

RECYCLING: New Pig Power

Agriculture helps lead changes in society

A research study initiated about ten years ago at Harvard University, dealing with the relation of modern technology to society, has a direct bearing also on the relation of modern agriculture to society. Just think of agriculture as a vital part of technology in some of the following abstracts from a report of this project, and I think that you will agree that agriculture must prime itself for not only some soul-searching but also for new ways of developing leadership and influencing public attitude.

The study addressed itself to many of the distorted views of the role of tech-

nology in society—that technology is a monster that will ultimately reduce people to numbers and ruin their environment, or that technology is the forerunner of all progress and the solver of most of the world's problems, or that technology is not worthy of special notice because its changing effects are no greater than those since the industrial revolution.

Each of these views contains a measure of truth, and the study concluded that technology brings about both positive and negative effects that are inseparably intertwined, and that are profound. The negative effects include diminished privacy, feelings of insecurity in face of "the machine," pressures to conform to the system, the crush of the cities, environmental pollution, and the social problems caused by automation. On the other hand, technology has given the individual a greater range of choices than ever before in consumer behavior—picking a spouse, choosing an occupation, finding a place to live, and forming attachments to friends and groups. People have greater mobility and are healthier and better educated than they were just 25 years ago.

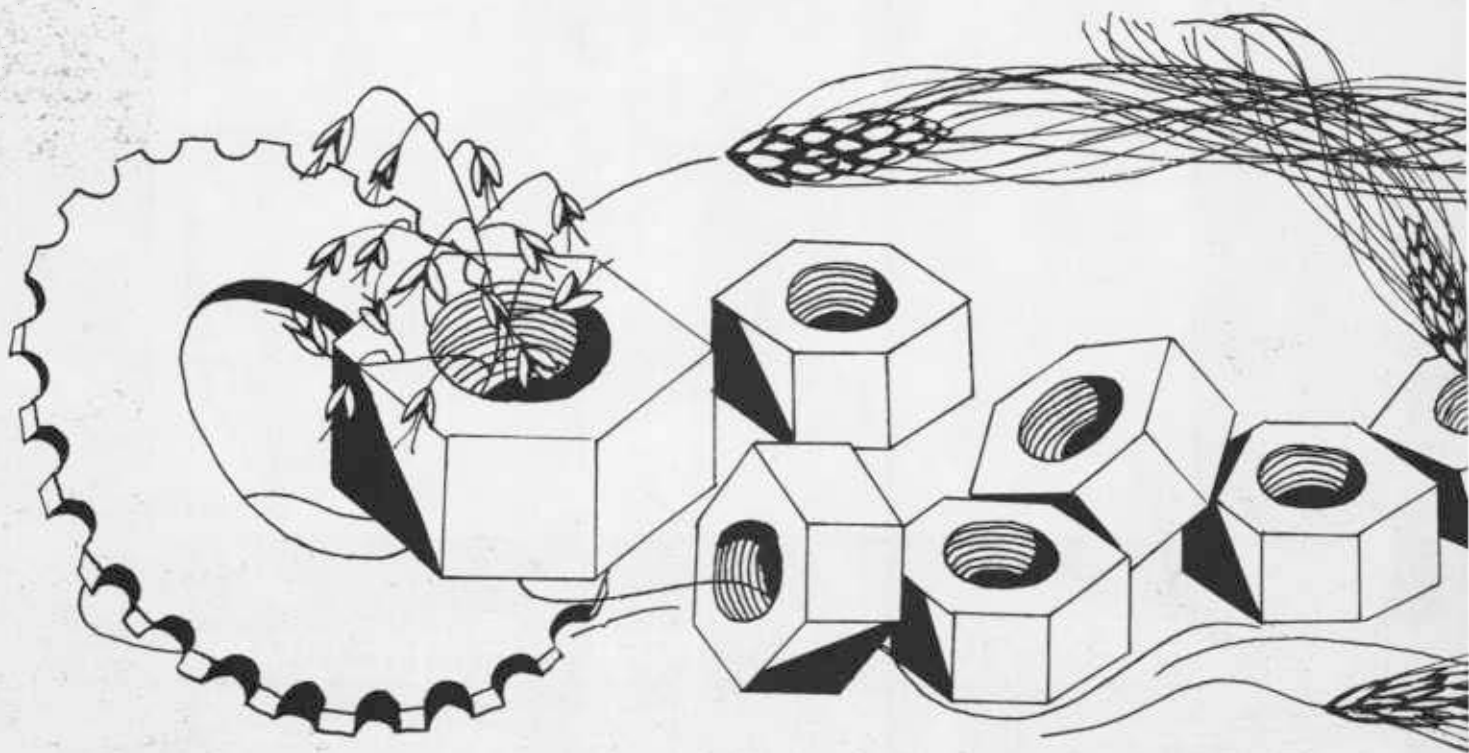
In general, the Harvard study found that technology has created a society of such complex diversity and richness that most Americans have a greater range of personal choice, a wider experience, and a more highly developed sense of self-worth than before. The



John R. Davis
Director

individual's new self-assurance has subsequently led him to make bolder and more aggressive demands on governments—at a time when the decline of authority and the complexity of problems have made governments less self-confident than ever. The result is an increased probability of public disorder, which we have all recognized during the past few years. The paradox in all this is that the social order which is made possible through the growth of individuality is simultaneously also endangered by the growth of the individual who now requires a high degree of accountability and participation.

It may be necessary to rely on an emerging group of society regulators,



for example, persons trained in computer based analyses needed to sort out the complexities and subtleties of a rapidly changing and highly interdependent society. However, making these expert decision-makers accountable to the citizens poses a major problem. There could be rising tension between the expert technicians or accountants in government and those who want a direct voice in public policy but who are not equipped with the necessary analytical skills. If one goes the full way of the regulatory elite, we wind up with a technocracy or a rule by authority. If one goes the way of those who want full participation, we wind up with chaos. The big question is, therefore, how to take advantage of the knowledge necessary to run a big, complex society without giving up the values of participation.

Agriculture bears a large part of the responsibility for the changes in society, and must be in a better position to anticipate the necessary changes in government, public sentiment, and relationships between individuals. This will require greater individual and collective leadership, and an ability to change and to influence change. Dean Rusk said several years ago, "If you are confused, take heart—you are only in touch with reality." But out of confusion must come reality, not chaos, and agriculture must organize itself to be a full and active influence in a complex society.



