 6: Hills 1-11 = LI

Variety Trial Plot, Horst Yard, Independence, (Cont.)

Row 7: Hills 3, 9 = O
Hills 1-2, 4-8, 10-13 = LI
Hill 6 = S
Row 8: Hills 2-12, 16-17 = LI
Hills 1, 14 = S
Row 9: Hills 1-20 = LI
Row 10: Hill 1 = O
Hills 5,6 = barely up
Hills 2-4, 7-10, 13-23 = LI
Row 11: Hills 2, 5, 17, 28 = O
Hills 3-4, 6-9, 11-16, 18-25, 27, 29 = LI
Hills 3-4, 7-9, 12-15, 18-21, 23-26, 27, 29 = bs
Hills 10, 16 = S
Row 12: Hills 1-29 = LI
Hills 9-11, 13-15, 18-21, 23, 29 = S
Row 13: Hill 27 = O
Hills 1-26, 28-30 = LI
Hill 2 = bs
Hills 4, 22 = S
Row 14: Hills 1-14, 16-30 = LI
Hills 4-5, 8, 12, 14-17, 19-21, 24-30 = S
Row 15: Brewer's Favourite:
Hills 3-6, 11= O
Hills 1-2, 7-9, 12 = barely up
Hill 10 = LI
Hill 10 = S
Oregon Early Clusters:
Hills 1-48 = LI
Hills 1-48 = S
Row 16: Brewer's Gold:
Hills 1-7, 9-12 = O
Hill 8 = barely up
Oregon Early Clusters:
Hills 1-48 = LI
Hills 1-48 = S
Row 17: Hills 1, 3-14, 16-20 = LI
Hills 1-3, 8, 12, 14 = S
Row 18: ---
Row 19: Hill 5 = O
Hill 16 = barely up
Hills 1-3, 6-15, 17-20 = LI
Hills 1, 6-7, 9-15, 17-20 = S
Row 20: Hills 2-8, 10-13, 15-20 = LI
Hill 11= S
Row 21: Hill 3 = barely up
Hills 1-20 = LI
Hills 3, 5-6, 8-10, 12-14, 16-20 = S
Row 22: ---
Row 23: Hill 3 = barely up
Hills 1-2, 4-5, 7-20 = LI
Hills 7-10, 12-13, 16-20 = S
Row 24: Hills 1-20 = LI
Hill 20 = S

Table 19. Notes Taken on Variety Trial Plot at the Horst Yard - Independence, June 8, 1936

Row	Variety
1	Golding MRPQCA -
2	Verte (Jagger) -
3	Spalter (Simon) -
4	Tettnanger Früh - Hills 5, 6, and 7 not typical.
5	Alsace (Urban) -
6	Saaling (Salmon) - Hill 11 not typical. Vines vigorous. Small amount of leaf infection but no spikes.
7	Spalter - Plants have yellow mottled leaves. Appears to be a genetic character.
8	Spalter (Urban) - Vigorous vines. Hills 1, 3, 13/14, and 15 have green stems. Others are red vines.
9	Spalter (Rohmer) - Vigorous vines. Hill 18 not typical.
10	Klassar - Bad leaf infection.
11	Semsch - Poor vines. Many spikes.
12	Burgunder (Simon) - Vines vigorous but have lots of leaf infection and spikes.
13	Early Green (Duba) - Fair vines but considerable mildew.
14	Landhopfen (Simon) - Vines vigorous but considerable mildew.
15	Brewers' Favorite - Plants just coming up.
15	Early Clusters - Badly spiked.
16	Brewers' Gold - Only one plant up.
17	B. C. Kent Goldings - Considerable leaf infection, and spikes.
18	B. C. Kent Goldings - Considerable leaf infection and spikes.
19	California Clusters - Bad mildew infection.
20	Fuggles - Very light leaf infection. No spikes.
21	Riverside Seedling - Hills 1, 2, 6, and 11 red vine. Hills 3, 4, 5, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19 and 20 green vine - look much like Early Clusters.
22	Riverside Seedlings - Hills 4, 5, 14 and 17 red vines; others up to hill 20 are green. Notes only taken to hill 20.
23	Oregon Late Cluster -
24	Fuggles Nursery - Light leaf infection.

Table 20. Notes on Foreign Varieties at the Hearst Yard

July 13, 1936

	Vine Color	*Stage of Maturity	General Plant Vigor and Remarks.
1. Golding M.R.P.Q.C.A. -	Red	0	Weak plants due to mildew.
2. Verte Jagger	Green	1	Good.
3. Spalter (Simon)	Red	0	Fair.
4. Tettnanger Früh	Red	0	Poor.
5. Alsace (Urbann)	Red	0	Good.
6. Samling (Salmon)	Red	0	Good. Mottled leaves.
7. Spalter	Mixed	Vary	Poor. Mottled leaves. Plants 6 and 13 have hops 1 inch long. Others in stage 2.
8. Spalter (Urbann)	Red	1	Good.
9. Spalter (Rohmer)	Red	0	Good. Best of Spalter types.
10. Elassar	Red	0	Poor.
11. Semsch	Red	0	Very poor.
12. Burgunder (Simon)	Red	0	Fair. Mottled leaves.
13. Early Green (Duba)	Green	2	Good. Plant 4 has 1 inch hops.
14. Landhopfen (Simon)	Red	2	Very good. Uniform.
15. Brewers Favorite	-	0	Very poor. Plant Nos. 1, 2, 5, 7 and 10 very weak growth. Others dead.
16. Brewers Gold	-	0	Only one plant growing and it is very weak.
17. B. C. Kent	Green	0	Good. Uniform.
18. Oregon Early Cluster	Green	Vary mostly Stage 3.	Very poor. Almost total loss due to mildew.
19. California Cluster	Green	3	Fair. Much better than Oregon Clusters.
20. Oregon Fuggles	Green	Vary from stage 2 to 1 inch hops.	Fair - uniform.
21. Riverside Seedlings	Reddish	3	Fair to good. Look like red vine type.
22. Oregon Late Cluster	Green	1	Fair. Are uneven.
23. Fuggles (Nursery)	Green	Vary from 0 to 3.	Fairly good. Uniform.

* Stage of Maturity - 0 -- Flowers not showing at this date.
1 -- Flowers very small. Stigma just showing.
2 -- Flowers larger. About 4 days earlier than 1.
3 -- Flowers quite large. About 4 days earlier than 2.

Table 21. Notes on Foreign Varieties at the Horst Yard

August 21, 1936

Riverside Seedlings - Medium small cone, ripe about August 22. Fair yield. Vary in cone shape and maturity.
Oregon Fuggles - picked.
California Clusters - Mature about August 29. Long cones, fair yield.
Brewers Gold - no hops.
Brewers Favorite - no hops.
Landhopfen - Picked part of row. Small cone, fairly good yield, good vine growth. Ripe about August 27.
Early Cluster - Very few hops, uneven, some ripe.
Early Green - Good yield, good medium large size cone. Vary in maturity, some nearly ripe.
Burgunder (Simon) - Small slender cone, fair yield. Good vine growth. 1 inch cones. (Mature August 25. Vary)
Semsch - Square cone. Mature August 27. Vary. Poor yield - mildew.
Elassar - Fluffy small cone, fair yield, fair vine growth.
Spalter (Rohmer) - Small blunt cone, fair yield. Mature August 30.
Spalter (Urbann) - Small blunt cone, fair yield. Mature August 29.
Spalter - Small blunt cone, poor yield. Mature August 23.
Samling (Salmon) - Small blunt cone, fair yield, mature September 4.
Alsace (Urbann) - Small cone, fair yield. Mature August 23.
Tettnanger (Früh.) - Medium size cone, poor yield. Mature August 23.
Spalter (Simon) - Same as other Spalters.
Verte Jagger - Small round cone, fair yield. Mature August 29.
Golding - Small round cone, poor yield. Mature August 24.

All vary in cone size, shape and maturity.

Table 22. Comparison of Mildew Infection of Foreign Varieties at the Horst Yard and at Corvallis, 1936

Variety	Horst Yard 6/8/36				Corvallis 6/5/36			
	Total No. Plants	No. (1) S	No. (2) L	No. Free	Total No. Plants	No. S	No. L	No. Free
1. Golding	2	2	2	0	3	1	0	2
2. Verte (Jagger)	2	0	2	0	3	0	0	3
3. Spalter (Simon)	2	1	2	0	8	0	3	5
4. Tettnanger Früh	5	1	5	0	5	0	0	5
5. Alsace (Urban)	4	2	2	0	7	3	5	2
6. Samling (Salmon)	11	0	11	0	10	7	10	0
7. Spalter	11	1	11	0	9	2	2	7
8. Spalter (Urbann)	17	2	13	2	9	4	6	3
9. Spalter (Rohmer)	20	0	20	0	10	2	4	6
10. Hlasnar	18	0	16	2	15	5	9	6
11. Semsch	25	18	22	3	9	0	4	5
12. Burgunder (Simon)	29	12	29	0	18	2	16	2
13. Early Green (Duba)	29	3	29	0	13	2	8	6
14. Landhopfen (Simon)	30	18	29	1	21	6	19	2
15. Brewer's Favorite	1	1	1	0	-	-	-	-
16. B.C. Kent Goldings	20	6	18	1	14	2	6	8
17. California Clusters	18	14	17	1	10	7	8	2

(1) S - Spike
(2) L - Leaf infection

Chemical Analysis

Chemical analysis of the more promising seedlings and of the foreign varieties grown in the experimental yard at Corvallis, Oregon, were run by Mr. Frank Rabak, Associate Biochemist, Division of Drug and Related Plants, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. Mr. Rabak also analyzed hop samples from a fertiliser trial and from a stage of maturity experiment conducted by Dr. W. C. Smith. The reports submitted by Mr. Rabak are included verbatim in the following pages as a matter of record. These reports are for the 1935 season rather than for 1936 as they arrived too late to be included in the 1935 Annual Report.

