Cover Picture: Tobacco mosaic virus particles magnified 100,000 times by the Utah State University electron microscope. The plant virus laboratory at Utah State has made distinctive contributions in research on the basic nature of virus agents and in methods for their ultimate control. The new grant of $320,048 from the National Institutes of Health to Dr. George W. Cochran, head of the laboratory, is for studies of the biochemical changes which the virus induces in host plants. Evidence of progressive chemical changes is being obtained from spectrophotometric studies of infected tissues. It is hoped that these studies may provide the key which will unlock some of life's best kept secrets; for an understanding of virus action within cells is the first step toward an understanding of the life process itself.

Land Grant Universities — U. S. Department of Agriculture Centennial 1862-1962
Let our future be nourished by the past

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Utah Farm and Home Science

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Farm and Home Science
FOR THOUSANDS of years man looked at the world around him with un­
critical eyes. He had ideas about himself, the plants and the animals, the earth and the heavens. Some ideas were useful, others appealed to him for differ­
ent reasons. He created gods for the sun, moon, thunder, and other objects or events he did not understand. Fam­i­
ines, drought, accidents, and disease he attributed to fate or to unfriendly spir­
its. Truths, half-truths, and myths were com­mingled in a confused body of "knowledge" and "beliefs." Because the world was assumed to be unknowable, fear reigned as a dominant force in life.

Milestones in the struggle for understanding

The path man has followed in struggling upward in this fog of igno­
rance has been a winding one. A few of the milestones along his way seem significant.

After a written language had de­
veloped, some men started to keep careful records of certain events such as the position of the stars, the symp­toms associated with disease, the growth process of plants, and the weather. These records provided at least two advances: first, the observa­tions could be checked by others; and second, the accumulated observations were evidence of an orderly succession of events in the universe.

Probably later man devised ways to measure things — distance, weight, light, magnetic power, radiation — he is still devising such sys­

tems. As a third milestone, he observed that certain events had recognizable causes. Heat caused ice to melt; bees collected nectar from plants and made honey; bacteria caused diseases. The world ceased to be capricious, and man realized that he could be the master instead of the slave of his environment.

Fourth, man found that ideas proved valid under a limited situation were often of extensive importance — the law of gravity, the concept of evolu­tion, and many others.

Fifth, man found that he could carry out experiments to test the quality or validity of his ideas. Some of the gar­
den variety of such ideas early tested included: Do root crops yield better if planted in the dark of the moon; do plants need other materials than water for growth.

Responsibilities of public agencies for the solution of fundamental problems

Gradually man realized that to con­quer his age-old enemies of hunger, dis­
ease, cold, and fear he must energeti­cally and systematically study the world around him. These studies could not be left to chance and so public agen­
cies were assigned the responsibility.

Since food, clothing, land, water, plants, and animals were the basis of man’s existence it was natural that these should receive first attention. In the United States this was done through establishment of the state ag­
gricultural experiment stations and the U. S. Department of Agriculture.

Although the Utah Agricultural Ex­
periment Station was not established until 1888, it is appropriately, with

(Continued on page 24)
Industrialization has made necessities of many things that were formerly nonexistent. It has also brought with it many problems which were previously absent. Automobiles, airplanes, television, plastics, and superhighways are just a few of the formerly nonexistent necessities which now play vital roles in our lives. We are all aware of the hazards on the highways and in the air resulting from vastly increased travel. However, most of us are not as keenly aware of another problem which has resulted from industrialization and the crowding together of many people in limited areas. This is the problem of air pollution. Any gaseous or particulate matter not normally present in the air is an air pollutant. This includes dust, smoke, gaseous fumes, radioactive fallout, and any other foreign matter.

Sources of air pollution

Our society is one which is dependent upon burning, and most pollutants get into the air as a result of burning. Much of the energy used in cooking our food, lighting our cities, or operating our TV sets comes from the burning of coal. After we have made use of food or fiber in order to live, the refuse ends up on the fire — either at home or on the city dump. Automobiles function only as a result of burning, and the products of that combustion pollute the air.

In the burning process, most fuels are only partially consumed, and many chemical products of partial combustion are released into the air. Some of these are visible as smoke. Others are not visible, but are made up of complex chemicals which may be a menace to the health of plants and animals.

Usually the products of combustion are carried away from the site of burning by air currents, so that they do not become concentrated enough to damage life; however, at times the air, containing products of combustion, is trapped and held close to the earth by a thermal inversion. When this occurs, the build-up of toxic products may be so great that both animal and plant life are injured.

Effects on animal life

One notable example of toxic build-up was the smog which occurred at Donora, Pennsylvania, in October 1948. For several days the smog failed to lift, and by the end of the third day nearly 6,000 persons were reported ill and 17 people had died. Those who became ill at this time and recovered had a higher illness and death rate later than those who remained well during the smog disaster.

According to Dr. Walsh McDermott, professor of public health and preventive medicine at the Cornell University Medical College, there is much evidence that unclean air has bad effects on health. One disease, the increased incidence of which apparently is associated with unclean air, is chronic bronchitis-emphysema. When this disease occurs, several tiny air sacs in the lungs merge to form a larger air sac, and a smaller surface for the transfer of oxygen to the blood results. In addition, the bronchial tubes leading to the sacs are narrowed, causing the bronchitis phase of the disease. Susceptibility increases with age, with the illness and death rate going up rapidly after 45. Bronchitis-emphysema is more common among city dwellers than country people and more of a problem...
in large cities than in small ones; "There is some indication, however, that the advantage of country living can be cancelled by cigarette smoking, which is, in effect, a portable form of air pollution." Dr. McDermott also states that chronic bronchitis and its complications is now the leading cause of death in men over 45 in Great Britain.

The Utah Agricultural Experiment Station has realized the seriousness of the problem of air pollution for many years and has cooperated with the public and industrial concerns in determining the effects of air pollutants on plants and animals. Since fluorides have been released into the air through industrial processes in a number of places, with resulting higher fluoride content in soil, water, and plants, much of the study has been on the effects of fluorides.