Progress

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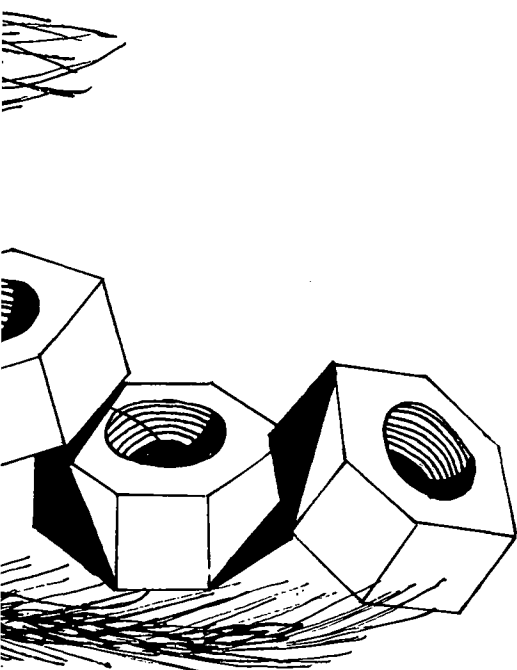
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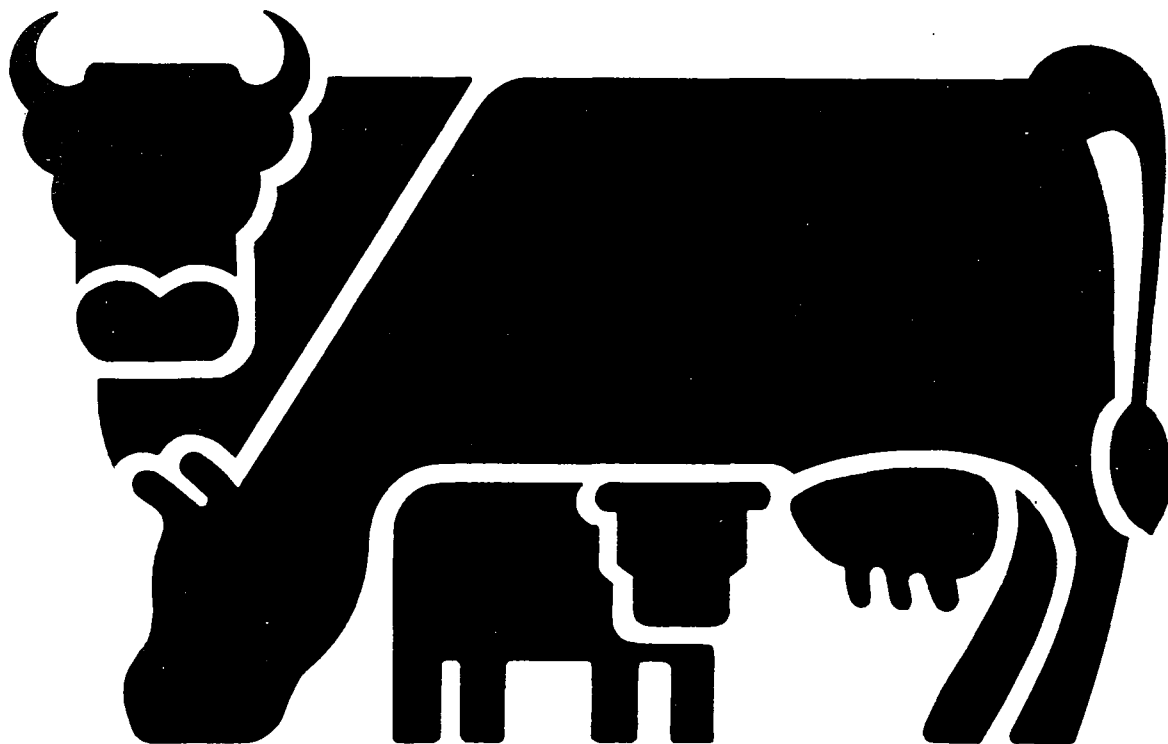
The status of swine may be changing as OSU scientists find new ways to work with waste. See the story on page eight.

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Beefing-up reproduction easier said than done

Knowing what to do to improve the reproductive potential of livestock is easy.

The problem: How to do it.

"Successful production of any livestock clearly depends on management practices which permit the animal to express its inherent ability to reproduce," said Fred Stormshak, animal physiologist.

"However, even under the best management, maximum reproductive efficiency of livestock is seldom, if ever, achieved."

Efficiency in reproduction could be improved, he pointed out, if methods were available for:

1. Inducing puberty (bringing the animal into production at an earlier age by shortening the interval from birth to puberty).
2. Synchronizing estrus (permitting maximum use of superior germ plasma by artificial insemination).
3. Preventing death in early stages of development (increasing the number of young born).
4. Inducing parturition (permitting better use of the labor force which would cut both labor costs and losses of young at birth).

Practical methods to improve reproductive efficiency must be based on a thorough understanding of the function of the endocrine glands which secrete

the hormones essential for ovulation, conception and maintenance of pregnancy. Research in reproductive physiology of domestic animals at OSU by Stormshak and his research assistants, S. P. Ford and K. B. Koligian, has been directed toward this goal.

One aspect of the research has been to gain a better understanding of how the central nervous system regulates the function of the anterior pituitary gland. This gland at the base of the brain produces two hormones essential for successful reproduction.

One, follicle-stimulating hormone (FSH), causes growth of ovarian follicles (sacs) containing the egg, or ova. Rupture of the follicles (ovulation) at the time the female displays behavioral estrus is caused by a second hormone, luteinizing hormone (LH).

Release of FSH and LH from the anterior pituitary is regulated by a hormone synthesized and released from the hypothalamus, an area of the brain directly above the pituitary. This hormone is called the gonadotropin-releasing hormone (GnRH).

Release of GnRH is believed to occur after a gonad hormone activates receptors on nerve cells which synthesize GnRH.

To determine whether the GnRH release mechanism really works this way, ewes at OSU are getting various doses

of drugs which block the nerve cell receptors. Levels of LH in the blood of the same ewes prior to treatment are being monitored as a control to determine treatment effectiveness.

"Results suggest that the receptors are involved in promoting the release of GnRH since LH levels become drastically reduced after treatment with certain drugs," Stormshak said.

"If the basic mechanism for the release of GnRH can be identified further, dosing domestic animals with a particular chemical may provide a way to regulate the secretion of FSH and LH and, hence, the growth and ovulation of follicles."

Little is known about the causes of death of the young embryo of domestic animals. It is presumed that a certain percentage of embryo deaths is caused by genetic mismatching.

"However, early embryonic mortality may be caused by an inadequate supply of blood to the uterus or to the ovaries where the hormone progesterone, essential to maintain pregnancy, is secreted," Stormshak said.

"Results of research at OSU suggest that in the non-pregnant cow and ewe, the main artery to the uterus on the side adjacent to the ovary secreting progesterone responds differently in terms of smooth muscle contraction than the corresponding artery on the other side of the uterus adjacent to the ovary not secreting progesterone."

These differences in artery contraction are not detectable in the pregnant cow and ewe.

"These data suggest that local ovarian control of uterine blood flow may be one mechanism a species uses to ensure an adequate supply of nutrients for the developing young," said Stormshak.

"Failure for such a protective mechanism to be established in the pregnant animal would explain, in part, the incidence of embryonic mortality and, hence, the 'repeat breeding' female in domestic animals."

Another way to expand livestock production is multiple births. Many studies have been conducted throughout the U.S. to increase the incidence of multiple births by increasing ovulation in the beef cow.

Traditionally, a hormone with FSH activity has been injected near the end of the estrous cycle of the cow. The hormone most commonly used is pregnant mare serum gonadotropin (PMS). Injection of this hormone at the end of the cycle increases the number of ovulatable follicles in an unpredictable manner.

Ovulations range from 2 or 3 to as many as 20 to 40. The largest number is not desirable because it exceeds the uterine capacity of the cow for embryonic development. The result is nearly always embryonic mortality.

At OSU, research has been conducted to determine whether it might be feasible to induce a second ovulation in the cow shortly after the first ovulation.

"We hypothesized that injection of PMS within 36 hours after detected estrus would result in development of fewer ovarian follicles than occurs after injection of PMS near the end of the cycle," said Stormshak.

Beef heifers were injected with PMS on the day of detected estrus and again 36 hours after detected estrus.

At 55 hours after detected estrus, the heifers were injected with GnRH to cause release of LH and, hence, ovulation of the induced follicles.

"Results have been disappointing," said Stormshak. "Ovaries of cows during the first 36 hours after detected

estrus appear 'refractory' to further stimulation of follicular growth by injected PMS."