Analysis of Seedling Hops Grown at Corvallis, Oregon in 1935

Seventy-four seedling hops were grown on the experimental plot at Corvallis, Oregon, by Dr. D. C. Smith in 1935. These were divided into three groups according to a tabulation submitted by Dr. Smith. Group 1 - 16 seedlings, group 2 - 17 seedlings, and group 3 - 41 seedlings.

Physical and chemical examinations were made of the hops obtained from the various seedlings, some of which were grown in 1933 and 1934. The results were tabulated in three groups. In group 1 eight seedlings yielded hops containing from 16.03 to 19.71 per cent, four from 14.36 to 15.93 per cent and four from 11.09 to 12.72 per cent of soft resins. The seedlings in these three percentage ranges of soft resins may be classed as good, fair and poor respectively.

These seedlings rearranged in decreasing order of their soft resin content were as follows:

Seedlings	Per cent Total Soft Resins	Quality Classification
52-31	19.71	
Late Clusters	19.12	
8-12	19.06	
62-27	18.12	Good
Fuggles	17.62	
70-13	17.16	
Red Vine	17.11	
36-7	16.03	
53-10	15.93	
63-31	15.00	Fair
2-31	14.41	
19-33	14.36	
47-18	12.72	
100-8	12.45	Poor
24-7	11.80	
77-5	11.09	

Five of the sixteen seedlings grown in 1935 were also grown in 1933 and 1934. In order that a comparison of these five seedlings

Analyses of Seedling Hops - Corvallis, Oregon, 1935

Group 1

Sample No.	Plant No.	Color	Odor	Seeds	Picking	Lupulin	Strobiles	Moisture %	Resins: Total Soft %	Alpha %	Beta %	Gamma Hard %	Total Resins %
18	47-18	Golden yellow with pale brown cones	Strong pleasant	Very many	Clean	Yellow, fairly plentiful	Broken, medium to large	7.66	12.72	0.60	12.12	1.15	13.87
23	19-33	Pale green	Mild pleasant	Many	Very clean	" " "	Broken, large	8.10	14.36	Trace	14.36	1.38	15.74
24	62-27	" "	" "	"	" "	Yellow, plentiful	Broken, small to medium	7.52	18.12	"	18.12	1.91	20.03
27	36-7	Pale green with few brown cones	Mild, not pleasant	"	Clean	" "	Broken, medium to large	7.82	16.03	2.56	13.47	2.50	18.53
33	100-8	Pale green	Mild, pleasant	Few	Clean	Yellow, fairly plentiful	Unbroken, medium	8.16	12.45	4.12	8.33	1.61	14.06
37	77-8	Dark green	Mild, pleasant	Few	Clean	Yellow, fairly plentiful	Broken, medium to large	8.66	11.09	1.78	9.31	1.38	12.45
43	63-31	Yellowish green brown cones	Very mild, not pleasant	Few	Clean	Yellow, fairly plentiful	Broken, medium to large	7.80	15.00	Trace	15.00	2.01	17.01
45	70-15	Pale green	Mild, pleasant	Few	Clean	Yellow, plentiful	Broken, medium	8.20	17.16	0.61	16.55	0.72	17.88
48	Fuggles	Golden, green variegated	Mild, very pleasant	Medium	Unclean	Lemon yellow, plentiful	Broken, medium	7.64	17.62	5.30	12.32	1.91	19.53
55	52-31	Pale green, brown cones	Strong, pleasant	Medium	Unclean	Lemon yellow, plentiful	Unbroken, medium to large	8.06	19.71	5.82	13.89	2.05	21.74
61	53-10	Green, slightly brown	Strong, pleasant	Many	Clean	Yellow, fairly plentiful	Broken, large	7.56	15.93	1.51	14.42	1.86	17.79
66	8-12	Yellowish green	Mild, agreeable	Many	Fairly clean	Lemon yellow, very plentiful	Broken, medium to large	7.28	19.06	4.98	14.08	2.15	21.21
69	Late Clusters	Yellowish green	Mild, agreeable	Few	Clean	Lemon yellow, very plentiful	Broken, small to medium	6.72	19.12	5.74	13.38	1.78	20.90
74	Red Vine	Golden yellow	Strong, not pleasant	Many	Clean	Yellow, plentiful	Broken, large	6.74	17.11	2.54	14.77	1.80	18.91
75	2-51	Green with yellow tint	Mild, not pleasant	Few	Clean	Yellow, scarce	Broken, medium to large	7.86	14.41	1.88	12.53	2.01	16.42
76	24-7	Yellow green with brown cones	Disagreeable	Very Many	Unclean	Dark golden, very scarce	Broken, small, discolored	7.10	11.80	Trace	11.80	0.84	12.64

grown during three successive years might be made, a tabulation of the total soft resin content of the hops produced in 1933, 1934, and 1935 was made.

Comparison of Total Soft Resin Content of Five Seedlings of Group I Grown in 1933, 1934, and 1935

	Per cent of Total Soft Resins		
	1933	1934	1935
36-7	18.22	17.95	16.03
53-10	17.10	16.96	15.93
19-33	17.49	16.77	14.36
62-27	17.53	14.93	18.12
2-31	-	14.24	14.41

Seedlings (36-7) and (53-10) remained fairly constantly high in total soft resins during the three successive years. Seedling (19-33) decreased and seedling (62-27) increased in 1935 over 1933 and 1934, while seedling (2-31) remained fairly constant in 1934 and 1935.

In group 2 only three seedlings yielded hops containing from 16 to 16.68 per cent, eight from 13.64 to 15.55 per cent and six from 11.05 to 12.69 per cent of soft resins. The majority of the seedlings (14 of the 17 seedlings) in group 2 were poor to fair in quality. Of these 17 seedlings two were also grown in 1934 and none in 1933.

Seedlings (32-31) and (41-31) with 15.35 and 12.42 per cent in 1935 compared with 15.28 and 13.13 per cent of soft resins respectively in 1934.

The seedlings of Group 2 re-arranged in decreasing order of their soft resin content and classed as good, fair and poor were as follows:

Analyses of Seedling Hops - Corvallis, Oregon, 1938

Group 2

Sample No.	Plant No.	Color	Odor	Seeds	Picking	Lupulin	Strobiles	Moisture %	Resins				
									Total Soft %	Alpha %	Beta %	Gamma Hard %	Total Resins %
4	32-31	Yellowish green	Strong pleasant	Few	Clean	Yellow, fairly plentiful	Broken, medium to large	8.00	15.38	3.00	12.38	1.68	16.98
11	30-6	Golden yellow green tint	Mild, pleasant	Very few	Clean	Yellow, scarce	Broken, large	8.30	12.89	0.59	12.30	1.55	14.48
15	56-31	Yellowish green	Strong, pleasant	Many	Clean	Deep yellow, fairly plentiful	Broken, medium to large	8.44	16.00	Trace	16.00	1.15	17.15
18	51-8	Golden yellow, green tint	Mild, very pleasant	Many	Clean	Deep yellow, fairly plentiful	Broken, medium to large	9.04	14.49	3.05	11.44	1.26	15.75
19	36-8	Dark green with many brown cones	Strong, pleasant	Few	Fairly clean	Golden, scarce	Unbroken, medium	8.46	11.05	Trace	11.05	1.81	12.86
26	38-7	Bright green	Pleasant, flowery	Many	Clean	Yellow, plentiful	Broken, medium to large	7.80	15.48	Trace	15.48	1.39	16.87
28	50-7	Pale green	Mild, pleasant	Very few	Clean	Yellow, scarce	Broken, medium	8.00	12.68	1.50	11.12	1.15	13.77
31	52-1	Green with brown cones	Strong, not pleasant	Few	Fairly clean	Yellow, plentiful	Broken, medium	7.80	16.57	2.74	13.83	2.00	18.57
32	33-9	Green with brown cones	Fair, mild	Many	Fairly clean	Yellow, plentiful	Broken, medium	8.50	14.95	2.64	12.31	1.90	16.85
38	55-15	Golden yellow, green tinted	Mild, agreeable	Few	Clean	Yellow, scarce	Unbroken, large	6.62	12.69	Trace	12.69	1.20	13.89
39	62-23	Dull yellow green	Mild, agreeable	Many	Clean	Yellow, scarce	Unbroken, small	7.72	13.64	0.64	13.00	1.58	15.22
40	43-18	Yellowish green	Very pleasant	Med.	Clean	Yellow, fairly plentiful	Unbroken, medium to small	7.68	15.55	3.16	12.39	1.48	17.03
47	74-6	Pale yellow green	Strong, not pleasant	Very few	Fairly clean	Yellow, scarce	Unbroken, small to medium	7.04	11.90	0.87	11.03	1.53	13.23
60	55-12	Pale green, brown cones	Very mild pleasant	Med.	Fairly clean	Yellow, scarce	Broken, medium to large	7.80	14.96	0.87	14.39	1.07	16.03
62	27-9	Pale yellow green	Mild, agreeable	Few	Clean	Yellow, scarce	Broken, large	8.00	14.40	1.20	13.20	1.50	15.90
63	35-35	Pale yellow green	Mild, agreeable	Few	Clean	Yellow, plentiful	Broken, medium	7.60	16.68	2.62	14.06	1.77	18.45
65	41-51	Pale yellow green	Mild, agreeable	Many	Clean	Yellow, scarce	Unbroken, medium	7.28	12.42	None	12.42	0.96	13.38

NOTE: All percentages of resins calculated on dry basis.