These experiments have shown that the eating of above-normal amounts of fluorides by young animals during the period of tooth development causes (Continued on page 26)

Fig. 1. Yellowish-brown to dark-brown dead areas developed between the veins and the remaining green areas of these maple leaves injured by sulfur dioxide

Fig. 2. Dead tissues at leaf margins and within this apricot leaf resulted from excess fluorine in the air

Fig. 3. Yellowing, death of tissues, and abscission of this cherry leaf followed exposure to too much chlorine in the air

Fig. 4. These narrow, distorted cowpea leaves developed after exposure to 2,4-D fumes

Fig. 5. Automobile exhaust fumes contribute heavily to air pollution in urban areas
A dramatic increase in knowledge and improvement of techniques that have doubled farmland productivity in the past hundred years. The tremendous and continuing effect of having centers of research and training for such knowledge, thus opening up a new dimension in university work. The bold decision to make higher education available to classes of people never before thought suitable for it. These are the achievements likely to be noted during this centennial year of the Land-Grant Colleges and Universities.

The importance of such matters is obvious, and indeed can hardly be overemphasized. But in celebrating them, we should not overlook other contributions of no less worth which have been made to "the industrial classes" — the ordinary working people — by the Land-Grant program.

If we look at American farmers as those most directly affected by the Land-Grant system, we do indeed see that they are productive, prosperous, and trained as farmers never before have been in any society. But in the continuing social evolution that has led to the unique achievements of the American society which we enjoy, a concurrent development at least as interesting and important, is the general social recognition won by the American farmer.

Farmer is a respected word in America

"Farmer" is a respected word in our society! One hint of how great a change this is, may be gained by looking at a few words from other countries and times. Many terms that at first simply meant a worker on the land, over the years came to mean someone thoroughly disreputable. A "villain" originally was just a person who lived on some country property, a "villa." The word "village" goes back to the same root. "Churl" is an Old English equivalent, probably related to the word "corn." "Boor" is a comparable word, originally meaning merely one who dwelt in the country. A long list could be made of words which in various ways reflect the low opinion for the soil-tiller prevalent in most societies before ours: clown, serf, peasant, lout, rustic. Even in our own society in fairly recent times, slang used in place of the word "farmer" showed the same tendency: "hick," "rube," "hayseed."

But such terms do not fit American conditions, and are dying out. There are no more churlish villains or villainous boors in the country these days than there are in the rest of society. The modern American farmer can be and often is as sophisticated, as aware, as influential in society as his counterpart in business, industry, or the professions.

Obviously, there are many reasons for his present status. His prosperity and productivity help give him both the time and the means to do something besides work all his waking hours for a bare subsistence. With modern transportation he is no longer isolated from the rest of society for long periods. He has radio, television, movies, newspapers, magazines, books — all the communication media available to all other parts of society.

A participating member of society

However good he may be in his field, a farmer who knows nothing more than farming is not in a position to exercise effective influence outside it. Other than his effect as an individual voter, his influence in society and government will depend on how well he understands society as a whole and how clearly he sees farming in relation to the whole, and not as the all-in-all of life. Traditionally, even independent farmers of some skill, let alone serfs, have had little concern for anything beyond their own acres.
The American farmer's knowledge of, interest in, concern with, matters outside of farming surely has been essential to his gain in influence off the farm.

The Land-Grant system's contribution has been no less important in this matter than in knowledge related directly to farming. If a university did no more than introduce a farmer to agricultural economics, this would represent a significant development: serfs know nothing about agricultural economics. But a university presents agricultural economics as being one part of economics in general; then it teaches economics in relation to other areas of the social sciences and the humanities. And more importantly, even, it insists that the student consider himself in his many roles, not as farmer only. Farmers thus are prepared not only to develop leadership for their own concerns, but also to make their contribution to the leadership that works for all of society.

Training in the humanistic tradition

Finally, and I would affirm most important of all, when the Land-Grant system opened higher education's curricula to subjects and its doors to students never before admitted, it did not deny to either students or curricula association with the humanistic traditions central to older style universities. It in fact made a tremendous democratic implementation of the humanistic ideal that the individual should get as much education as he can assimilate simply because he is a uniquely significant being with innate dignity and worth, and because his potentialities will not be as richly realized as they might be unless he has the best education that his society can give him.

The Land-Grant system not only helped make available to the ordinary citizens of America new facts about farming and ways to get the facts to people who could use them. It not only provided for them in addition, train-
Haywire and green leaf different expressions of

**CURLY TOP INFECTION IN POTATOES**

**GOLDEN L. STOKER AND ORSON S. CANNON**

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Fig. 1. Terminal growth and leaf of Russet Burbank potato showing current season curly top symptoms (left) and similar parts of healthy plant (right). Note cluster of small, rolled, elongated terminal leaflets with pubescent underside of leaflets exposed.

Fig. 2. Top portion of Russet Burbank plant infected with current season curly top. Note curved, rolled, bulged or distorted leaflets with faded margins.

Fig. 3. Healthy Russet Burbank leaf (left) and diseased leaf (right) Note elongated, rough or wrinkled leaflets with irregular, knotted midribs and faded margins.

Fig. 4. Leaflet showing green central portion with bulging tissue between veins.

A POTATO disease known as haywire in Utah and the potato disease described as green dwarf in Oregon are both caused by the curly top virus. Haywire is a current-season expression of curly top infection when plants are grown under field conditions in Utah, while green dwarf is a tuber-perpetuated expression of curly top when plants are grown under winter greenhouse conditions in Utah and under field conditions at Oceanside, California, during the winter months.

The curly top virus has been known as the cause of a disease in potatoes since 1925 when the virus was first transmitted from naturally infected potato plants to beets by means of leafhoppers. However, potato curly top symptoms described in the literature are extremely variable in different localities and with different varieties.

Studies in Utah on curly top infected

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potatoes have shown that plants infected naturally in the field by the beet leafhoppers express current-season symptoms which are fairly constant and different from other diseases that commonly occur, while tuber-transmitted symptoms are extremely variable, are influenced by the environment under which they are grown, and may have little or no resemblance to current-season symptoms. Current-season symptoms known in Utah for several years as haywire are similar to haywire symptoms reported in Nebraska.

Economic importance of haywire in Utah

Although haywire (curly top) occurred in many seed fields in Utah, it did not become of economic importance until certified seed potatoes were grown extensively in the southwestern part of the state in the early forties. This disease has been one of the most prevalent diseases in certified seed potato fields in that part of the state.