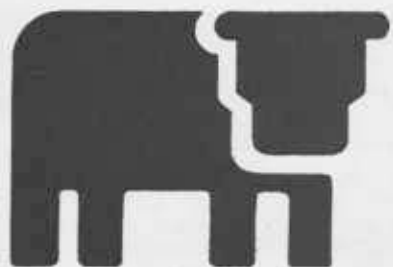
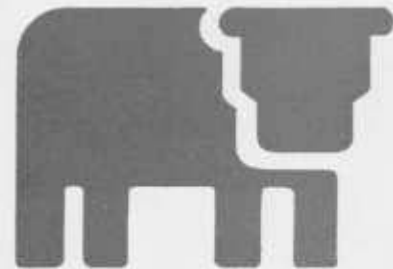
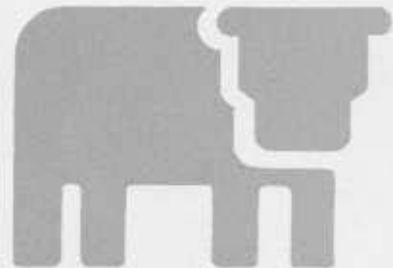
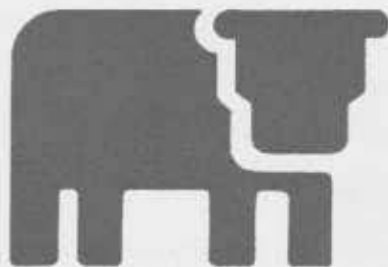
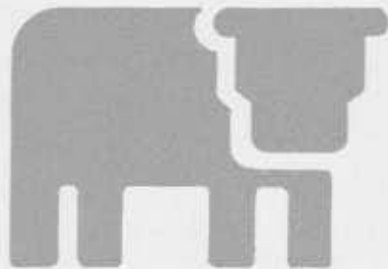
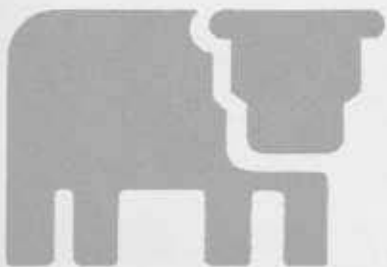
No follicles of ovulatory size were detected on the ovaries at the time of injection of GnRH. Injection of GnRH did, however, cause a significant increase in blood LH levels, indicating that the anterior pituitary contains sufficient releasable quantities of LH at the designated treatment time.

"Surprisingly, ovaries of PMS-treated heifers were greatly enlarged by day 10 of the cycle as a result of increased follicular growth," said Stormshak.

"Analysis of blood serum from these heifers indicated that the ovaries were producing substantial quantities of progesterone and estrogen compared to the levels of these hormones in blood serum of control animals."

This unusual increase in the synthesis and release of these ovarian hormones may account for the prolonged length of the estrous cycle of the PMS-treated heifers.

"It is obvious that further research is needed before a reliable and predictable method is developed for inducing multiple births in beef cattle," said Stormshak.



Moth spray leaves birds unharmed

In the summer of 1974, 400,000 acres of forest land in parts of Oregon, Washington and Idaho were sprayed with DDT to kill tussock moths.

Some persons were outraged by the spraying because they feared the environmental hazards of the pesticide. Others were pleased that the bothersome bugs would not be able to continue munching their way through the trees.

But all the controversy and spray seemed to go unnoticed by at least some of the animals living in the forested areas of Northeastern Oregon in the summer of 1974. For them, life went on very much as usual.

Cal McCluskey, a graduate student working with the Cooperative Wildlife Research Unit in OSU's Department of Fisheries and Wildlife, spent the summers of 1974 and 1975 trying to determine what effect, if any, the DDT spray had on bluebirds and wrens nesting in the forests near LaGrande and Enterprise. After two years of study, he reports: no detectable effects at all.

"The first summer I studied the immediate effects of the spray and nestling survival. Nestling mortality was of particular interest because small birds can starve if the parent birds die or become negligent. They also can die just from exposure to DDT. But the DDT seemed to have absolutely no effect on any of the species of Western and mountain bluebirds and house wrens studied. Not one of the nestlings in our study sample died," McCluskey said.

In 1974, 200 nest boxes were placed in areas that would be sprayed and 350 more were placed in control areas where no spray would reach them. Special sensitized cards were tacked to wooden stakes near each box. The cards reacted to the pesticide and gave McCluskey an indication of how much exposure the area had received. That year, 59 pairs of mountain bluebirds, 10 pairs of Western bluebirds and 14 pairs of house wrens occupied the nest boxes in the test areas.

"DDT was sprayed at three-quarters pound per acre but we estimated overall that between 30 and 60 percent never reached the ground," McCluskey said.

The rest of the pesticide stayed in the trees, wiping out populations of tussock moths. The U.S. Forest Service, in charge of the spray program, estimated the DDT was 98 percent successful in getting rid of the moths.

McCluskey went back again in 1975 to determine if any effects of DDT might be seen in the birds at a later time. He moved 150 nest boxes from the control area into the spray area, leaving 200 boxes in the control area. That year, 100 pairs of mountain bluebirds, 100 pairs of Western bluebirds and 11 pairs of house wrens occupied the nest boxes in test areas.

"In 1974, we were late getting some boxes out and did not pick up as many migrating adults as we would have liked. There might have been fewer birds in the study areas and, too, the boxes were new and less desirable to live in," McCluskey said. However, bluebirds tend to nest in the same areas each year, and the Experiment Station researcher surveyed the entire population both years to determine whether DDT had any effect on the birds.

"We looked for reduced numbers of eggs and reduced hatching success as indications of DDT effects. We also looked for reduced weight gains and development time in nestlings. Egg eating, parent birds not caring for their young and other abnormal adult behavior were secondary considerations," he said.

Several things may have contributed to the lack of any symptoms of DDT intoxication in the birds. McCluskey said the Forest Service was very careful not to spray over the grassy areas where bluebirds and wrens search for food. They usually nest at the edge of forests and hunt for insects in the grassy areas near the trees.

"In some cases, to make sure the spray didn't go into the open areas, the pilots may have turned off the spray before they reached the grassy areas. Maybe not too much of the pesticide reached the insects on the ground . . . the ones bluebirds and wrens generally eat. So we can't be sure how much DDT the birds took in with their food," McCluskey said. "We do know that some grassy areas were contaminated by spray drift but the amount and number of times this occurred are unknown."

Another thing the OSU graduate student thinks may have helped keep the birds healthy is an ability to rid their



bodies of pesticides more easily than animals higher up on the food chain.

"Birds low on the food chain are just as susceptible to DDT intoxication and other ill-effects related to DDT but they are not exposed to DDT constantly like birds higher on the food chain. If DDT is sprayed once and contaminates some insects which the bluebirds and house wrens eat, they will consume some DDT. However, insects with resistance to DDT or those not sprayed will continue to reproduce, producing an available food source with no DDT residue. Although there may always be some DDT residue, it will not be in harmful levels and the bird's physiological cleansing mechanisms can get rid of the pesticide," McCluskey said.

But birds higher on the food chain are more likely to eat still other animals which have a constant intake of DDT.

"Predatory birds such as bald eagles, osprey, pelicans, goshawks and sea gulls may be subject to small doses of DDT every day since it is so widespread in the environment," the wildlife scientist said. "Because they feed on higher level animals which may in turn feed on other DDT-consuming animals, it is stored in body tissue and the birds cannot cleanse their bodies faster than they intake the DDT. Large quantities eventually build up, affecting reproductive ability and behavior."

"We didn't do any tissue analysis with the birds so we can't know for certain whether their bodies contained any of the pesticide. But judging by their behavior and reproductive success, nothing seemed to be wrong," McCluskey said.

"One of the problems in studying cavity nesters such as bluebirds and wrens is that not much research has been conducted on them. Traditional studies have been conducted with predatory birds and not much is known about insectivores like these."

But meanwhile, life goes on as usual for the small birds.

Birth control takes toll for some pill users

Something is missing from almost every prescription for oral contraceptives say two Oregon State University nutritionists.

It's a warning about the importance of good nutrition.