Seedlings	Per cent Total Soft Resins	Quality Classification
35-33	16.68	
52-1	16.61	Good
56-31	16.00	
43-18	15.55	
38-17	15.48	
32-31	15.35	
55-12	14.96	Fair
33-9	14.95	
51-8	14.49	
27-9	14.40	
62-23	13.64	
30-5	12.89	
55-15	12.69	
50-7	12.62	Poor
41-31	12.42	
74-5	11.90	
36-8	11.05	

In group 3 consisting of 41 seedlings grown in 1935, thirteen may be classed as good in quality with percentages of soft resins ranging from 16.01 to 18.96; eighteen as fair with percentages from 14.01 to 15.77 and ten poor, with 11.00 to 13.35 per cent soft resins.

These seedlings of group 3 re-arranged in the decreasing order of their soft resin content and classed as good, fair, and poor are as follows:

Seedlings	Per cent Total Soft Resins	Quality Classification
Late Clusters	18.96	
101-32	17.75	
36-32	17.70	
73-12	17.20	
Fuggles	17.00	
35-5	16.80	
8-10	16.77	Good
64-8	16.76	
92-22	16.66	
47-32	16.40	
72-22	16.33	
63-1	16.27	
65-12	16.01	
21-6	15.77	
49-28	15.60	
59-16	15.56	
14-32	15.53	
46-4	15.42	
80-21	15.33	

Analyses of Seedling Hops - Corvallis, Oregon, 1935

Group 3

Sample No.	Plant No.	Color	Odor	Seeds	Picking	Lupulin	Strobiles	Moisture %	Resins: Total Soft %	Alpha %	Beta %	Gamma Hard %	Total Resins %
1	102-20	Golden yellow	Mild, unpleasant	Many	Fairly clean	Scarce	Broken, medium	8.22	12.46	Trace	12.46	1.30	13.76
2	53-15	Yellowish green	Mild,pleasant	Med.	Clean	Fairly plentiful	Broken, medium	7.92	14.34	3.02	11.32	1.58	15.92
3	8-10	Yellowish green	Strong, pleasant	Very many	Clean	Plentiful	Broken, large	7.48	16.77	3.02	13.75	2.24	19.01
5	14-32	Pale green	Mild,pleasant	Many	Clean	Fairly plentiful	Broken, medium to large	8.02	15.53	0.46	15.07	1.60	17.13
6	58-14	Yellowish green	Strong, unpleasant	Med.	Clean	Fairly plentiful	Broken, medium to large	8.12	15.19	2.15	13.04	2.26	17.45
7	43-5	Pale green	Strong, unpleasant	Many	Clean	Scarce	Broken, medium	7.96	14.76	1.15	13.61	1.33	16.09
8	73-12	Yellowish green some brown cones	Strong, unpleasant	Med.	Fairly clean	Very plentiful	Broken, small to medium	7.84	17.20	3.42	13.78	2.53	19.73
9	101-32	Bright green	Very mild, pleasant	Med.	Very clean	Very plentiful	Broken, medium to large	7.56	17.75	5.30	12.45	1.60	19.35
10	44-15	Pale yellow green	Very mild, pleasant	Few	Fairly clean	Fairly plentiful	Broken, medium to large	8.28	14.18	0.60	13.50	1.26	15.44
14	46-4	Greenish yellow	Strong, pleasant	Many	Clean	Plentiful	Broken, medium to large	7.44	15.42	3.93	11.49	1.87	17.29
15	40-13	Golden yellow	Strong, pleasant	Many	Clean	Plentiful	Broken, medium to large	8.28	14.80	1.21	13.59	1.55	16.35
16	86-23	Golden yellow	Strong, unpleasant	Many	Clean	Scarce	Unbroken, large	8.04	13.00	2.07	10.93	1.20	14.20
17	76-4	Pale green	Mild,pleasant	Few	Clean	Scarce	Broken, large	7.78	14.34	4.15	10.19	1.67	16.01
20	92-22	Dirty green	Pleasant, flowery	Many	Fairly clean	Plentiful	Broken, medium	7.70	16.66	4.87	11.79	1.94	18.60
21	68-5	Yellowish green	Mild,pleasant	Many	Clean	Scarce	Broken, medium	8.48	14.01	Trace	14.01	2.15	16.16
22	80-21	Brownish green	Mild,pleasant	Many	Clean	Fairly plentiful	Broken, small to medium	7.42	15.33	Trace	15.33	1.54	16.87
25	56-28	Greenish yellow	Strong, pleasant	Many	Clean	Very scarce	Broken, small to medium	8.08	12.80	Trace	12.80	1.89	14.69
29	26-11	Greenish yellow	Mild, pleasant	Many	Fairly clean	Very scarce	Broken, medium to large	7.86	13.35	2.43	10.92	1.66	15.01
30	44-11	Greenish yellow	Mild, pleasant	Many	Fairly clean	Very scarce	Broken, medium to large	7.88	13.15	3.67	9.48	1.73	14.88
34	64-8	Pale green	Pleasant, flowery	Many	Clean	Plentiful	Broken, medium to large	7.70	16.76	3.25	13.51	2.19	18.95
35	49-28	Yellow green	Strong, pleasant	Many	Clean	Plentiful	Unbroken, large	7.74	15.60	Trace	15.60	1.40	17.00
36	63-1	Yellow green	Mild,pleasant	Few	Clean	Plentiful	Unbroken, large	7.74	16.27	3.27	13.00	1.47	17.74
41	40-4	Bright green	Mild	Few	Clean	Very scarce	Unbroken, medium	7.72	12.96	1.55	11.41	1.67	14.63
42	2-33	Yellowish green	Mild, unpleasant	Many	Fairly clean	Scarce	Broken, large	7.30	14.18	Trace	14.18	2.00	16.18
44	60-29	Olive green	Strong, pleasant	Few	Fairly clean	Scarce	Broken, large	7.68	13.17	Trace	13.17	1.46	14.63
46	53-15	Pale yellow green	Mild	Med.	Clean	Scarce	Broken, large	7.70	12.41	Trace	12.41	1.45	13.86
49	Fuggles	Pale yellow green	Mild,flowery	Very few	Fairly clean	Fairly plentiful	Broken, small to medium	6.96	14.15	2.00	12.15	1.36	15.51
50	Fuggles	Bright green	Strong, flowery	Very few	Clean	Plentiful	Broken, small to medium	7.64	17.00	3.64	13.36	1.40	18.40
51	36-32	Pale green	Mild, pleasant	Few	Clean	Plentiful	Broken, small to medium	7.58	17.70	3.76	13.94	2.03	19.73
52	10-30	Yellowish green	Mild, pleasant	Few	Clean	Scarce	Broken, medium	7.66	14.83	2.42	12.41	1.50	16.33
53	21-6	Pale golden yellow	Mild, pleasant	Few	Clean	Fairly plentiful	Broken, medium to large	7.68	15.77	2.58	13.19	1.38	17.15
54	57-16	Pale green	Mild, unpleasant	Few	Unclean	Very scarce	Broken, medium to large	8.80	12.35	Trace	12.35	1.46	13.81
56	47-32	Pale green Brown tint	Very	Few	Clean	Plentiful	Broken, small-medium	8.04	16.40	2.62	13.78	1.49	17.89
57	72-22	Pale green Brown tint	Strong, pleasant	Few	Clean	Plentiful	Broken, medium-large	6.90	16.33	0.64	15.69	1.76	18.09
58	35-5	Pale green Brown tint	Mild,pleasant flowery	Many	Fairly clean	Plentiful	Broken, medium-large	7.54	16.80	4.26	12.54	1.92	18.72
59	59-16	Pale green Brown tint	Mild,pleasant	Many	Fairly clean	Plentiful	Broken, medium	7.26	15.56	2.26	13.30	1.63	17.19
64	65-12	Pale green Brown tint	Strong, pleasant	Few	Clean	Plentiful	Broken, medium	7.32	16.01	4.36	11.65	1.80	17.81
67	25-5	Pale green Brown tint	Mild,pleasant	Many	Clean	Fairly plentiful	Broken, medium	8.04	15.30	1.14	14.16	1.73	17.03
68	84-11	Pale green Brown tint	Mild,pleasant	Many	Clean	Scarce	Unbroken, medium	7.38	14.10	Trace	14.10	1.68	15.78
70	Late Clusters	Golden yellow	Strong, pleasant	Many	Clean	Very plentiful	Unbroken, medium	6.80	18.96	5.04	14.92	2.06	21.02
77	4-33	Pale yellow green	Mild	Few	Clean	Very scarce	Broken, medium to large	8.16	11.01	Trace	11.01	1.00	12.01

NOTE: All percentages of resins calculated to dry basis.