The occurrence of the disease has been erratic from year to year and from field to field. The percentage of disease has frequently been higher on one side or corner of a field and has decreased as the distance from the edge of the field increased. Individual fields have exceeded disease tolerance for certification during the past sixteen years, but the most serious damage in the history of potato certification in Utah occurred during the 1958 season when large populations of beet leafhoppers moved from their desert breeding grounds to the cultivated farms. Fifty-eight percent of the potato acreage listed for certification in the southwestern part of the state representing 79 percent of the total state acreage exceeded the disease tolerance for certification. Disease readings as high as 38 percent were recorded.

Current season symptoms

Symptoms first appear at the apex or terminal growth of the plant. Symptoms may or may not appear on all stems of a plant at the same time and they may appear at any time during the development of the plant. Terminal growth is markedly reduced resulting in a stunting of the plant. Disease symptoms appear only on the parts of the plant that grow after infection occurs.

Leaflets of the terminal leaves are erect, stiff, rolled upward from the midrib and often are curled over the rachis (fig. 1). Green color development is inhibited and the growing point is light green to yellow. The cluster of small, rolled terminal leaflets with the pubescent underside of the leaflets exposed gives the terminal growth a greyish white appearance.

Leaves near the growing point are longer in proportion to width than healthy ones and basal leaflets are much more stunted than terminal leaflets (fig. 1). The margins of leaflets become light green to yellow and the affected leaflets may fade to a light green to yellow between the veins. Some leaflets become distorted and curve sideways, some may roll slightly upward and some downward. The marginal chlorotic tissue often is restricted more in growth than the central green tissue, causing a cupping or an upward or downward bulging of the leaflets (fig. 2 and 3). They have a thick, rough or wrinkled appearance as if gathered along the midrib. The midribs, and to a lesser extent the veins, often develop a rough, irregular, knotted appearance (fig. 5). Central green portions of the leaflet may continue to grow causing a bulging of the tissue between the veins. This gives the leaflets a rough appearance which on a miniature scale resembles mountainous terrains with the veins appearing as streams or ravines (fig. 4). The leaves of plants infected early in the season may lose all green coloration by late summer and what were earlier chlorotic margins may become necrotic.

All varieties of potatoes grown in Utah develop the characteristic curly top symptoms when naturally infected in the field with the curly top virus; however, the Kennebec variety is much more severely damaged than the Russet Burbank or White Rose varieties. The degree of marginal and interveinal yellowing, leaf distortion, and necrosis varies slightly with varieties. The thicker leaflets of the Kennebec variety tend to remain smoother and the marginal yellowing may be less pronounced as the leaflets fade to a light green or yellow color. The margins and tips of leaflets of red tuber varieties may develop a reddish or purplish color.

Plants that develop disease symptoms in the early stages of growth produce a few small, misshapen tubers. Large plants that develop symptoms later in the growing season may produce one or more marketable tubers in addition to small ones which are often mis-
The destructive nature of the alfalfa seed chalcid, *Bruchophagus roddi* Guss., has been recognized since the latter part of the nineteenth century. The lack of effective controls makes this insect a most important problem to alfalfa seed producers. This jet-black hymenopteran wasp, mistakenly called the "chalci-fly," destroys from 5 to 25 percent of the alfalfa seed in Utah each year. Damage as high as 85 percent of the seed has been reported. The female lays her egg in green seeds and the developing larva hollow out the seed thus destroying it. Much of this destruction goes unnoticed as damaged seed is commonly blown out in the trash during harvesting and cleaning operations.

Insecticides which might be used to control this pest have not been perfected but many are receiving considerable research attention in Utah and elsewhere. On the other hand, control by cultural methods was suggested by C. J. Sorenson of the Utah Station years ago, but success depends upon community effort which is not always obtainable.

The seasonal abundance of alfalfa seed chalcids has been determined by periodic sweepings of alfalfa plots with standard 15 inch diameter nets on the Evans Experimental Farm south of Logan, Utah. This farm is located outside of the alfalfa seed producing areas; however, the insect occurs in large numbers. The rare use of insecticides in the area may be a partial explanation for this situation. Chalcid infestation rates have been higher on this farm than in the seed producing section around Delta where the spraying of alfalfa seed fields is a common occurrence.

**Developmental cycles of alfalfa and the seed chalcid**

During a growing season alfalfa produces two sets of bloom in most areas of Utah. The first bloom starts about June 1 to 10 and is full by June 15 to 20 and then declines. If the field is not cut but has sufficient soil moisture, a shorter second growth will bloom in late July. If first crop hay is cut approximately June 10 and there is sufficient soil moisture, the second crop will begin to bloom about July 10 and be in full flower by July 20.

If second crop is cut for hay there will be a third bloom in September but this will be too late for chalcid infestation or seed production.

Chalcid populations are closely associated with the blooming habits of alfalfa. The first adult chalcids that appear in the spring come from seed infested the previous year. Such infested seed may come from nearby

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**SEASONAL ABUNDANCE OF THE ALFALFA SEED CHALCID**

**Figs. 1 - 3. Seasonal abundance of adult seed chalcids, 1959, 1960, 1961, Evans Experimental Farm, Logan, Utah**

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volunteer plants or from seed scattered on the ground. Adults are rarely found in an alfalfa field which is not in bloom and relatively few are found in the first bloom. However, this small population deposits eggs in many green seeds. These eggs become larvae in 3 to 4 days and change to pupae in an additional 8 to 10 days. The pupae emerge as adults 7 to 10 days later. Thus it takes approximately 3 weeks from egg to adult stage during the warm part of the season. Cycles are repeated as long as temperature and alfalfa bloom periods permit. Toward the end of the season as temperatures decrease, the cycle is not completed and most of the chalcids overwinter as larvae.

The seasonal abundance of adult alfalfa seed chalcids on the Evans Experimental Farm during 1959, 1960, and 1961 is shown in figs. 1, 2, and 3.

Seasonal and locational differences in chalcid numbers are exhibited in these figures with the 1961 season producing by far the greatest number. All seasons show a minor peak in numbers during the latter half of July and a major peak during late August.