Lorraine Miller and James Leklem have conducted research on the effects of oral contraceptives on the nutritional requirements of women, specifically on vitamin B₆ (pyridoxine). They said while a majority of the more than 10 million American women taking birth control pills will not have any adverse reaction resulting from the contraceptives, all women should be more aware that their nutritional needs are altered by taking the pill.

"The additional nutrients needed can be obtained just by making simple dietary changes, without the use of supplemental vitamins," Miller said.

Some women may need increased amounts of vitamins B₆, B₂ (riboflavin), B₁₂, C (ascorbic acid) plus folic acid and zinc while taking birth control pills. Supplemental vitamin pills designed specifically for oral contraceptives users are available, although the OSU nutritionists do not feel they are needed if a proper diet is eaten.

Leklem said three specific groups of women must be especially careful about filling their nutritional requirements. Those groups are teenage girls, users who smoke or take other drugs and users who contemplate going off the pills to have a child.

"Teenage girls taking oral contraceptives run a great risk of developing nutritional deficiencies because their bodies already have high nutrient requirements for growth," said Leklem. "Cigaretts and drugs add yet another insult to the body and increase nutrient requirements. Smoking in particular increases the need for vitamin C."

But women who want to go off the pill to have a child run the greatest risk of all.

"Pregnancy increases nutritional requirements. If a woman with nutritional deficiencies become pregnant soon after going off the pill, other deficiencies may result which could be harmful to the fetus as well as to the woman," Leklem said.

Another group which also has high nutrient requirements while taking birth control pills is women older than 30, Miller said. After the age of 30, the levels of vitamins in the blood goes down and more vitamins may be needed to maintain health.

Nutritional needs are complicated further because of the vast numbers of oral contraceptives on the market. More than 30 types of birth control pills are available, and doctors prescribe one they feel is right after looking over the woman's medical history, physical condition and family medical history.

However, Leklem doesn't think that is all they should do.

"Physicians need to become much more aware of nutrition and its influence on good health. They could suggest well designed diets for women taking birth control pills which could help prevent deficiencies," Leklem said.

Complicating the fact that not much nutrition counseling is done by doctors is the fact that there are still questions about some of the nutrients themselves.

Both Miller and Leklem are involved in vitamin B₆ research at OSU. Miller recently studied 20 college women—10 who were taking birth control pills and 10 who weren't—to find out whether oral contraceptives had an effect on the levels of the vitamin. She found that although the need for B₆ is increased while women are taking birth control pills, the increased need is not as great as had previously been suspected.

"It's difficult to get the proper amount of B₆. The regular daily allowance wasn't set too long ago, and food consumption tables are incomplete. For instance, we know how much B₆ is contained in raw beef, but we don't know how much there is after the meat has been cooked. We're at a disadvantage in trying to study B₆ because people are overestimating the amount consumed," Miller said.

Vitamin B₆ deficiencies are also hard to trace because there is no clinical sign of deficiency such as the scurvy caused by a vitamin C deficiency. And supplemental vitamin B₆ is not usually recommended because nutritionists don't know what effect taking too much B₆ might have.

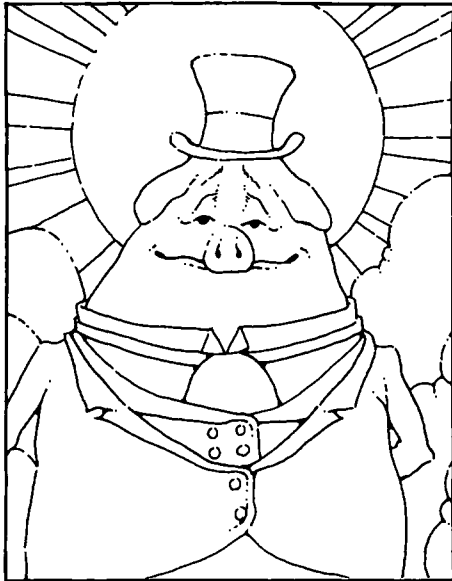
The problems with B₆ have been complicated further by studies linking vitamin B₆ deficiencies with mental depression. Reports about such studies often have lead to hasty conclusions on the part of an ill-informed public, the two Experiment Station researchers said.

"It is true that in some severe cases of schizophrenia, vitamins have been

(Continued on page 12)



Pig manure: the waste is gone . . .



Hog manure. A disposal problem.

Not to a group of campus scientists who see it in terms of recycling nutrients, an alternative food production method.

"As our concerns about the ability of the earth to provide food and fiber for the rapidly increasing number of people grow, we have to think about alternatives to make our food production more efficient," said soil scientist Larry Boersma.

Other members of the group are animal scientist James Oldfield, agricultural engineers J. Ronald Miner and Ekkehart Gasper and botanist Harry K. Phinney.

Boersma pointed out that only about 11 percent of land is suitable for cultivation. This is 3.7 billion acres (about 0.9 acres per person). Most authorities seem to agree that the present arable land area could be doubled by using all available reclamation techniques, including (1) irrigating dry land, (2) fertilizing lands with low fertility or (3) draining wet lands.

"But while we talk about increasing arable land, we have to recognize that crop land is shrinking because of the diversion of land for non-agricultural uses—highways, shopping centers, housing developments," said Boersma.

"So we are slowly approaching an inevitable conflict between the number of acres available for crop production and the number of acres needed—a conflict that could occur as early as the year 2000."

However, it has been suggested that cultivation of the additional land needed to feed everyone by the year 2000 could exhaust known fuel supplies in only about 20 years. There are no known alternatives to the modern, mechanized methods of production which require large fossil fuel inputs.

"To meet the needs for alternative methods of food production, we are trying to develop methods for nutrient recycling," said Boersma.

A pilot plant, designed by Miner, has been built by Gasper at the OSU Swine Center to study ways to recover nutrients from swine manure.

Removed from the pens by hydraulic flushing, the manure is collected in a sedimentation sump where solids collect on the bottom and are pumped to an anaerobic digester for breakdown by microorganisms into methane gas, carbon dioxide gas, soluble nutrients and organic forms of carbon.

Liquids from the sedimentation sump and the anaerobic digester are pumped to heated basins. The liquids contain nitrogen, potassium, sodium, calcium, sulfur and other nutrient elements

which are the building blocks of feed consumed by the swine.

The feed contains carbohydrates and proteins. During the digestive process, the carbohydrates are broken down to provide energy to perform physical activity and maintain body temperature. The proteins are absorbed and used as building blocks for new body tissues. The remainder (or debris) of the digestive process, discharged in manure and urine, contains partially broken down materials and nutrient elements.

This debris can be reassembled by microorganisms to be used again as feed. Algae and/or bacteria are particularly good at reconstruction of these materials if nitrogen and carbon are available. Since carbon is plentiful, reconstruction is controlled by the amount of nitrogen available in the manure.

The bacteria and algae, growing in the heated basins at the pilot plant and absorbing the nutrients, can multiply rapidly and build up a large amount of reconstructed material which can then be "harvested." At harvest, there are 1 to 2 grams of dry matter per liter of suspension. The dry matter consists of individual algal or bacterial bodies which are very small—2 to 10 microns.

Since it would be impossible to feed the suspensions directly to livestock—they would have to drink too much water to obtain sufficient feed—the bodies of the microorganisms must be separated from the water. Centrifugation is used, much like the process which separates cream from milk. Although centrifugation requires energy, it is no problem because the digestion part of the operation produces enough methane gas to drive the centrifuge.

Centrifugation produces a slurry which contains about 100 grams of dry matter per liter of water. This material could be used for direct feeding or the slurry could be run through an evaporation process, removing all water and leaving a dry powder. This material could be mixed with other feeds.

Both the concentrated slurry and the dried material have a neutral smell, slightly musty or earthy.

The dry harvested material contains from 50 to 75 percent crude protein. The crude protein content of grains and soybeans, by comparison, is about 10 percent and 40 percent.