Seedlings	Per cent Total Soft Resins	Quality Classification
25-5	15.30	
54-18	15.19	
10-30	14.83	
40-13	14.80	
43-5	14.76	
53-15	14.34	Fair
76-4	14.34	
44-15	14.18	
2-33	14.18	
Fuggles	14.15	
84-11	14.10	
68-5	14.01	
26-11	13.35	
60-29	13.17	
44-11	13.15	
86-23	13.00	
40-4	12.96	Poor
56-28	12.80	
102-20	12.46	
53-16	12.41	
57-16	12.35	
4-33	11.01	

Nine of this group were also grown in 1934 and five in 1933. A comparison of these was made with those grown in 1935.

Comparison of Total Soft Resin Content of 9 Seedlings of Group 3 Grown in 1934 and 5 Seedlings of Group 3 Grown in 1933

Seedlings	Per cent of Total soft resins		
	1933	1934	1935
53-15	-	15.38	14.34
8-10	18.70	17.61	16.77
58-14	-	12.82	15.19
40-13	-	14.12	14.80
92-22	-	16.06	16.66
56-28	14.60	10.24	12.86
60-29	-	10.50	13.17
10-30	-	12.85	14.83
57-16	-	13.70	12.35
43-5	11.68	-	14.76
73-12	17.59	-	17.20
2-33	16.63	-	14.18

Because the total soft resin content (alpha and beta resins) is a good index of the quality, the seedlings were not compared as regards the above two components of the soft resins. Usually hops with the highest soft resin content also contain the highest alpha and beta resin content. The gamma or hard resin content of the seedlings vary considerably and no attempt was made to compare them with respect to this constituent. Nearly all of the seedlings contained less than 2.5 per cent hard resins. Any higher percentages would indicate unusual destruction or change of the desirable constituents from which the hard resins are found.

Frank Rabak
Washington, D.C.
July - 1936

Analysis of Foreign Varieties of Hops Grown at Corvallis, Oregon, in 1935

During the season of 1935 a total of 25 foreign varieties of hops were grown at Corvallis, Oregon, by Dr. D. C. Smith for the purpose of determining their respective yielding properties, resistance to disease and chemical composition. The hops were picked when fully mature, dried, compressed and cold stored for later physical and chemical analysis.

The results of the analysis of the samples were tabulated for comparison of their quality.

The color of the samples ranged from pale green to deep golden green and their odor varied considerably as indicated in the table. Nearly all of the varieties from continental Europe possessed a characteristic "oxidized" odor, which is usually observed in hops grown in Europe. None were seedless, although several varieties contained very few seeds. A large number contained many seeds. Apparently no attempt was made to eliminate male plants, in order to produce seedless hops. It is possible that some of the varieties are low seed producers which accounts for their partial seedlessness.

The samples were in general clean picked, being comparatively free from leaves and stems. The strobiles were for the most part small to medium in size as compared with the usual domestic varieties grown in Oregon.

The several varieties which were analyzed for their resin content were arranged in the table in the decreasing order of their total soft resin content. It will be observed that the majority contained very high percentages of soft resin ranging from 16 to 20.88 per cent. Only 8 samples contained less than 16 per cent and seven of these contained from 14 to 15.99 per cent.

Physical and Chemical Analyses of Foreign Hops Grown at Corvallis, Oregon in 1932

Variety	Color	Odor	Seeds	Picking	Lupulin	Strobiles	Moisture	Resins				
								Total soft (p.c.)	Alpha (p.c.)	Beta (p.c.)	Garma Hard	Total (p.c.)
#208 Landhopper	Yellow green, some brown cones	Strong, pleasant	Many	Clean	Yellow, very plentiful	Broken, medium	7.28	20.88	6.66	14.22	1.75	22.63
#202 Burgunder	Golden yellow, green tint	Pleasant, oxidized	Few	Clean	Yellow, very plentiful	Broken, small	7.62	19.92	6.09	13.83	1.41	21.33
#215 Bavarian	Yellowish green	Mild, pleasant	Many	Clean	Lemon yellow plentiful	Broken, small	6.98	19.17	5.02	14.15	1.63	20.80
#219 Alsace (Urbann)	Pale green	Strong, not pleasant	Few	Clean	Lemon yellow, plentiful	Broken, medium	7.10	18.60	5.21	13.39	1.72	20.32
#212 New Zealand Fuggles	Yellowish green	Mild, pleasant	Many	Clean	Yellow, plentiful	Much broken, medium to large	7.68	17.89	4.04	13.85	1.91	19.80
#225 Kent, Golding	Golden yellow Green tint	Mild, not pleasant	Few	Fairly clean	Yellow, plentiful	Broken, small to medium	6.56	17.87	1.10	16.77	1.96	19.83
#211-M-45	Yellowish green	Mild, pleasant	Few	Clean	Yellow, plentiful	Broken, medium	7.60	17.70	3.61	14.09	2.07	19.77
#209 Spalter (Simon)	Pale green	Excellent, oxidized	Very few	Clean	Yellow, plentiful	Unbroken, medium	8.00	17.54	7.50	10.04	1.53	19.07
#210 Elassar	Yellowish green	Very pleasant oxidized	Few	Clean	Yellow, plentiful	Broken, medium	8.10	17.54	6.73	10.81	1.67	19.21
#223 Samling (Urbann)	Yellowish, green, variegated	Mild, flowery	Nearly seedless	Fairly clean	Yellow, plentiful	Broken, small to medium	7.26	17.37	8.06	9.31	1.60	18.97
#203 Verte (Jagger)	Golden yellow Green tint	Mild, pleasant oxidized	Many	Clean	Lemon yellow plentiful	Much broken, medium	7.78	17.21	3.25	13.96	1.99	19.20
#204 Spalter (Rohmer)	Pale Green	Strong, pleasant, oxidized	Few	Clean	Yellow, plentiful	Broken, medium to large	8.20	16.92	6.44	10.48	1.74	18.66
#213 Late Grape	Yellowish green with brown	Strong, pleasant	Many	Fairly clean	Yellow, plentiful	Broken, small to medium	7.28	16.72	3.07	13.65	1.83	19.79
#221 Early green	Deep green	Mild, agreeable	Very many	Clean	Yellow, fairly plentiful	Unbroken, medium	7.54	16.66	5.12	11.54	1.76	18.42
#217 Samling (Salmon)	Deep green	Pleasant, oxidized	Very few	Clean	Yellow, plentiful	Unbroken, medium	6.98	16.65	6.91	9.74	1.92	18.57
#218 Spalter (Urbann)	Yellow green, brown tint	Pleasant, oxidized	Very few	Clean	Lemon yellow, plentiful	Unbroken, small to medium	7.44	16.20	4.47	11.73	1.53	17.73
#214 Spalter (Rohmer)	Pale green	Pleasant, oxidized	Nearly seedless	Clean	Yellow, fairly plentiful	Unbroken, small	7.56	15.99	6.71	9.28	1.56	17.55
#220 Miller's Resistant	Yellowish green	Strong, pleasant	Many	Clean	Lemon yellow, plentiful	Unbroken, small	7.40	16.20	1.53	14.67	2.11	18.31
#224 - - -	Yellowish, green	Mild, pleasant	Many	Clean	Yellow, fairly plentiful	Broken, small	6.88	15.72	trace	15.72	1.53	17.25
#216 Golding MRPQCK - OZ1103	Green with brown tint	Mild, not pleasant	Many	Clean	Yellow, not plentiful	Broken, medium	7.06	15.43	3.48	11.95	1.70	17.13
#205 Tigo Blanche (Jagger)	Yellowish green with some brown cones	Mild, oxidized	Many	Clean	Yellow, fairly plentiful	Broken, small	7.70	15.16	3.68	11.48	1.72	16.88
#207 Muhlverter Grume (Binder #2)	Bright green	Mild, pleasant	Few	Clean	Yellow, fairly plentiful	Broken, small	6.74	14.67	2.30	12.37	1.35	16.02
#201 Spalter	Yellowish green	Pleasant, oxidized	Many	Clean	Yellow, fairly plentiful	Unbroken, small	7.62	14.11	1.13	12.98	1.17	15.28
#200 Semsch	Golden yellow greenish	Strong, not pleasant	Many	Clean	Yellow, scarce	Broken, medium to large	7.54	14.09	2.72	11.37	1.17	15.26
#206 Auscher Tote (Binder #1)	Yellowish green	Mild, not pleasant	Medium	Clean	Yellow, scarce	Broken, small	7.40	12.53	0.95	11.58	1.51	14.04

NOTE: ALL percentages of resins calculated to dry basis

The total soft resin content of many of the varieties was strikingly similar to that found in the same varieties grown in 1934. (See 1934 report).

The alpha resin content of the samples ranging from 0.95 to 8.06 per cent while considerably more variable was nevertheless very similar in the same varieties grown in 1934 and 1935. This likewise is true of the beta resin content. The hard resin content of the 1935 samples ranged from 1.17 to 2.07 per cent as compared with 1.24 to 2.08 per cent in the 1934 samples.

The above comparisons are made on basis of resin content of the hops calculated to the dry basis during both seasons. The percentages of resins in 1935 samples are calculated on the dry basis while those given in the 1934 report represent samples containing from 6.8 to 8 per cent moisture. For comparison of each variety during the two seasons it is necessary that the percentages of resins in the 1934 samples be calculated back to the dry basis.