The progressive changes in adult seed chalcid numbers shown in fig. 3 may be described as follows:

June 25 to July 11 — The relatively few adult chalcids (0 to 20 per 100 sweeps) probably came from plants infested the previous year. Many probably originated in the immediate vicinity; however, some may have blown in from other areas.

July 11 to August 6 — This mid-season peak in chalcids (20 to 400 to 150 per 100 sweeps) resulted from the first generation chalcids from the study and ad-

(Continued on page 28)
GRAZING STEEP MOUNTAIN SLOPES

Steep slopes not only receive slight use by livestock, but they constitute a source for sediment, rock, and debris and contribute to reduction in water quality.

Fig. 1. Cattle in experimental pastures on mountain slopes

Fig. 2. Animal movements and plot locations in pastures on 60 percent slopes

Fig. 4. Portraits of soil surfaces made it possible to measure small changes in distribution of litter

THE use of mountain slopes as a source of summer feed for livestock has been a common practice, so common in fact that many livestock producers assume that a summer range allotment includes every acre within its boundaries.

In recent years as land managing agencies have attempted to evaluate range and watershed resources under

D. L. GOODWIN

their jurisdiction, they have frequently observed that some mountain slopes not only receive slight use by livestock but they also constitute a source area for sediment, rock, and debris. These contribute, if not to flooding, then at least to reduction in water quality.

As a result of these observations, many mountain slopes have been or are being classified as non usable range. In conflict with this action are the observations of livestock people who see abundant "good" forage on mountain slopes being wasted by such decisions.

FARM AND HOME SCIENCE
\[ a = \text{plot location} \]
\[ x = \text{animal movements on 1st day} \]
\[ o = \text{"} \]
\[ 24 \text{ day} \]
\[ \cdot = \text{"} \]
\[ 3\text{rd day} \]

**Fig. 3. Animal movements and plot locations in pasture on 68 percent slope**

**Research to supply information**

Prompted by the conflict of interpretation of observations and by the need for criteria upon which to base a decision as to the exclusion or inclusion of a mountain slope as part of the range resource area, the Utah Station in cooperation with the Range Management Division of the Forest Service and the Intermountain Forest and Range Experiment Station activated a research program to determine the effects of grazing cattle on steep mountain slopes. The study is being conducted in Cowley Canyon and Herd Hollow on land either administered by the Forest Service or owned by Leland Peterson of Hyrum.

Four two-acre pastures have been established on slopes that have a gradient varying between 23 and 68 percent. Vegetation within the pastures is typical of summer range used by cattle. Serviceberry, chokecherry, sagebrush, wheatgrass, bluegrass, fescue, and balsamroot are some of the plants present in each pasture (Fig. 1).

Within each pasture, measurements of crown cover by species, infiltration rate, soil density, soil movement, and litter cover are being made. All measurements except infiltration and soil density are made before and after each grazing period. Infiltration and soil density are determined each spring. Behavior of cattle while in each pasture is also recorded.

**Behavior of cattle on steep slopes**

The behavior of the cattle has been extremely interesting. Apparently the action of the animals is influenced by their recent experiences, by the proximity of other cattle, and by the gradient of the slope. Animals with a previous experience in enclosed pastures were less nervous, did less fence searching, and covered pastures more uniformly than did animals from the open range. The former appeared to be less concerned about the proximity of other cattle than did the latter.

When cattle that had been previously enclosed in small pastures were placed in a pasture with a slope of 60 percent, they immediately moved to the top of the pasture where they stayed most of the time. Animals from the range herd when placed in a pasture on a 68 percent slope stayed at the bottom of the pasture as near the range herd as they could until the range herd moved away (Figs. 2 and 3).

The influence of slope upon cattle movement was most clearly demonstrated in a single pasture in which gradients of 23, 33, and 56 percent were included. In this pasture, most activity occurred on the two slopes with least gradient. Cattle moved rather freely and uniformly covered the area of pasture with a slope of 45 percent.

**Movement of cattle displaces soil**

As the cattle grazed the pastures, soil was loosened and displaced. The maximum and minimum vertical displacement in each pasture is presented in Table 1.

Extent of soil displacement appears to be related to slope, although soil characteristics and condition of vegetation probably exert modifying influences. Changes in position of soil (Continued on page 28)
Radiation preservation of fruits

To preserve foods as nearly as possible in their natural state has long been the aim of man. Each method of preservation has obvious advantages, but no one method has wholly accomplished this aim. So we are always on the lookout for newer and better methods of preservation. Fruits and vegetables, which are especially perishable, make up a large part of human diet. At present, 25 to 50 percent of these products spoil before they can be consumed. This has led to the exploration of preservation by the irradiation given off by atomic reactors.

Preservation by irradiation

Research in the use of atomic energy for food preservation began on a large scale in 1953. Because of the many complex problems associated with radiation sterilization, researchers have found that the use of low doses for pasteurization is the most practical method. There are several factors responsible for effective radiation preservation: first, radiation dose; second, selection of variety and maturity of product; third, pre-irradiation treatment; and fourth, packaging. The radiation dose required depends on the number and kind of microbial organisms present on the product before irradiation. Without loss of quality, most fruits and vegetables can be irradiated at a medium level (2 to 3 x 10^5 rads) to extend the shelf life from two to six weeks at refrigeration temperatures. (A rad is a measure of radiation absorbed and is equal to 100 ergs per gram of material irradiated.)

Effect of irradiation on acceptability

At Utah State we have studied the effects of gamma radiation on the acceptability and refrigerated life of different varieties of strawberries and sweet cherries. Strawberry varieties tested were Kasuga, Lindalicious, Sparkle, Marshall, Robinson, and Shasta. Bing, Lambert, Napoleon, and Windsor sweet cherries were the varieties irradiated. Results showed an increase in shelf-life at refrigeration temperature (40 degrees F) with increase in radiation dosage; however, the acceptability of the product declined progressively as the storage period was extended (fig. 1). A 2 x 10^5 rads dose was found to be the optimal dose of...
radiation for the preservation of strawberries; the 30x10^5 rads dose for the preservation of sweet cherries. Cherries were more suitable for radiation than strawberries because of their firmness. Irradiated strawberries had a shelf life of 30 days and that of cherries 57 days when stored at 40°F.