The nutritional quality of protein is measured by its content of amino acids. On this basis, the protein derived from microorganisms using swine manure as their source of nutrition is nearly identical to that of soybeans and milk. The value of the product is further measured by its digestibility and palatability.

"Short term feeding trials with rats proved encouraging in both digestibility and acceptance," said Boersma. "The algal protein was superior to cottonseed meal. We will know more after feeding trials with pigs begin this summer."

Also unanswered are questions about the commercial aspects of the pilot plant since the project is in the basic research stage. Oldfield pointed out that the proposed system must provide the farmer with less expensive feed than can be bought now, must provide

a reliable feed source which means a storage product, or dried material, will be necessary and the system must be simple enough to operate under farming conditions.

If the pilot plant is successful, the next step will be a larger plant operated on a semi-commercial basis.

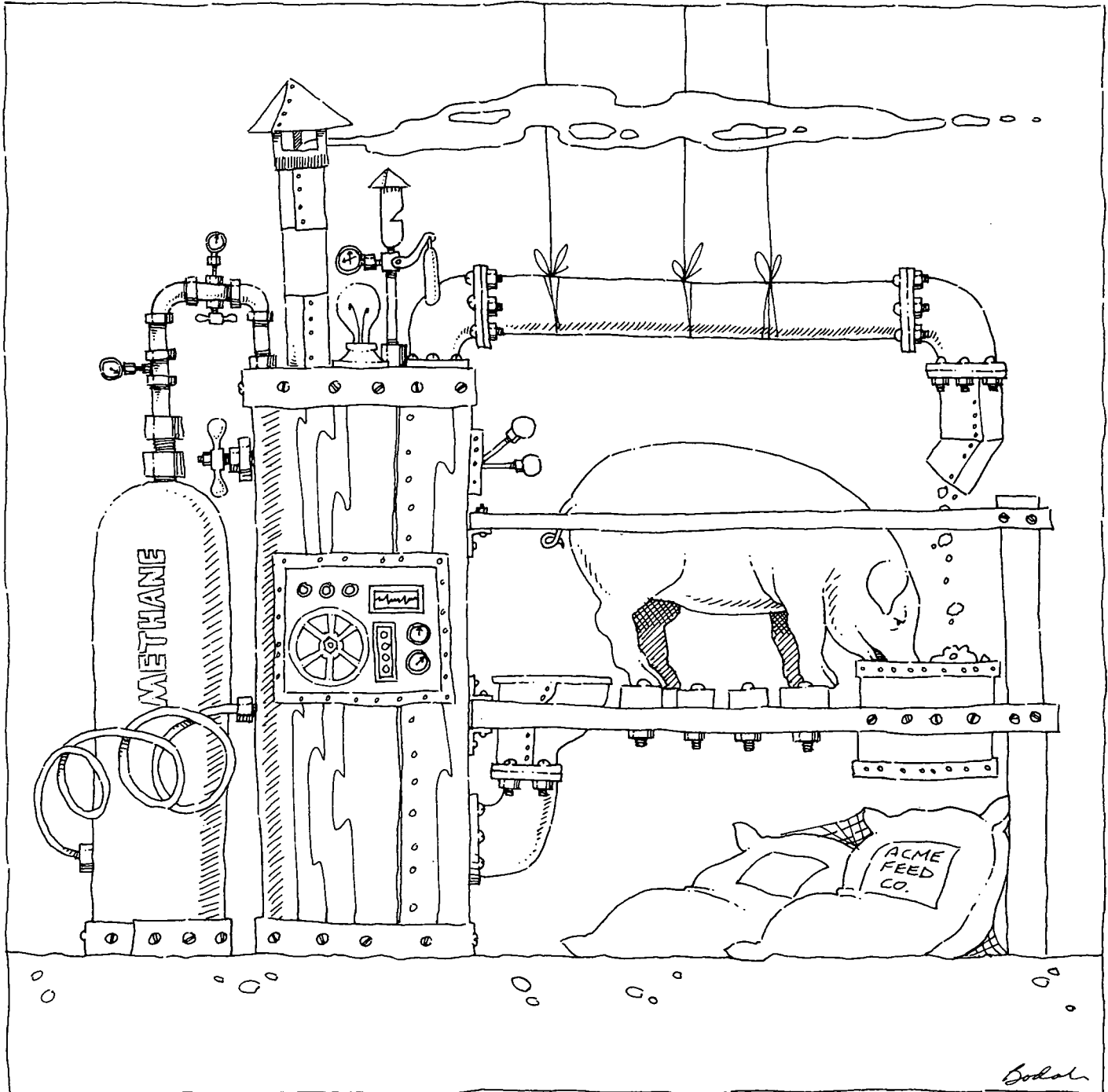
The project has attracted visitors from several states, Canada, France and Germany where similar projects are under way or are being planned.

"They, too, recognize the limits of land availability, the high cost of feed

and the fact that it may be less expensive to recycle nutrients than to treat the waste," said Boersma.

Based on the pilot plant operation, the scientists estimate that about half the swine feed can be reconstructed.

Said Boersma, "The ideal system, of course, would be one in which all materials discharged by the pigs could be recovered so that the only material to leave the premises would be the pigs themselves. Our experiments will be continued to achieve this goal."



Pear corking controlled by calcium spray

Corking—it's a problem which plagues pear growers and pear eaters alike.

Growers of Anjou pears have tried to fight the minor problem of corking (also known as "drought spot") for years. Consumers have been annoyed by the problem, too, when they found spongy, dark spots on their pears.

But now neither consumer nor grower need be annoyed by the problem because two Oregon State University horticulturists have found a simple, inexpensive way to combat corking in Anjou pears.

In a cooperative research project conducted on the OSU campus and at the Southern Oregon Experiment Station near Medford, scientists Daryl Richardson and Porter Lombard sprayed trees known to have corking problems with calcium. It had long been thought that calcium deficiency was responsible for corking, and the experiment was a success.

"Corking is a disorder similar to bitterpit in apples, but when apples are harvested they can be dipped into a calcium bath and spots will not form. That can't be done with pears. They must be sprayed while the fruit is developing on the tree," Richardson said.

Fruit affected by corking has depressed, superficial yellow spots. Internal brown spots can go deep into the fruit, sometimes reaching the core. But instead of feeling soft and mushy like a bruise spot, cork spots feel dry and spongy. Fruit affected by corking is slightly more bitter tasting and is more susceptible to storage disease.

"We don't really know all of the factors which cause corking although we do know it is related to a calcium deficiency and is limited almost entirely to Anjou pears. It does have some relationship to drought or lack of adequate moisture. More research will be needed to find the source of the problem," Richardson said.

The Experiment Station researcher said normal fruit has a calcium content of at least 400 parts per million and deficient fruit has only about 250 parts per million calcium (dry weight basis).

"Fruit low in calcium has a higher rate of respiration and a shorter storage life. Most Anjous can be held in storage until April or May. Then they are the only fresh pears on the market and sell well. But with corking, they won't last that long," Richardson said.



Horticulturist Daryl Richardson tests problem pear.

In some orchards, corking affects as much as 25 percent of the pear crop. However, it is a predictable problem. Weak, virus infected trees have a greater problem with corking than do strong, healthy trees. Certain rootstocks are also less susceptible to corking, and the disorder usually strikes trees badly only when there is a light pear crop, which tends to occur every other year.

"Fruit serves as a water reserve," Richardson said. "Hot, dry conditions cause water and elements such as calcium to bypass the fruit or to flow out of the pears and into the leaves and corking may result. Overhead sprinkling can help reduce the problem, and trickle irrigation often makes it worse."

To combat the problem, Richardson and Lombard mixed calcium chloride with water and a wetting solution (surfactant) and sprayed the fruit every other week from approximately mid-July until the time the fruit was harvested.