The results of the analyses of the foreign varieties show a remarkable similarity during the two successive years (1934 and 1935). It will be of interest to ascertain whether the same varieties grown this season (1936) will continue to maintain their high quality as regards their content of alpha, beta (total soft resins) and gamma or hard resins.

Frank Rabak
Washington, D. C.
July, 1936.

Fertilizers and Their Relation to Quality of Hops

The series of fertilizer tests on hops begun in 1933 at Corvallis, Oregon were continued in 1934 and 1935 by Dr. D. C. Smith. The tests in 1935 were conducted on three varieties; namely, Early Cluster, Late Clusters and Fuggles, in the experimental yard at Corvallis with fertilizers containing nitrogen, phosphorus and potash in varying quantities and combinations. In addition to tests with these fertilizing elements tests were also made with ammonium sulphate, calcium nitrate, sodium nitrate and calcium cyanamid to ascertain their effect on the resinous constituents of hops. Tests were also made on Late Cluster hops on the Gouley and Seavey Plots located near Corvallis, using nitrogen, phosphorus and potash fertilizers in different combinations.

The hops from each of the numerous plots were picked when fully mature as determined by physical examination. The samples were dried without heat, compressed, wrapped and stored for subsequent physical and chemical analysis.

The samples were analyzed and the results of the analyses of each variety grown on the experimental plot at Corvallis and on the Gourley and Seavey Plots near Corvallis, were tabulated.

Analyses of Hops from Fertiliser Tests at Corvallis, Oregon in 1938

- Early Clusters -

Sample No.	Plant No.	FERTILIZERS * 1933	FERTILIZERS * 1935	Color	Odor	Seeds	Picking	Lupulin	Strobiles	Moisture %	Resins: Total Soft %	Resins: Alpha %	Resins: Beta %	Resins: Gamma Hard %	Resins: Total Resins %
126	6-15	2 lbs.16-20-8		Golden green	Strong, pleasant	Many	Unclean	Yellow, fairly plentiful	Broken, large	7.10	16.93	3.81	13.12	1.60	18.53
109	5-17	2 lbs.8-10-4		Yellowish green	Strong, not pleasant	Many	Fairly clean	Yellow, fairly plentiful	Broken, small to medium	7.02	17.57	3.75	13.82	1.80	19.37
112	4-20	Check		Golden yellow green tint	Strong	Many	Fairly clean	Yellow, fairly plentiful	Broken, medium	8.04	16.86	3.34	13.52	2.17	19.03
128	5-25	2 lbs.16-20-0		Dull golden green	Strong, pleasant	Many	Clean	Yellow, fairly plentiful	Broken, medium to large	7.70	17.16	2.88	14.28	1.95	19.11
126	5-27	1 lb. 16-0-8		Brownish green	Strong, pleasant	Many	Clean	Yellow, fairly plentiful	Broken, medium	7.00	17.00	3.34	13.66	1.62	18.74
129	13-15		1 lb.16-20-8	Yellowish green	Mild, pleasant	Many	Clean	Yellow, very plentiful	Broken, medium	7.22	18.75	3.80	14.95	1.96	20.71
124	15-18		1 lb.16-20-0	Yellowish green	Mild, pleasant	Few	Clean	Yellow, very plentiful	Unbroken, medium to large	6.66	19.11	4.58	14.53	1.84	20.95
117	14-20		Check	Golden green	Mild, not pleasant	Many	Clean	Yellow, scarce	Broken, medium	6.84	15.93	2.08	13.85	2.23	18.18
122	13-26		1 lb.16-0-8	Pale, yellowish green	Strong, not pleasant	Few	Clean	Yellow, plentiful	Broken, medium	6.90	17.23	3.70	13.53	1.70	18.93
119	13-24		½ lb.16-20-8	Yellowish green, brown cones	Strong, pleasant	Many	Clean	Yellow, plentiful	Broken, medium to large	6.66	17.41	3.47	13.94	2.14	19.55
115	33-26		Check	Golden green	Strong, pleasant	Many	Clean	Yellow, plentiful	Broken, medium to large	6.66	18.58	5.01	13.57	2.17	20.75
113	26-12		Seedling	Green with yellow tint	Strong, pleasant	Many	Clean	Yellow, plentiful	Broken, medium	8.00	17.04	3.35	13.69	2.08	19.12
108	32-19		Ammonium sulphate	Light green yellow tint	Mild, agreeable	Few	Clean	Yellow, plentiful	Unbroken, medium to large	6.66	18.60	5.33	13.27	1.95	20.55
111	32-21		Calcium nitrate	Golden green	Strong, pleasant	Few	Clean	Yellow, plentiful	Broken, small to medium	6.46	18.33	3.74	14.59	2.00	20.33
130	32-15		Sodium nitrate	Pale yellow green	Pleasant	Many	Fairly clean	Lemon yellow, very plentiful	Broken, small to medium	7.20	19.27	4.46	14.52	1.80	21.07
123	31-25		Calcium cyanid	Yellowish green	Mild, very agreeable	Many	Fairly clean	Lemon yellow, very plentiful	Broken, large	7.34	19.21	4.70	14.51	1.82	21.03

NOTE: All percentages of resins calculated on dry basis.
* Numerals listed in this column refer to fertilizer mixtures containing nitrogen, phosphorus, and potash in the order mentioned.

Analyses of Hops from Fertilizer Tests at Corvallis, Oregon in 1935

- Late Clusters -

Sample No.	Plant No.	FERTILIZERS * 1933	FERTILIZERS * 1935	Color	Odor	Seeds	Picking	Lupulin	Strobiles	Moisture %	RESINS Total soft %	Alpha %	Beta %	Gamma hard %	Total Resins %
148	3-16	2 lbs. 16-20-0		Pale, yellowish green	Strong, pleasant	Medium	Clean	Yellow, plentiful	Broken, medium	6.96	13.61	3.17	15.44	1.77	20.38
147	2-18	2 lbs. 8-10-4		Pale, yellowish green	Mild, pleasant	Many	Fairly clean	Yellow, plentiful	Unbroken, medium to large	6.86	19.62	5.40	14.22	1.88	21.50
153	3-21	check		Golden green	Strong, agreeable	Few	Fairly clean	Yellow, plentiful	Broken, medium to large	6.86	19.07	4.56	14.51	2.10	21.27
154	2-23	2 lbs. 16-20-0		Bright, yellowish green	Strong, agreeable	Few	Unclean	Yellow, fairly plentiful	Broken, medium to large	7.28	17.87	4.44	13.43	1.76	19.63
152	3-27	1 lb. 16-0-8		Pale, golden green	Strong agreeable	Many	Clean	Yellow, very plentiful	Broken, medium	7.42	20.39	4.90	15.49	1.96	22.55
75	10-23		½ lb. 16-20-8	Yellowish green	Mild, agreeable	Many	Clean	Yellow, plentiful	Much broken	7.42	18.19	3.43	14.76	1.62	19.61
151	11-15		1 lb. 16-20-8	Golden green	Strong, not pleasant	Many	Fairly clean	Yellow, plentiful	Broken, medium to large	6.60	18.13	3.10	15.03	1.86	19.99
150	29-26	Check		Yellowish green	Mild, agreeable	Few	Clean	Yellow, very plentiful	Broken, medium to large	6.84	19.35	5.67	13.68	2.20	21.55
144	10-17	1 lb. 16-20-0		Pale, yellowish green	Strong, pleasant	Many	Fairly clean	Yellow, fairly plentiful	Broken, small to medium	6.50	16.63	1.92	14.71	2.63	19.26
145	10-26	1 lb. 16-0-8		Golden green	Strong, pleasant	Medium	Fairly clean	Yellow, plentiful	Broken, medium	7.50	18.55	4.97	13.58	1.81	20.36
71	11-22	Check		Golden green	Strong, pleasant	Many	Fairly clean	Yellow, plentiful	Broken, medium	6.92	19.76	6.09	13.67	1.90	21.66
143	28-19	Ammonium sulphate		Yellowish green	Strong, agreeable	Many	Clean	Lemon yellow very plentiful	Broken, medium	7.86	20.27	5.75	14.52	1.87	22.14
146	28-22	Calcium nitrate		Very pale golden green	Strong, agreeable	Many	Fairly clean	Lemon, exceedingly sticky	Broken, medium to large	7.20	21.38	6.87	14.51	1.80	23.18
72	28-14	Sodium nitrate		Golden yellow	Strong, agreeable	Many	Clean	Lemon, very sticky	Broken, medium	7.20	19.85	5.37	14.48	1.67	21.52
149	28-24	Calcium cyanamid		Golden green	Strong, agreeable	Few	Fairly clean	Lemon, very sticky	Broken, small to medium	7.16	20.46	6.35	14.11	2.05	22.51

NOTE: All percentages of resins calculated on dry basis.

* The numerals listed in this column refer to fertilizer mixtures containing nitrogen, phosphorous and potash in the order mentioned.