Firmness was the reason that Kasuga and Sparkle strawberries and Bing cherries were the best varieties for irradiation. Maturity of the crop is also important. The firm-ripe stage is the best for radiation preservation. Immature or green products when irradiated do not ripen evenly. Overmature crops become soft and are prone to fungal infestation when irradiated.

Details on how the tests were made

For the tests at USU only top quality produce was selected. After sorting, the fruit was placed in perforated no. 10 cans containing no. 10 kraft paper bags and sealed. Cardboard dividers were used in the cans to prevent bruising of the fruit during travel. The fruit was transported in a refrigerator unit held at 40 degrees F. to the Material Testing Station near Arco, Idaho. It was irradiated under 20 feet of water in a swimming pool type reactor with gamma rays from spent fuel elements. During the process of irradiation the fruits were aerated to remove the gases given off (fig. 2).

The fruit was checked for radioactivity before it left the irradiation center. No radioactivity has been found in any of the materials irradiated in our tests.

Following irradiation, the cans of fruit were stored at 40 degrees until opened. Samples were examined carefully to determine color, texture, odor, and other physical characteristics. All moldy fruits were counted and discarded and the percent of edible fruit calculated. Quality of the irradiated fruits was compared with that of non-irradiated fruits by a panel of 10 judges.
Many rural communities are withering on the vine. Homes are boarded up; there are fewer people and fewer opportunities. With loss of opportunity, the young people leave. This loss of future leaders is the real tragedy of many small communities. Some communities have disappeared entirely. Ghost towns — a curious phenomenon of the "sizzling sixties."

Yes, the face of rural America is changing. Changes in agriculture, industry, and transportation seem to be spelling the end to Thomas Jefferson’s dream of a pleasant American countryside with scattered rural populations. For some, the change is inevitable. For others, there are unrealized opportunities that offer the hope of survival and healthy growth.

Tourism is one such opportunity. Most rural communities have a one or two dimensional economy, based on agriculture or industry. Tourism can add a third dimension, to bolster a faltering economy and help check a population decline.

Consider for a moment the value of tourism. According to the U. S. Department of Commerce, 24 tourists

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stopping daily in a community is the equivalent of an industry having an annual payroll of 100 thousand dollars. To states like Utah, with countless tourists stopping or passing through communities, this is extremely important. Tourists annually spend 22 billion dollars in the United States. For Utah, the figure is 100 million.

**Wildlife — a built-in attraction**

This is where wildlife fits in - fishing and hunting are forms of tourism. Wildlife is a built-in attraction, a community resource. Fishermen and hunters spend almost 60 million dollars every year in Utah. Of this amount, 15 million is used for transportation, over 9 million for meals and lodging, and more than 32 million for equipment and supplies.

On the surface, sportsmen’s visits to communities or downtown businesses have little importance to the landowner. Looking a little deeper, the visits are of significance to everyone, including the farmer. For example, purchases by sportsmen increase sales of local potato, beef, and other farm products. According to studies by the Knoxville Tourist Bureau, Knoxville tourists annually eat a half million eggs, almost three million pounds of fresh meat, over two million pounds of fresh vegetables, a million and a half pounds of fresh fruits, and a quarter of a million pounds of butter. Tourist expenditures also ease the tax burden. In reality tourist visits, including sportsmen visits, are vital to everyone.

Obviously fishing and hunting have made a considerable impact on Utah’s economy. This has been virtually without planning. Few, if any, communities have deliberately planned to realize the full potential of sportsmen visits. With planning, how substantial might these visits become?

**Awakening Utah communities**

Several Utah communities are awakening to the impact of wildlife resources. Beaver has a community development project actively concerned with fishing and hunting. The deer hunt is important to Beaver’s economy. Studies are under way to find ways and means of increasing hunter expenditures by increasing attractions and services.

Panguitch is an outstanding example of a shifting economy. In a brief period this small livestock and agricultural community has become a tourist center and a headquarters for fishermen and hunters. There are new motels, restaurants, and other facilities and you can sense the hustle-bustle of vigorous new growth.

A fine example of a community taking advantage of a latent resource is the now popular Green River boat trips. The simple act of providing services and hospitality so that water enthusiasts can “float the Green” annually causes an influx of visitors from several western states, giving the local economy a much-needed shot in the arm.

The elk herd at the Blacksmith Fork Ranch in Cache County annually attracts over 18,000 visitors. Here is a tremendous opportunity to provide services to these winter visitors anxious to buy or take pictures, enjoy a hot meal, or leave with a momento — and to stimulate the economy during a slack period.

A community must be alert to the opportunity and willing to plan and serve. It must know how many hunters and fisherman visits are made to or through the community. It must provide adequate facilities and services: attractive restaurants (open before and after fishing and hunting hours); adequate motel facilities; places where sportsmen can obtain equipment and supplies — tackle, ammunition, white gas, ice, groceries, and licenses after hours. And, most imperative, these facilities should be readily available.

There are real opportunities to provide special services and create new businesses based on sportsmen visits. Hide processing, meat processing (including freezing and shipping); and the preparation of specialty items such as deer salami, the sale of artwork, photographs, and momentos, are but

*(Continued in page 30)*
RECLAMATION OF POORLY DRAINED SOILS

Cache irrigation and drainage farm is the center of irrigation and drainage research activities

A. ALVIN BISHOP

Large drain constructed

In June of 1958, a large open drain was constructed to serve as an outlet for future experimental drains and to drain off surface water which usually flooded the farm. With the completion of this drain the surface waters were controlled and an immediate influence was observed on the water table. Where, under the prevailing conditions, the water had normally been at or near the soil surface, it had dropped to as much as 10 feet below the surface by December of 1958. The falling water table was accomplished by the slight natural subsurface drainage and by the consumptive use of the vegetation growing on the soil surface. By removing the source of supply to the soil through control of the surface water this was possible. With a heavy application of irrigation water, the soil would again become saturated and a rise in water table would result, thus indicating the close relation between the surface ir-
Collecting drainage water from a mole drain

Mole drains installed

In 1959, a system of mole drains was installed to determine the suitability of this type of drainage. These drains are constructed by drawing a moling device (somewhat similar to a subsoiler) through the soil. This leaves a cavity or tube in the soil after it passes (mole hole). Part of the moles were installed with a thin plastic liner whereas others were left unlined. Mole spacings of 20, 30, and 40 feet were used. The depth of moles usually varies from 15 to 36 inches. The depth of those installed at the Cache Irrigation and Drainage Farm averaged 22 inches for those lined with plastic and 28 inches for the unlined moles. The difference in depth was due primarily to the difference in power required when the plastic lining device was used. At the time the moles were installed the water table was below 4 feet, the soil was dry, and had a tendency to crumble resulting in greater power requirements and a less stable mole.