They tried calcium chloride in water at a range of concentrations from one pound calcium chloride per 100 gallons of water with a surfactant to 10 pounds per 100 gallons applied at a rate of 400 gallons per acre.

"At high levels such as 10 pounds per 100 gallons there is damage to tree leaves," Richardson said. "We're recommending growers use about three or four pounds per 100 gallons of water with a surfactant."

It is also important to use a surfactant with the calcium and water solution because otherwise the liquid will not spread evenly over the fruit. Calcium sprayed without a wetting solution will run to leaf edges where it may become very concentrated at phytotoxic levels and may injure and kill the leaves. Research is still in progress to determine optimum timings of calcium sprays for cork spot control.

"Luckily for growers, calcium is one of the few cheap agricultural chemicals. And since it's such a low-risk, high gain factor in control of corking, we feel confident recommending it to growers on a trial basis," said Richardson.

Fruit affected with cork spot is usually culled before it is sent into storage. However, corking can worsen when a pear is being stored and for that reason fruit must be sorted again before the fruit is marketed.

"The culled fruit can be used in juice if the percentage is not too great, so it isn't totally unmarketable," Richardson said.

However, with new information about calcium sprays, the day may be coming when corking will be rare. And that will make everyone happier.



Cow and calves on Squaw Butte range.

Center of interest Range is wide at Squaw Butte, Union Stations

Oregon State University's newest agricultural research center is really the oldest and the biggest.

How can something be old and new at the same time? Easy.

Last year, the oldest branch station—the Eastern Oregon Experiment Station established in 1901 in Union—was administratively merged with the biggest branch station—the Squaw Butte Experiment Station—headquartered in Burns.

Combined, the two stations now are called the Eastern Oregon Agricultural Research Center. They share responsibility for research in the range livestock industry, an industry with cash marketings representing about 25 percent of all agricultural market sales in Oregon.

The Squaw Butte Station is operated jointly by the Oregon Agricultural Experiment Station and the Agricultural Research Service of the U.S. Department of Agriculture. Research at the Station, which was established in 1911, is primarily in three areas—livestock, agronomy and range science.

"Squaw Butte findings apply directly to about 100,000 square miles which includes parts of Oregon, California, Nevada, and Idaho. Additionally, the research relates closely to the vast area between the Rockies and the Cascade range from Central Washington to Northern Arizona," said Robert Raleigh, superintendent of the two stations. "This total area is typified by cold winters and dry summers with vast expanses of desert vegetation intermingled with flood meadows created by runoff from interspersed block-fault mountain masses. The large expanses, short growing seasons, poorly drained, highly organic and sometimes salty meadow soils, and shallow, sandy and frequently rocky desert soils represent a combination of factors unique to the Station's service area."

But while the area served by the Squaw Butte Station is large, Station area is large, too. The Squaw Butte Range located 45 miles west of Burns consists of more than 16,000 acres of mostly federally owned semi-arid sagebrush-bunchgrass covered land.

The other tract of land—called Section Five—is 660 acres of state-owned

native flood meadowland seven miles south of Burns. The Section Five facility is equipped with corrals, animal feeding facilities and laboratories; the Squaw Butte Range has federally owned buildings and corrals.

But while space and land may be important, research depends mostly on people and animals. Fourteen persons work at the Squaw Butte Station which is headquartered in the Burns Post Office Building. Their titles range from animal nutritionist, range scientist and agronomist to research assistant, laboratory technician, secretary and farm worker. A herd of 300 breeding cows works for the Station, too, serving as test animals in various research studies.

Station research is aimed at maintaining an ecological balance while obtaining maximum beef cattle production. New knowledge is sought in range land fertilization and brush control types and amounts of feeds needed for full grown animals and growing calves, water requirements for both plants and animals, merits of fall versus spring calving and new understanding of animal and plant life by Experiment Station investigators at Squaw Butte.

Agricultural needs of Northeastern Oregon differ from those near Burns, and research at the Eastern Oregon Experiment Station in Union is reflective of those needs. Beef cattle are still important in the Wallowa, Union, Baker, Grant and Umatilla county areas served by the Union station, but sheep, agron-

omic crops, range and forestry management problems are also areas of agricultural concern.

Topography in the region includes mountains and valleys. Foothill land is primarily owned by private individuals and supports mixed coniferous forests unique to Northeastern Oregon. These lands are managed for summer grazing of livestock and timber production, but also support great numbers of wild animal populations which compete with grazing domesticated animals. Valley land is used primarily for forage production and wintering cattle and sheep.

The Eastern Oregon Station office building, barns, animal feeding facilities and corrals are on 600 acres of state-owned irrigated valley bottom land, most within the town of Union. Another 2,000 acres of state-owned open and timbered grazing land known as the Hall Ranch is also Station property. It is 12 miles northeast of Union. Station staff at Union includes animal scientists, a part-time agronomist, biological aides, a secretary and farmhands. About 300 breeding ewes and a herd of 200 brood cows are used in the various research projects.

Studies include tests to induce sheep to breed out of season and produce more than one crop of lambs per year, monitoring the grazing habits of both domesticated animals and wildlife in forested and open grazing areas, studying the merits of spring versus fall calving, testing new feeds for animals and working cooperatively with the Columbia Basin Agricultural Research Center in Pendleton to test possible new crops for the region.

"The results of Union Station research have had an important influence on Eastern Oregon," said Martin Vavra, assistant superintendent of the research center who is based in Union. "Farmers have altered traditional practices and instituted concepts based on research results from the Eastern Oregon Station. Ninety percent of the grain and hay varieties grown here were those tested by the Station and most fertilizer recommendations for alfalfa, wheat and grass seed grown in the area were developed by the Station."

Results from both stations have consistently aided farmers and ranchers in Eastern Oregon. And by combining resources, scientists may ask a wider range of questions.

Then the Eastern Oregon Agricultural Research Center not only will be the newest, the biggest and the oldest, but its answers will be the best.



Field days provide ranchers with new information.

PILL

(Continued from page 7)

used successfully as part of the treatment therapy. Vitamin B₆ is needed for maintenance of a healthy nervous system. But probably less than 10 percent of all the depressed women taking birth control pills have a vitamin B₆ deficiency," Leklem said.

For the majority of women taking the pill, all that is needed to maintain good health is proper nutrition. Deficiencies usually can be diagnosed by a doctor during the woman's annual checkup. But increased emphasis is needed on nutrition, both in the laboratory and the doctor's office, Leklem said, which will help prevent deficiencies.

"Very few medical schools have courses on nutrition, although it would be to their advantage to teach it. Some are making advances and perhaps professions in new areas of nursing will be able to help in designing diets for patients. But for the most part, dietitians now in the medical world work in hospitals where it is too late to do much preventative nutritional

Nutrients influenced by continued use of oral contraceptives

NUTRIENT	FUNCTION IN BODY	FOOD SOURCES
Folic Acid	Needed for cell division, protein metabolism and red blood cell maturation	Liver, nuts, asparagus, spinach, legumes (soy beans, kidney beans, lima beans)
Vitamin C (Ascorbic Acid)	Needed for tissue structure and repair	Citrus fruits, tomatoes, cabbage, spinach, broccoli, potatoes
Vitamin B ₂ (Riboflavin)	Needed for maintenance of a healthy nervous system and for normal cell metabolism	Milk, cheese, liver, split peas, spinach, enriched breads and cereals
Vitamin B ₆ (Pyridoxine)	Needed for maintenance of a healthy nervous system and for normal cell metabolism	Tuna, soybeans, nuts, bananas, spinach, whole grain and enriched breads and cereals, raisins
Vitamin B ₁₂	Needed for maintenance of a healthy nervous system and for normal cell metabolism	Liver, fish, meats, eggs
Zinc	Needed for utilization of food and for carbohydrate metabolism	Whole grain breads, fish, eggs, nuts

planning, or in clinics where they have been assigned primarily to planning weight reduction diets," Leklem said. So for now, most women will need

to ask more questions of their doctors so they can plan their diets more wisely and write their own prescription for health.