Analyses of Hops from Fertilizer Tests at Corvallis, Oregon, in 1935

- Puggles -

Sample No.	Plant No.	FERTILIZERS * 1934	FERTILIZERS * 1935	Color	Odor	Seeds	Picking	Lupulin	Strobiles	Moisture %	RESINS: Total soft %	Alpha %	Beta %	Gamma hard %	Total Resins %
121	9-16	2 lbs.16-20-8		Olive green	Mild, very pleasant	Few	Fairly clean	Bright yellow, plentiful	Broken, small	7.40	17.49	4.95	12.54	1.81	19.30
127	9-19	2 lbs.8-10-4		Dark yellow green	Strong, not pleasant	Few	Unclean	Golden, fairly plentiful	Broken, medium to large	7.10	17.19	3.43	14.00	2.42	19.61
120	9-20	Check		Yellow green	Mild, agreeable	Many	Unclean	Golden, not plentiful	Broken, medium	7.68	15.97	3.61	12.36	2.16	18.13
110	7-24	2 lbs.16-20-0		Deep green	Strong, pleasant	Many	Unclean	Yellow, not plentiful	Broken, large	7.60	15.80	2.60	13.20	2.16	17.96
116	7-27	1 lb.16-0-8		Yellow green, some dark cones	Strong, pleasant	Many	Very unclean	Yellow, fairly plentiful	Broken, large	7.76	16.37	3.66	12.71	2.32	18.69
106	17-16		1 lb.16-20-8	Golden green	Strong, pleasant	Many	Fairly clean	Yellow, fairly plentiful	Broken, medium to large	6.80	16.54	3.47	13.07	2.05	18.55
105	17-24	½ lb.16-20-8		Bright green	Strong pleasant	Many	Clean	Yellow, plentiful	Much broken, medium to large	6.98	17.82	4.27	13.55	1.67	19.49
103	16-21	Check		Pale olive green	Mild, not pleasant	Many	Clean	Yellow, plentiful	Broken, medium	6.94	17.97	5.07	12.90	1.89	19.86
102	17-17	1 lb.16-20-0		Greenish	Mild, pleasant	Many	Fairly clean	Yellow, plentiful	Broken, medium	7.10	17.34	3.96	13.38	2.07	19.41
104	16-27	1 lb.16-0-8		Green with yellow tint	Pleasant flowery	Few	Clean	Yellow, plentiful	Broken, medium to large	6.86	17.00	4.52	12.48	1.98	18.98
114	34-26	Check		Golden green	Mild, pleasant	Few	Fairly clean	Yellow, not plentiful	Broken, medium	7.34	16.18	2.84	13.34	2.11	18.29
107	34-19	Ammonium sulphate		Yellowish green	Mild, pleasant	Many	Unclean	Yellow, not plentiful	Unbroken, medium to large	6.76	16.54	4.10	12.44	1.81	18.35
101	34-21	Calcium nitrate		Yellowish green	Strong pleasant	Many	Fairly clean	Yellow, fairly plentiful	Unbroken, medium to large	6.76	16.76	3.48	13.27	1.88	18.63
100	36-16	Sodium nitrate		Golden yellow green tint	Strong, agreeable	Few	Fairly clean	Yellow, plentiful	Unbroken, medium to large	7.08	17.66	4.34	13.32	1.76	19.42
118	36-23	Calcium cyanamid		Yellowish green	Strong agreeable	Medium	Fairly clean	Yellow, fairly plentiful	Broken, medium to large	6.66	16.20	2.93	13.27	2.00	18.20

NOTE: All percentages of resins calculated on dry basis.

* Numerals listed in this column refer to fertilizer mixtures containing nitrogen, phosphorus, and potash in the order mentioned.

Analyses of Late Cluster Hops from Fertiliser Tests on Gouley and Seavey Plots at Corvallis, Oregon in 1935

Sample No.	Plot	Fertilizers * 1935	Color	Odor	Seeds	Picking	Lupulin	Strobiles	Moisture %	RESINS: Total Soft %	Alpha %	Beta %	Gamma hard %	Total Resins %
							-GOULEY PLOT-							
131	2	½ lb. 16-20-8	Golden green	Mild pleasant	Medium	Unclean	Yellow, plentiful	Broken, medium to large	7.06	18.80	4.72	13.78	1.80	20.30
132	4	1lb. 0-20-8	Pale yellow green	Mild pleasant	Many	Fairly clean	Yellow, plentiful	Broken, medium to large	7.00	19.97	5.00	14.97	1.38	21.35
133	10	1 lb. 16-20-8	Pale yellow green	Mild pleasant	Few	Unclean	Yellow, plentiful	Broken, medium to large	7.52	18.70	5.00	13.70	1.86	20.56
134	12	1 lb. 16-0-8	Pale olive green	Strong, agreeable	Many	Clean	Yellow, very plentiful	Broken, medium to large	7.32	19.85	4.90	14.95	1.82	21.61
135	6	Check	Pale green	Strong, agreeable	Many	Clean	Yellow, very plentiful	Broken, medium to large	7.50	19.76	5.77	13.99	1.90	21.66
136	8	1 lb. 16-20-0	Yellow green	Mild agreeable	Few	Fairly clean	Yellow, very plentiful	Broken, medium to large	6.78	19.65	5.28	14.37	1.62	21.27
							-SEAVEY PLOT-							
137	34	1 lb. 16-20-0	Yellow green	Mild agreeable	Few	Fairly clean	Yellow, very plentiful	Broken, medium	7.14	18.32	5.44	13.38	1.80	20.62
138	37	1 lb. 16-20-8	Golden green	Mild, very pleasant	Few	Fairly clean	Yellow, very plentiful	Broken, medium	7.00	19.14	5.35	13.29	1.65	20.79
139	39	Border check	Golden green	Mild, pleasant	Few	Fairly clean	Yellow, very plentiful	Broken, medium	7.26	18.00	4.94	13.06	1.50	19.50
140	40	½ lb. 16-20-8	Bright green	Strong, pleasant	Few	Fairly clean	Yellow, very plentiful	Broken, medium	7.40	20.09	6.48	13.61	1.60	21.69
141	43	1 lb. 0-20-8	Yellowish green	Strong, pleasant	Few	Fairly clean	Yellow, very plentiful	Broken, medium	6.64	18.80	5.18	13.42	1.41	20.01
142	51	1 lb. 16-0-8	Golden green	Mild,pleasant	Few	Clean	Yellow, very plentiful	Broken, medium	6.96	20.63	6.02	14.61	1.96	22.59

NOTE: All percentages of resins calculated on dry basis.

* All numerals listed in this column refer to fertilizer mixtures containing nitrogen, phosphorus, and potash in the order mentioned.

The results of the tests on Early Cluster grown on the experimental plot at Corvallis are for the most part self-explanatory. The percentages of total soft resins are slightly lower than those from the same plots grown in 1934. The alpha and beta resin content of the samples bear a similar relationship to the 1934 samples. The hard resin content averaged about the same as the 1934 samples. Two of the three check plots contained considerably lower percentages of resins than the fertilized plots. All of the check plots, however, contained noticeably higher percentages of hard resins than the fertilized plots.

The four plots, as listed in the table, fertilized with ammonium sulphate, calcium nitrate, sodium nitrate and calcium cyanamid all produced hops with high percentages of alpha, beta and total soft resins and about the average percentage of hard resins. It is possible that these special fertilizers may prove beneficial in improving quality. Therefore it is recommended that the tests be duplicated.

Fertilizer tests with Late Clusters on the experimental plot were not especially significant. A generally high percentage of total soft resins was found in most samples fertilized with nitrogen, phosphorus and potash mixture although it was not greatly different from that of the check plots. This is likewise true with respect to alpha, beta and gamma (hard resins). In this table it will again be noted that while the check plot samples differed little from the fertilizer plots, they were uniformly higher in gamma or hard resins.

Again, as with the Early Clusters the Late Clusters responded well to the fertilizing action of ammonium, sodium and calcium salts. These hops were uniformly high in alpha, beta and total soft resins, averaging consider-

ably higher than the check plots. The percentage of alpha or preservative resins was especially high in these samples while the percentage of gamma or hard resins was approximately the same as in the hops fertilized with nitrogen, phosphorus and potash mixtures. It will be interesting to note the effect of these various fertilizers on the quality of the hops produced during the third season.

The percentage of alpha, beta and total soft resins in the Fuggles hops treated with the same fertilizers was uniformly lower than in Early or Late Cluster varieties. The Fuggles variety is usually conceded to be less rich in lupulin (resins) than other varieties grown on the west coast.

When fertilized with ammonium, sodium and calcium salts as noted in the table this variety also produced hops with uniformly high percentages of alpha, beta and total soft resins. In general all samples of Fuggles hops from the fertilizer tests contained a rather high percentage of hard resins as compared with Early or Late Clusters.

The Late Cluster hops from the fertilizer tests conducted on the Gouley and Seavey plots in 1935 contained uniformly high percentages of alpha, beta and total soft resins, differing only slightly from the check plots. The gamma or hard resin content of the several samples from these two plots was somewhat lower than the Late Cluster hops grown on the experimental plot at Corvallis.

No significant conclusions can be drawn from the fertilizer tests to date although the tests may possibly show the beneficial effect of certain fertilizers after another year's observation. The response of fertilizers is not always immediate and may require a longer period to

exert their effect. It can, however, be stated that in view of the results obtained with ammonium sulphate, sodium nitrate, calcium nitrate and calcium cyanamid, further tests with these salts should be continued to ascertain their effect on improvement of quality of hops.

Frank Rabak
Washington, D.C.
July 1936.

The Relation of Stage of Maturity to the Formation of Resins in Hops

For the purpose of obtaining desired information on the formation of the resinous constituents in hops at different stages of maturity an experiment was conducted at the suggestion of the writer by Dr. D. C. Smith at Corvallis, Oregon, in 1935 which may have an important bearing on the proper time of harvesting hops.