Soil surveys showed the farm to have a salinity problem over about a third of the area, and the moles were used for drainage and leaching experiments. Both the lined and unlined moles were effective in removing water and salt from the soil during the initial period of leaching and continuous flooding.

Leaching reduced the salt content of the soil by about 2500 ppm and after the initial flooding, the drainage water had about the same salt content as the water used for flooding.

The unlined moles failed after the initial flooding period and were ineffective except for the first trials. On the other hand, those lined with plastic were still operating nicely after several flooding cycles and the freezing conditions of one winter.

Although the mole drainage experiments are still in progress, the pre-

Variation of artesian pressure and water table fluctuations during the time from 1957 to 1959, piezometer location B-5

(Continued on page 30)
Retailing
Christmas trees

FRANK W. KEARNS
WILLIAM G. POUlsen

Pinyon pine was the most popular species of Christmas trees in Utah during both 1960 and 1961, although it declined somewhat in percentage in 1961 (table 1). Montana and Utah supplied about 72 percent of the marketed trees in 1960 and over 85 percent of them in 1961 (table 2). Utah's share in 1961 increased 6 percent over that of 1960, predominantly in the pinyon and subalpine fir species. The supply of Nevada and Idaho pinyon decreased in 1961 from the previous years. Early snows in the 1961 cutting season probably was a major factor in this decrease. On the other hand, the majority of pinyon trees cut in Utah are from the southern part of the state where cutters were not faced so much with the problem of snow.

Montana has traditionally been the largest supplier of Douglas-fir trees for Utah.

Size and quality of trees marketed

Size preferences for Christmas trees vary tremendously. Schools, businesses, and civic organizations frequently favor trees which are too large for homes. However, since the great majority of trees are intended for home display, the maximum height is usually around 8 feet. Dealers say that a tree between 5 and 7 feet is in the preferred size range.

Pinyon pine, which has an extremely slow growth for a Christmas tree species, tends to be harvested at a smaller size than most of the other species. Form characteristics also influence the height at which trees are harvested. For instance, subalpine fir and white fir are the predominant species of trees cut at the 9 to 11 feet heights, for their traditional Christmas tree form is enhanced in the taller height classes.

Describing Christmas tree quality is difficult, since no established grading system is in use. A system of grading has been proposed for Douglas-fir trees by the U.S. Forest Service. The system recognizes four grades — premium, standard, utility, cull — based on the characteristics of density, balance, taper, deformity, and foliage, viewed from several angles of the tree.

Using this grading rule, some 3,000 trees of all species in metropolitan Utah retail yards were graded as part of the 1960 study. Twelve percent of the trees were classed as premium, 37 percent standard, 40 percent utility, and 11 percent cull. This evidence shows that good quality trees are hard to get.

Interviews with dealers in 1961 indicated that they felt that the quality of pinyon pine was declining over the years. Douglas-fir quality increased over that of 1960, and the quality of the other tree species remained fairly constant.

Quality of trees probably influences wastage more than any other characteristic for it is normally the cull trees than go unsold. Of the estimated 214,000 trees on the retail market in Utah in 1960, approximately 12 percent were unsold and burned at the end.

Table 1. Species of Christmas trees in Utah retail yards, 1960-61

<table>
<thead>
<tr>
<th>Species</th>
<th>1960</th>
<th>1961</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinyon pine</td>
<td>43.7</td>
<td>38.2</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>35.4</td>
<td>35.0</td>
</tr>
<tr>
<td>Subalpine fir</td>
<td>4.4</td>
<td>10.7</td>
</tr>
<tr>
<td>White fir</td>
<td>7.2</td>
<td>2.1</td>
</tr>
<tr>
<td>Spruce</td>
<td>5.4</td>
<td>9.1</td>
</tr>
<tr>
<td>Ponderosa pine</td>
<td>2.0</td>
<td>2.1</td>
</tr>
<tr>
<td>Lodgepole pine</td>
<td>1.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Others</td>
<td>.1</td>
<td>.1</td>
</tr>
</tbody>
</table>

Table 2. Source of Utah's Christmas trees, 1960-61

<table>
<thead>
<tr>
<th>State</th>
<th>1960</th>
<th>1961</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montana</td>
<td>38.8</td>
<td>45.8</td>
</tr>
<tr>
<td>Utah</td>
<td>33.0</td>
<td>39.5</td>
</tr>
<tr>
<td>Nevada</td>
<td>15.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Idaho</td>
<td>8.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Colorado</td>
<td>2.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Others</td>
<td>1.9</td>
<td>7.3</td>
</tr>
</tbody>
</table>
of the season. Over 75 percent of this surplus was low quality Montana Douglas-fir trees. In 1961 the total supply of trees was reduced by an estimated 9 percent, the quality of the Douglas fir was higher, and there were few surplus trees. In fact, many retail lots were sold out of trees a week or more before Christmas day.

Retail establishments

Any vacant lot in a city becomes a potential retail Christmas tree yard as the Christmas season approaches. A sample of the retail establishments in the metropolitan Salt Lake City and Ogden areas in 1960 provided the following classification:

<table>
<thead>
<tr>
<th>Establishment</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacant lots</td>
<td>37</td>
</tr>
<tr>
<td>Service stations</td>
<td>16</td>
</tr>
</tbody>
</table>

Used car lots .......... 10
Plant nurseries ......... 9
Food stores ............. 8
Fruit stands ............. 8
Other established
businesses ............. 12
(included Dairy Queens, Army surplus stores, motels, sporting goods stores, and farm and garden stores)

Far more trees were sold from retail yards set up on vacant lots than from lots belonging to established businesses. However, a few established businesses are commonly linked with Christmas tree retailing. The most prominent are service stations, used car lots, nurseries, and food stores. All of these have a few advantages in common: space for the placing of trees on display, customers who come for other items (and who may pick a tree incidentally); personnel and facilities to take care of tree sales at little or no additional sales cost.