New stuffing for poultry: our soybeans

Northwest poultry producers will be watching anxiously this year while three OSU poultry scientists test the feed value of Western-grown soybeans in chicken and turkey rations.

For more than 30 years, producers have fed their flocks Midwest soybean meal as the major source of protein in poultry feeds because soybeans were not grown commercially in the Northwest. Oregon poultry producers now purchase more than 60,000 tons of Midwest soybean meal annually, then pay an additional \$40 per ton to ship this ingredient West.

The three OSU researchers—professor James Harper, associate professor Harry Nakaue and poultry science department head George Arcscott, hope to determine how soybeans—which are now grown commercially on a limited basis in the Columbia Basin of Washington and Oregon—can be used to replace the soybean meal shipped from the Midwest. Their findings may help save money for both producers and consumers because if producers can save money on shipping costs they may be able to pass the savings along to consumers in lower prices for eggs and poultry meat.

The problem of feeding Northwest soybeans to poultry exists within the beans themselves. Unprocessed soybeans contain growth inhibitors which adversely affect the development of young chickens and turkeys. Processing can destroy the inhibitors but no processing plants have been built in the Northwest.

"When soybeans are processed for meal, growth inhibitors are destroyed," said Nakaue. "First, the raw beans are ground and the oil is removed for human consumption. What remains is heated and dried to form the meal which is fed to animals."

Another method known as the extrusion process is available for removal of growth inhibitor factors in whole soybeans. Since the oil is not removed this provides an energy source to the whole fat extruded soybean meal that is not present in the solvent meal.

During the study, soybean meal, extruded soybeans and ground, raw soybeans will be fed to test birds including broilers, replacement and laying chickens and young turkeys.

In earlier research, OSU Agricultural Experiment Station researcher Harper, and graduate student Marvin Stoller, found the extruded soybeans nearly equaled in feeding value to the solvent processed meal. Similar effects have been found by Arcscott in chick experiments.

But results with ground, raw soybeans are conflicting. In experiments conducted elsewhere, chicks responded well to raw soybean meal when methionine—an amino acid—was added to combat growth inhibitors. However, last year, Arcscott fed ground, raw soybeans with methionine to layers and found that the inhibitors caused a marked reduction in egg production, accompanied by a decrease in feed consumption and a reduction in body weight.

Soybean studies also will be conducted with other animals. A \$89,500 grant from the Pacific Northwest Regional Commission will fund Northwest soybean feeding trials with cattle and swine in addition to poultry.

If experiments succeed, soybeans could become an important crop in the Northwest. Extracted oil could be used by potato processing plants in the Columbia River Basin. The oil

now used to make potato products must be shipped West. If the amount of soybean processing warranted, an oil extraction plant eventually could be built which would produce soybean meal similar to that now shipped here from the Midwest.

But in the meantime, poultry producers are keeping a sharp eye on the research being conducted by the three poultry scientists at OSU.

Root 'starts' put a leash on mugo pine

From the Austrian Alps to your backyard.

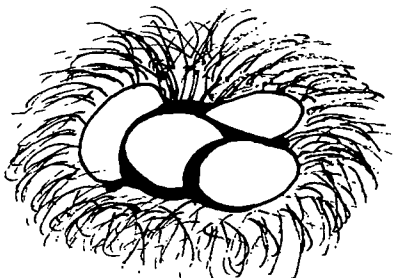
Starting soon, nurseries in the Northwest will be able to sell Mugo pines and practically guarantee that the popular landscape trees—admired for their dwarf growing habit—will not grow too tall.

Horticulturist A. N. Roberts said five varieties of Mugo pine have been selected and are in the process of being named with release scheduled for the next year or two. Stock plants now are being increased by 10 cooperative nurseries to assure ample cutting wood is available when the five are released.

"In the past there was no way of knowing whether Mugo pines would remain two feet tall or whether they would grow up to 30 feet in height," Roberts said. "This unpredictability makes the trees less acceptable to homeowners and landscape designers."

In addition to being highly variable species, Mugo pines can hybridize with Scotch pines resulting in seedlings that are even more variable. Some are extremely vigorous—nursery seedlings from mixed seed have reached 15 feet in 10 years.

While visiting in the Austrian Alps where the species are native, the Agricultural Experiment Station sci-



entist had a chance to observe sources of so-called true Tyrolean dwarf Mugo pine. From those seed lines he selected some outstanding dwarf types for landscape use then used the same methods to regenerate the Mugo pine selections that were being tested with Douglas fir cuttings.

"Conifers like Douglas firs and Mugo pines were the last plants to lend themselves to rooting from cuttings," Roberts said. "But in the last 10 years we've come a long way in developing the technology which will make it commercially feasible to reproduce forest species vegetatively instead of from seed."

When trees are started by regenerating roots from cuttings, one-year-old shoots are taken during late winter and treated with rooting hormones. Then they are put into plastic tubes resembling test tubes and subjected to environmental conditions which stimulate rooting. When the young cuttings are able to shift for themselves, they are planted in the same manner as young trees grown from seed. But unlike seedlings, growth of the vegetatively-propagated trees will be identical to that of the parent plant from which the cuttings were taken.

"The advantage of being able to reproduce unlimited numbers of identical trees from superior parents is obvious when you consider the needs of foresters, Christmas tree growers and nurserymen," Roberts said.

The OSU horticulturist now is in the process of convincing nurserymen that Mugo pines grown true to type from cuttings are economically feasible and offer distinct advantages in marketing.

"One definite advantage will be having a distinctive name attached to a predictable plant for landscape planting," Roberts said.

And in the process, the Alps will move a little closer to everyone's backyard.

Some vegetables vote 'yes' on reduced tillage

Tilling tells.

It speaks in terms of yield and costs, both labor and fuel. The question: Which is best—no-till, reduced tillage or conventional tillage?

Tillage experiments, mainly with agronomic crops, have been conducted for several years. Washington and Kentucky tests of vegetables using different tillage practices showed that plant survival and yields were less for all crops except corn under no-tillage.

The conclusion from these tests was that the only advantages of no-till were the ability to plant and harvest when soils were wet and sloping terrain could be used for row crops.

Most of the no-till testing in Oregon with row crops has been done by growers with field corn. To find out how the three methods—no-till, reduced-till and conventional-till—affect sweet corn and snap beans, tests were set up at the North Willamette Experiment Station.

W. A. Sheets, horticulturist based at the station; Dean Booster, agricultural engineer, and Harry Mack and William Mansour of the Department of Horticulture selected a fall-seeded field of wheat for the experiments.

The test area was sprayed in March with Paraquat to kill the wheat. In April and early May, 1975, the conventional-till plots were disked, chiseled and harrowed in the usual way.

Reduced tillage consisted of a single pass with a five-wheel gang rolling cultivator centered 30-inches apart on a single tool bar with a two-inch working depth. A single pass at about 3.5 miles an hour was made ahead of the planting operation. The action of the "slicer tines" thoroughly tilled the row area without pulverizing the soil.

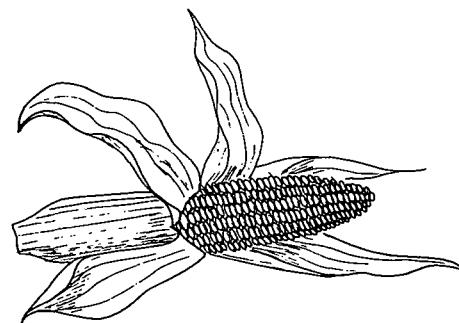
"Ideally, the gangs could be mounted on and ahead of the planter-fertilizer unit, eliminating an extra operation," said Sheets.