Several vigorous vines of the Late Clusters variety were grown adjacent to each other in the experimental yard at Corvallis. Hops were picked from these vines at definite intervals beginning August 10 and ending October 4, a total of 8 samples being picked. The hops were picked on each date from all parts of the vines and made into one composite sample which represented the maturity of the hops on the particular date when picked. Each successive picking represented strobiles of gradually increasing maturity varying in length from 1/2 to 2 1/2 inches. Each sample was carefully dried without heat, compressed and wrapped. The several samples were immediately placed in cold storage. Later they were forwarded to Washington for analysis.

Physical and chemical analyses were made of the samples and the results tabulated.

Analyses of Hops Picked at Different Stages of Maturity - Corvallis, Oregon 1935

Samples	Color	Odor	Seeds	Picking	Lupulin	Strobiles	Moisture	RESINS				
								Total Soft %	Alpha %	Beta %	Gamma Hard %	Total Resins %
156 Aug. 10	Greenish with many brown cones	Mild and unpleasant	Very few, immature	Clean	Very scarce	Very small, ½ inch.	8.76	8.08	0.46	7.62	1.54	9.62
157 Aug. 16	Bright green, some brown cones	Mild and unpleasant	Few, immature	Clean	Yellow, scarce	Unbroken, small, ½ to 3/4 inch.	8.00	9.60	0.60	9.00	1.15	10.75
158 Aug. 24	Bright green	Mild, agreeable	Few	Clean	Bright yellow fairly plentiful	Unbroken, 1 to 1½ inch	7.40	12.96	2.55	10.41	1.80	14.76
159 Aug. 31	Yellowish green, some brown cones	Strong, pleasant	Many	Fairly clean	Bright yellow fairly plentiful	Unbroken, medium 1 to 2 inch	7.24	16.42	5.18	11.24	2.43	18.85
160 Sept. 7	Pale green, some brown cones	Strong, pleasant	Many Many	Clean	Yellow, plentiful	Unbroken, large 2 to 2½ inch	7.60	17.62	4.80	13.32	2.55	20.17
161 Sept. 13	Variegated, green yellow brown	Strong, pleasant	Many	Many small stems	Yellow, plentiful	Broken, large	7.36	17.92	3.80	14.62	3.02	20.90
162 Sept. 20	Yellowish green with few brown cones	Strong unpleasant	Many	Clean	Dark yellow, plentiful	Much broken large	7.90	18.70	1.85	16.85	3.27	21.97
163 Oct. 4	Brown	Strong disagreeable	Many	Clean	Pale brown, Fairly plentiful	Much broken, large	8.18	15.24	None	15.24	5.24	20.48

NOTE: All percentages of resins calculated to dry basis

The samples represented immature, mature and over-ripe hops and varied in color from green to brown as they progressed in maturity.

The samples picked August 10 and 16 were decidedly immature. These possessed a mild and rather unpleasant odor. The strobiles were 1/2 to 3/4 inch in length and contained comparatively little lupulin. The sample picked August 24 was more agreeable in odor, with strobiles 1 to 1 1/2 inches in length and contained noticeably more lupulin than the two earlier picked samples. Beginning with the pickings on August 31 and continuing through September 20 the hops were fully mature as indicated by their yellowish green color, strong characteristic odor, large size of strobiles (2 to 2 1/2 inches in length) and plentiful lupulin content. The sample picked October 4 was distinctly over-ripe. It was brown in color and possessed a strong disagreeable odor. The color of the lupulin in this sample was pale brown instead of lemon yellow.

The percentages of alpha, beta (soft resins) and gamma (hard resins) in the samples picked on the several dates as noted in the table, show that distinct changes in the percentages of these constituents occur as the hops develop. The two early picked samples (August 10-16) show the lowest percentage of alpha, beta resins and total soft resins. These samples may be considered as very immature and poor in quality because of their extremely low percentage of alpha resins. The alpha resins apparently do not form in hops to any great extent until the plants are mature. The four succeeding samples (August 24, 31, September 7 and 13) are shown to be distinctly superior as regards alpha, beta and total soft resins. Sample 7, picked September 20 contained the highest percentage of beta and total soft resins, although the alpha resincontent of this sample dropped considerably. This

sample while still of good quality may be considered as slightly over-ripe. The final sample picked October 4 was decidedly over-ripe, yet it contained a relatively high percentage of beta and total soft resins. Its alpha resins, however, had totally disappeared and therefore the sample could not be considered of good brewing value.

The gamma or hard resins apparently build up gradually as the hops become mature and over-ripe reaching a high total of 5.24 per cent in the over-ripe sample picked October 4.

The results in general indicate a gradual up-building of soft resins as the hops mature, followed by a decline as they become over-ripe. The hard resins, which are practically of no value, continue to increase up to and beyond maturity of the hops.

Any information which will more definitely establish the proper picking time will be of value to the hop grower. Frequently growers begin picking hops before they are fully mature. Such early picked hops are poor in quality and their dry-out ratio is high, thus causing loss to the grower not only in quality but in weight. Early picking should therefore be discouraged. Careful physical examination of the hops on the vines for several days prior to the usual start of picking should reveal their condition as regards maximum lupulin content which determines their maturity.

In order to check or confirm the results of the 1935 test which has been discussed it is desired to duplicate the experiment in 1936 on the same variety of hop and in the same locality (Corvallis, Oregon) by picking the hops on approximately the same dates with the same interval of time between pickings. It is suggested that at least two earlier pickings be made before

August 10, in order to obtain information on the development of resinous constituents in extremely early picked hops.

Frank Rabak
Washington, D. C.
July 1936

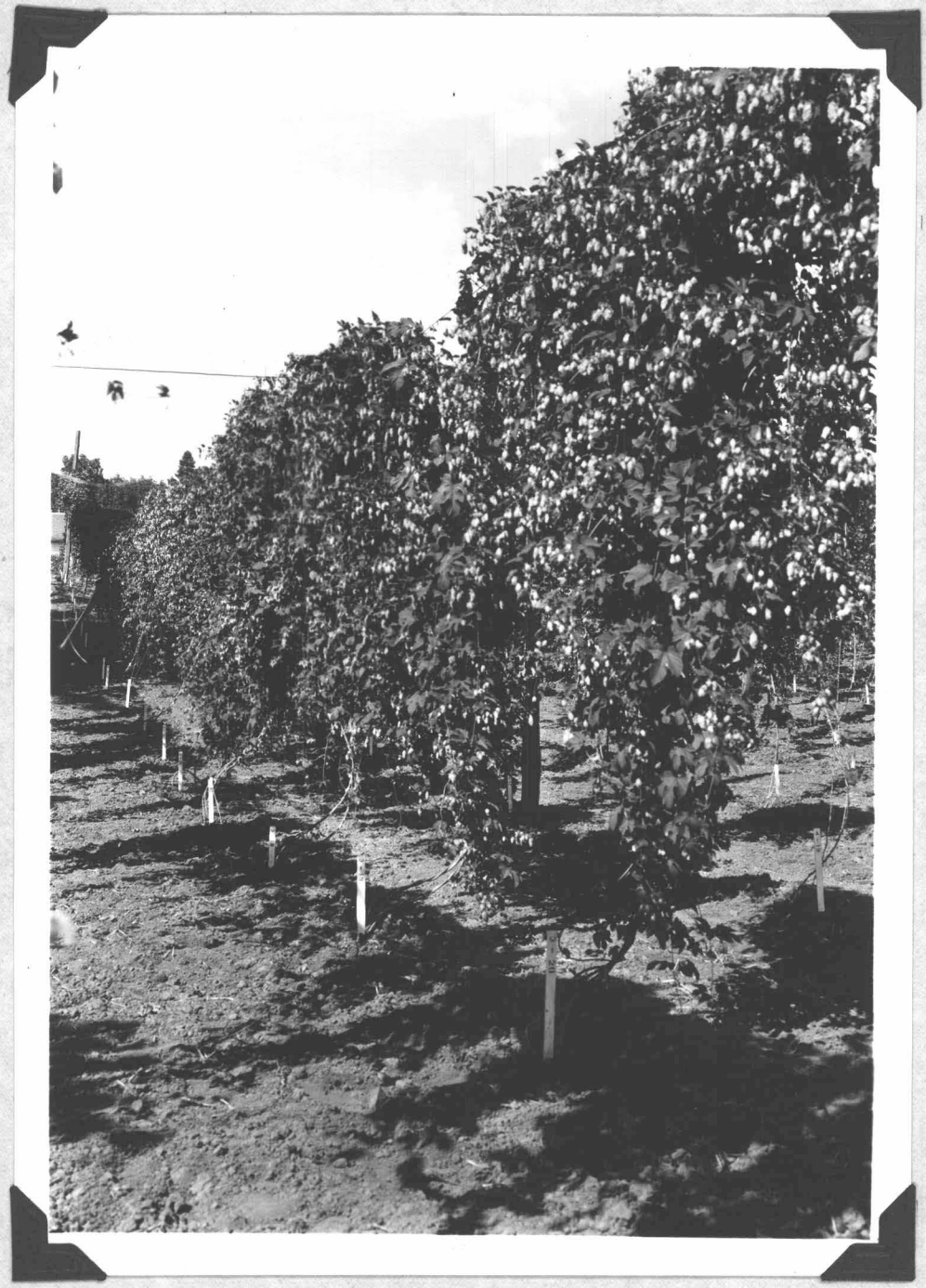


Figure 2.