Most of the lots in the metropolitan area were quite large, generally in the 101-500 tree class. There were several that sold over 1000 trees and at least two that sold close to 10,000 trees each. The biggest yards were usually located on main city streets near major intersections.

Merchandising features other than price played a big part in Christmas tree sales. Parking space was an important factor. Yards that had good displays that could be seen by passing motorists had an advantage in making sales. Front displays require good specimen trees, each of which is fully visible. As a result practically all dealers provided a wooden base already tacked on the tree so that the trees could be

(Continued on page 31)
Coming competition of fresh and sterile concentrated milk

They have the potential of creating many changes within the dairy industry of Utah and the nation.

RONDO A. CHRISTENSEN
RICHARD S. MAGLEBY

FRESH and sterile concentrated milk are now sold commercially in the United States. Neither is on the market yet in Utah. Since both products can be substituted for fresh whole milk when reconstituted with water, they have the potential of creating many changes within the dairy industry of Utah and the nation.

Fresh concentrated milk is reduced to one-third the volume of whole milk, is made from milk eligible for fluid consumption, requires refrigeration, and is distributed in a manner similar to whole milk. Because of its reduced weight, fresh concentrated milk can be shipped about three times as far as whole milk for the same cost.

Sterile concentrated milk is also concentrated three to one, but can be made from manufacturing grade milk, has a shelf life of several months without refrigeration, and will probably be distributed through the same market channels as evaporated milk. Much of the cooked flavor found in evaporated milk has been eliminated from sterile concentrated milk through new processing techniques. Compared with whole milk, sterile concentrate has lower product costs, lower transportation costs, and because of its method of distribution, may be able to sidetrack many of the trade barriers that presently restrict the distribution of whole milk.

Fresh concentrated milk has generally had to be sold for 2 to 3 cents less per quart equivalent than fresh whole milk to achieve sales of any consequence. A larger discount may be necessary to encourage a substantial amount of substitution of fresh concentrate for whole milk. Sterile concentrate will probably have to be discounted as much or more than fresh concentrate in order to compete seriously for sales with fresh whole milk. Sales of concentrated milk will probably be greater in areas where retail prices of whole milk are the highest.

The probable impact of fresh and sterile concentrated milk on the dairy industry is still a matter of speculation. There will probably be little effect if concentrated milk fails to attain general consumer acceptance and break down trade barriers. On the other hand, if it does, we can probably expect to see a narrowing of the spread between prices paid producers for milk used for manufactured products and milk used for fluid consumption, a narrowing of producer to retail price spreads between milk surplus and milk deficit areas, and extension of marketing areas.

Can Utah producers expand markets?

The question facing Utah producers and distributors is whether through the use of concentrated milk they can expand markets, and whether other surplus areas will expand their markets into Utah at a competitive advantage. To help answer these problems, costs were estimated at which distributors from a number of surplus milk areas could place whole milk and fresh and sterile concentrated milk on selected western markets. The margin between these estimated costs and the retail price of whole milk on each market was also determined. Transportation costs were obtained from rail and trucking firms. Other costs were derived or estimated from secondary sources.

Results of this study indicate that there would be little, if any, incentive at the present time for Utah handlers to process and distribute fresh or sterile concentrated milk if fresh concentrate has to be sold for at least 3 cents and sterile concentrate for at least 5 cents less than whole milk per quart equivalent to achieve sales of consequence. Profit margins would be as large or larger on sales of fresh whole milk on most western markets. Although there would be some savings in transportation and cartoning costs in making and selling fresh and sterile concentrated milk, these reduced costs would be more than offset by extra processing costs and the discount below the price of whole milk at which concentrated milk would probably have to be sold.

DR. RONDO A. CHRISTENSEN is assistant professor of agricultural economics. RICHARD S. MAGLEBY is a graduate student in the same department.

FARM AND HOME SCIENCE
With smaller or no discounts at all, Utah processors would probably find fresh and sterile concentrated milk desirable products to handle, particularly on the more distant markets.

With cost relations similar to those in 1959, fresh and sterile concentrated milk could be made from Utah milk and be distributed in Utah as cheaply as they could be made and shipped in from surplus milk areas such as the North Central States. Before turning to western markets these surplus areas will more likely develop sales of concentrated milk in the higher priced, milk deficit areas of the southern and eastern parts of the country.

Although it does not seem economically desirable now, fresh and sterile concentrated milk will probably be sold in Utah some day. The incentive for Utah processors to make and distribute them will increase as demand increases and as the discount at which they sell below the price of whole milk decreases. The incentive for other surplus areas to sell concentrated milk on the Utah market will increase as supply, demand, and price relations change making Utah a higher priced market in relation to other markets.

Cost of placing milk on western markets

Estimated costs include dealers' buying price for milk, processing, packaging, transportation, local delivery, and retail margin, but do not include selling costs and profit. Firms of equal size were assumed for all areas. The two costs that vary most depending on origin of milk are dealers' buying price and transportation. Other costs would be similar on the same market regardless of origin of milk.

Estimated costs indicate that with cost relations as they existed in 1959 a Logan supplier could place packaged whole milk on all western markets studied for less than any other supplier studied, except in Phoenix and Los Angeles, where a local processor could do so for less cost (table 1). Wichita, Kansas, and Madison, Wisconsin, suppliers would find no advantage cost-wise, except possibly on the Denver market. A Logan processor would have an advantage over other western suppliers on the Salt Lake City market mainly because of a lower dealers' buying price for milk eligible for fluid use, and over suppliers in the North

Table 1. Estimated cost* of placing packaged whole milk, fresh concentrate, and sterile concentrate on selected western markets from selected origins, 1959