No-till plots were left undisturbed.

After the corn and beans were planted May 20 in 30-inch rows, a solid-set sprinkler system was installed for irrigation.

On June 3, stand counts disclosed more plants in reduced-till and no-till treatments in both crops. These differences remained through harvest.

When the beans were handpicked, yield was essentially the same for no-till and conventional-till but reduced-till had about 30 percent higher yield. All plots were harvested the same day and no discernible difference in maturity was noted but grade tests showed that conventional-till had a larger percentage of smaller beans indicating they were slower to mature.



"The gross value per acre of beans ranged from \$738 an acre on no-till to \$1,153 on reduced-till, or 38 percent higher than that of conventional-till," said Sheets.

"The sweet corn yield, based on graded weight per acre, was the same for conventional-till and reduced-till. No-till was about 10 percent lower."

Corn in the reduced-till and conventional-till plots matured at the same time; no-till corn was seven days later in maturing. Ear length was not affected by the three methods but stalk height of conventional-till averaged about nine inches taller than no-till corn and two inches taller than reduced-till corn.

"Based on a single season's results, it would appear that some form of minimum tillage may be feasible in sweet corn and, possibly, snap bean production," said Sheets.

"It seems logical that production costs can be lowered with fewer tillage operations, yielding an economic advantage if production stays up."

Whether production stays up will be determined by further tests.

"Good growing practices are vital for no-till, too," said Don Rydrych, agronomist at the Columbia Basin Agricultural Research Center, Pendleton.

"No-till success depends on chemical seedbed preparation in the fallow year followed by selective weed control of cheatgrass and annual weeds in the crop year."

No-till has been more successful in the green pea program in the Pendleton area, with production about equal to production on tilled seedbeds. Lentil no-till culture has not been as effective.

"Like the cereals, green pea success with no-till was entirely dependent on good chemical seedbed preparation and good selective weed control in the pea crop," said Rydrych.

In 1974, no-till winter wheat at the Research Center yielded three more bushels than wheat grown with conventional tillage. In 1975, no-till wheat yields were 13 bushels more. At Moro's Sherman Station, Moro wheat yielded seven bushels more than wheat grown under conventional tillage.

And there may be additional benefits from no-till.

"In 1975, it was noted that the incidence of foot rot was much less in no-tilled soft, winter wheat seedbeds than in either a plow or stubble mulch culture," said Rydrych. "Discovered at the Pendleton Station, this great difference may account for some of the 13-bushel increase in yield."

The incidence of foot rot was down as much as 70 percent on some Pendleton Station plots. Foot rot, a problem particularly of early seeding, affects crowns and stems of the root and kills tissues.

The no-till studies will be continued this year at the Pendleton Station but only on wheat. An English drill, designed for no-till, has been used at the center since last spring.

Still experimental, no-till has found some friends.

In the 1974-75 year, there were 3,000 acres of no-till planted in the Oregon-Washington area.

In the 1975-76 year, there will be twice that, mostly in wheat.

... and cereals respond best to no-tillage

No-tillage, used experimentally in the Columbia Basin since 1968, has produced some affirmative nods.

Wheat, barley and peas have responded well to no-till culture. The plus comes in reduced labor costs and possibly higher yields. The negative: Cost of more chemicals, needed to kill weeds.

SNAP BEANS

Tillage system	Avg. No. plant/ft ¹	Yield lbs. per acre	Grade					Gross value ²	Per cent
			% sieve size						
			1+2	3	4	5	6		
Conventional	3.2	15,678	18	27	35	14	5	\$ 832	100
Reduced	5.2	20,555	15	26	38	16	5	1,152	138
No	5.0	15,330	12	22	38	20	7	738	88

¹ Plant count at harvest

² Based on these values: Sieve 1+2 @ .0808/lb; Sieve 3 @ .0579/lb; Sieve 4 @ .0464/lb; Sieves 5+6 @ .0256/lb.

SWEET CORN

Tillage system	Plants/Ft. ¹	Stalk Total Prod. Ht. (in)	Ear Lgth (in)	Yield (Tons/Acre)				Gross Value /A	Per cent
				Grade					
			No. 1	No. 2	1+2				
Conventional	1.7	1.5	85	7.5	7.0	2.7	9.7	749	100
Reduced	1.8	1.6	83	7.6	7.2	2.5	9.7	751	100
No	1.9	1.6	76	7.6	6.6	2.1	8.7	675	90

¹ Plant count at harvest

WINTER WHEAT YIELD

	Pendleton—1975 (pound/acre)		Moro—1975 (pound/acre)	
	Control	Chemical	Control	Chemical
Plow	2810	3490	2040	2420
Roto till	2600	3500
Stubble mulch	2140	3470	1760	2740
No-till	2630	4310	2340	2830

GREEN PEA YIELD

	Pendleton (pound/acre)				
	1971	1972	1973	1974	Average
No-till	4100	3480	1130	2120	2707
Plow	4260	3520	1160	1820	2690

Finicky fruit fly falling finally?

All the comforts of home.

That's what entomologists at OSU found they had to provide for experimental cherry fruit flies being raised in a laboratory study.

First, a special food was formulated for this orchard pest. The winning recipe: wood pulp, wheat germ, Brewer's yeast, sugar and a vitamin mixture combined into what looked like an unappetizing mush.

Then the scientists—working under the direction of assistant professor M. T. AliNiazee—perfected an artificial cherry where female fruit flies could lay their eggs.

Various types of waxes were tested, but the only kind which could be penetrated by the female fly's egg depositor and still retain its shape for the duration of the test period was a ceresin wax, imported from Germany.

Why go to all the trouble?

The entomologists hope by studying the biology, behavior and attraction of the cherry fruit fly they can get rid of the menace in cherry orchards. The fly eggs become the larvae which form worms in cherries.

"The cherry fruit fly is the No. 1 problem of cherry growers," Ali-

Niazee said. "If pesticides were not used, the fruit flies could ruin about 90 percent of the cherries grown in Oregon."

The cherry industry is one of the largest fruit industries in the Northwest. In 1973, the cherry crops of Oregon and Washington were valued at approximately \$28 million at the farm gate and \$50 million after processing. The cherry fruit fly will infest all types of cherries.

The flies are very selective breeders. Females deposit only one egg per cherry, although each female is capable of producing approximately 150 eggs. Each male fly patrols one cherry and fights off other flies until the female comes along to deposit her egg.

Now cherry growers spray pesticides over their trees five or six times each summer to get rid of



Cherry fruit flies deposit eggs in wax cherry.

flies. The spray is effective, but expensive, and sometimes, unwanted.

"If we can find a dependable system for monitoring the flies, growers could save time and money and cause less damage to the eco-systems of the orchard," Ali Niazee said.

AliNiazee hopes to develop some monitoring device to attract flies easily in six orchards. Then counts of flies can be made and the orchard can be sprayed when fly populations present a problem. So far the Experiment Station entomologist has experimented with objects of various shapes and colors sprayed with a sticky material. Flies are attracted to the shapes and colors and become stuck to the surface where they can be monitored.

"We are on the verge of coming up with such a trap," AliNiazee said. "It is a plain 16 by 18 centimeter piece of cardboard painted daylight fluorescent yellow and sprayed with a coat of sticky material. We hope growers will adopt this technique for checking cherry fruit flies in their own orchards."

Sex attractants and radiation are two other methods of pest control being considered.

"Some European studies have shown that one good way to limit the European fruit fly is to put out sterilized flies. Then when the flies mate, no eggs are produced," AliNiazee said.

So the laboratory fruit flies should enjoy the good life while they have it. Their days—and those of their kind—may soon be numbered in Oregon orchards.

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