A Row of Late Clusters in the Experimental Yard.
Note the long arms and heavy crop of hops.

Photo taken August 17, 1936.

Figure 3

A Row of Early Clusters in the Experimental Yard. Note the lack of arms and the poor set of cones. The poor condition of the vines is due to mildew.

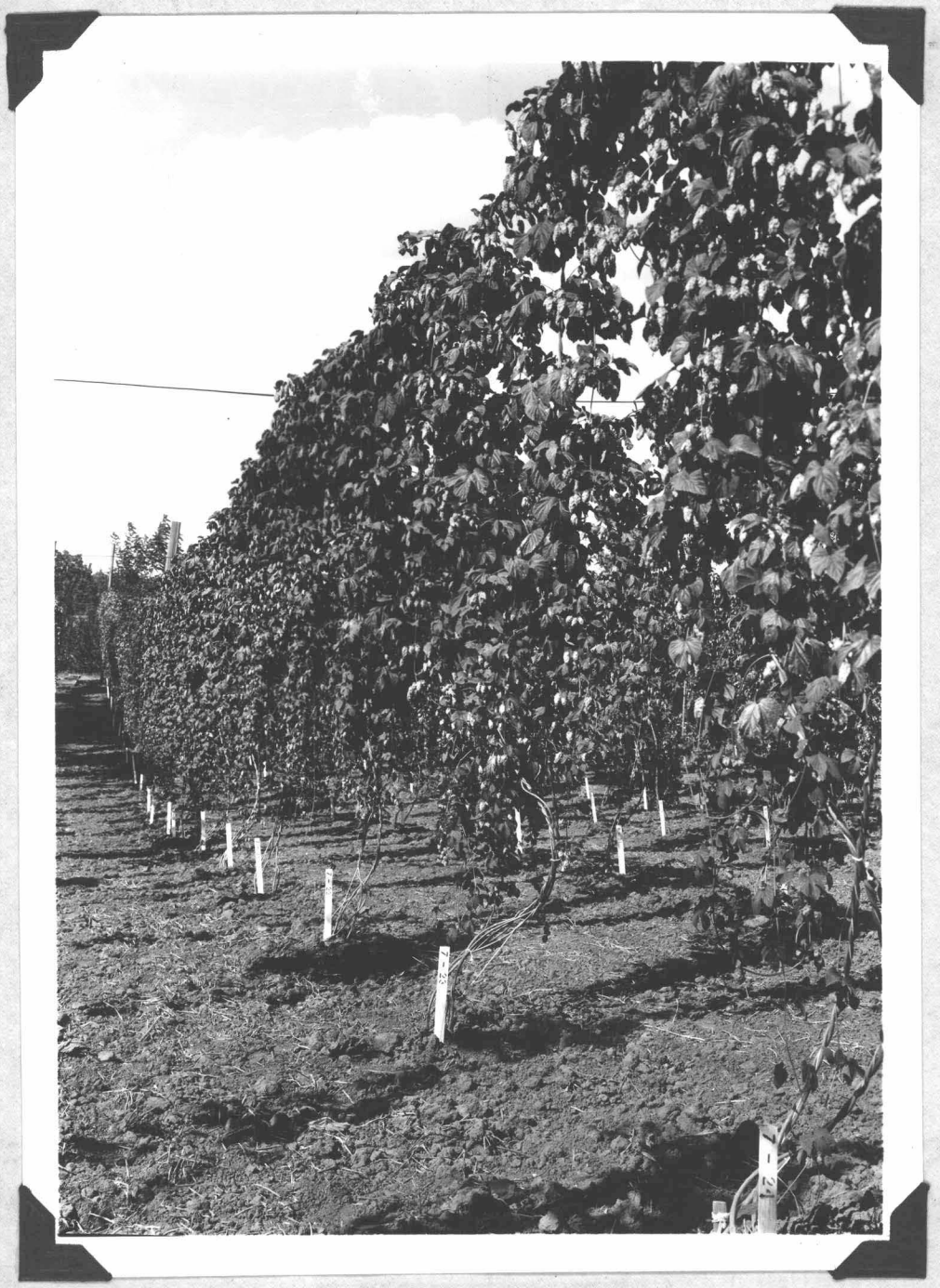


Figure 4

A Row of Fuggles in the Experimental Yard. Mildew damage slight. Note the short arms and scattered cones.

Figure 5

Early Green, One of the Better Foreign Varieties.
Note the large size and heavy set of cones.

Figure 6

A Bavarian Plant Obtained from an Oregon Yard. This type is showing up well as parent stock in crosses.

Figure 7

Plant 8 - 10. An Early Cluster Seedling. This plant gave a good yield in 1935, but was very badly damaged by downy mildew in 1936.

Figure 8

Plant 83-12. A Late Cluster Seedling showing fairly good agronomic characteristics in 1936.

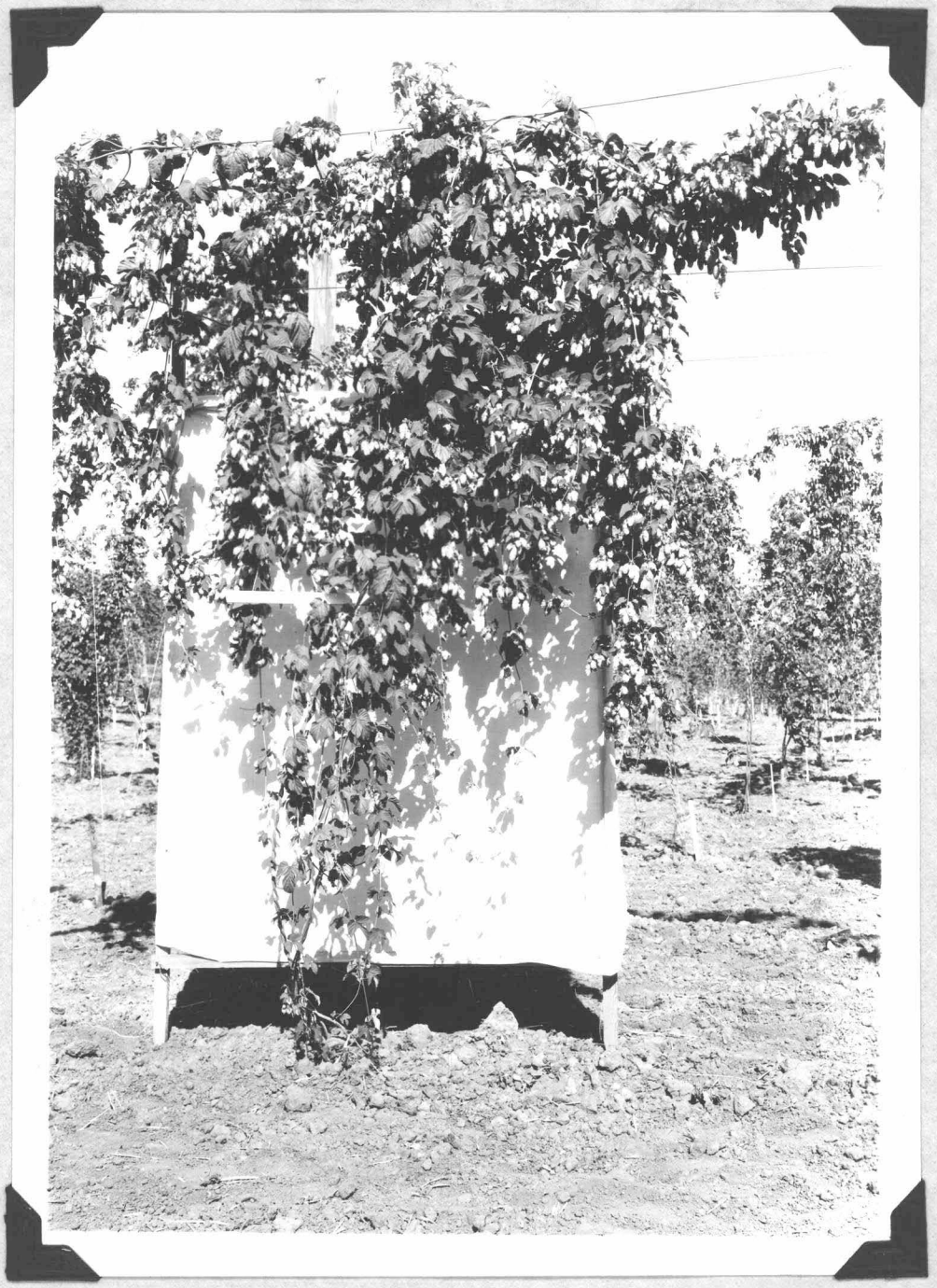


Figure 9

Plant 32-10. A California Cluster Seedling.
Note the small pointed cones.

Figure 10

Plant 70-13. An Early Cluster Seedling.
Note the large cones.

Figure 11

Plant 42-6. A Puggles Seedling with long arms. The cones are long and pointed and badly scattered.

Figure 12

Plant 49-28. A Fuggles Seedling with a nice set of cones but having rather short arms.

Figure 13

Plant 52-13. An Abnormal Fuggles Seedling. Note the arms growing from the strigs of the strobiles.