<table>
<thead>
<tr>
<th>Origin of milk</th>
<th>Whole milk</th>
<th>Local</th>
<th>Logan</th>
<th>Salt Lake City</th>
<th>Boise</th>
<th>Wichita</th>
<th>Madison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt Lake City</td>
<td>20.5</td>
<td>18.4</td>
<td>20.5</td>
<td>20.3</td>
<td>22.5</td>
<td>22.7</td>
<td></td>
</tr>
<tr>
<td>Denver</td>
<td>21.6</td>
<td>20.2</td>
<td>22.2</td>
<td>22.0</td>
<td>20.8</td>
<td>21.0</td>
<td></td>
</tr>
<tr>
<td>Phoenix</td>
<td>20.6</td>
<td>20.9</td>
<td>22.9</td>
<td>22.8</td>
<td>22.6</td>
<td>23.6</td>
<td></td>
</tr>
<tr>
<td>Albuquerque</td>
<td>22.6</td>
<td>21.5</td>
<td>23.6</td>
<td>23.6</td>
<td>22.3</td>
<td>23.2</td>
<td></td>
</tr>
<tr>
<td>Las Vegas</td>
<td>21.7</td>
<td>20.4</td>
<td>22.5</td>
<td>21.8</td>
<td>23.7</td>
<td>24.7</td>
<td></td>
</tr>
<tr>
<td>Los Angeles</td>
<td>19.1</td>
<td>19.5</td>
<td>21.5</td>
<td>20.6</td>
<td>22.4</td>
<td>23.5</td>
<td></td>
</tr>
</tbody>
</table>

*Not including selling costs and profit.

Table 2. Margin between retail price of whole milk and estimated cost* of packaged whole milk and fresh and sterile concentrated milk from Logan and Salt Lake City, selected markets, 1959

<table>
<thead>
<tr>
<th>Market</th>
<th>From Logan</th>
<th>From Salt Lake City</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whole</td>
<td>Fresh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logan</td>
<td>3.3</td>
<td>4.0</td>
</tr>
<tr>
<td>Salt Lake City</td>
<td>4.6</td>
<td>5.4</td>
</tr>
<tr>
<td>Denver</td>
<td>3.3</td>
<td>5.3</td>
</tr>
<tr>
<td>Phoenix</td>
<td>3.2</td>
<td>4.7</td>
</tr>
<tr>
<td>Albuquerque</td>
<td>5.0</td>
<td>7.2</td>
</tr>
<tr>
<td>Las Vegas</td>
<td>4.6</td>
<td>6.4</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>2.2</td>
<td>4.7</td>
</tr>
</tbody>
</table>

*Not including selling costs and profit

Table 3. Margin between the retail price of whole milk and estimated cost* of packaged whole milk and concentrated milk from Boise, Wichita, and Madison on local and the Salt Lake City markets, 1959

<table>
<thead>
<tr>
<th>Product</th>
<th>Boise</th>
<th>Wichita</th>
<th>Madison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local</td>
<td>S.L.C.</td>
<td>Local</td>
</tr>
<tr>
<td>Whole milk</td>
<td>3.9</td>
<td>2.7</td>
<td>2.4</td>
</tr>
<tr>
<td>Fresh concentrate</td>
<td>4.5</td>
<td>4.1</td>
<td>3.0</td>
</tr>
<tr>
<td>Sterile concentrate</td>
<td>7.8</td>
<td>7.4</td>
<td>6.6</td>
</tr>
</tbody>
</table>

*Not including selling costs and profit

FOR MARCH 1962
Central Region because of nearness to western markets.

Fresh concentrated milk could be placed on all markets studied at least cost by a Logan supplier. A Madison supplier would be the second most competitive and a Boise supplier third.

A Logan processor could market sterile concentrated milk on western markets at least cost; a Boise supplier would be second lowest. Wichita, Madison, Logan, and Boise processors buy milk for about the same price but Logan and Boise processors have lower transportation costs.

Margins for profit and selling expenses

Processors will not necessarily expand sales of whole milk or of concentrated milk on markets where they have a competitive cost advantage. Instead, they will tend to increase sales of the products on the markets where profit margins are greatest. In addition, limited supplies of milk will prevent infinite sales expansion by suppliers in some areas; trade barriers will prevent unlimited expansion by others.

The margin between the retail price of packaged whole milk on selected markets and the estimated cost at which whole milk and fresh and sterile concentrated milk could be placed on them by Logan and Salt Lake City suppliers are shown in table 2. The margin on whole milk is what is left for selling costs and profit. From the margins on fresh and sterile concentrated milk must come the discount at which they will be sold below the price of whole milk, plus selling costs and profit.

A Logan processor could market packaged whole milk in Salt Lake City, Denver, Phoenix, Albuquerque, and Las Vegas and have about as much or more margin for selling costs and profits as on milk sold in Logan. Salt Lake City processors would have as much or more margin for selling costs and profit on milk sold in Albuquerque and Las Vegas as on milk sold in Salt Lake City. Because of either higher costs or lower retail prices for packaged milk, margins on the other markets would be lower than on milk sold in Salt Lake City.

If fresh concentrate were sold for 3 cents per quart equivalent less than whole milk both Logan and Salt Lake City distributors would make more margin for selling costs and profits selling whole milk on all western markets considered. Boise, Witchita, and Madison distributors would all realize larger margins selling whole milk on their local markets than they would selling fresh concentrate in Salt Lake City (table 3).

If sterile concentrate were sold for 5 cents per quart equivalent less than whole milk, larger margins could also be made by Logan and Salt Lake City processors by selling whole milk on most western markets. With a discount of 3 cents or less sterile concentrate would be more profitable, particularly on the more distant markets.

With a 5 cent discount, Boise, Wichita, and Madison distributors would realize larger margins on local sales of whole milk than on sales of sterile concentrate on the Salt Lake City market. With a discount of 3 cents the latter would be more profitable.

MISSION FOR THE FUTURE

(Continued from page 3)

the Land-Grant Universities, commemorating the centennial of teaching and research in the Land-Grant system. In recognition of the event the Experiment Station is carefully reviewing its program to anticipate how it can best serve the interests of this area in the years ahead.

Ignorance is now recognized

Although much has been learned, still the enlightened area of knowledge is only a small island in a vast ocean of ignorance. The strength of the present position is that ignorance is recognized and man is determined to do something about it. Science is the procedure by which ignorance of the natural world is replaced with understanding. Research is the vehicle of science that carries it forward into unexplored territory.

Advancements from research in the past hundred years have exceeded the most soaring dreams of man. Yet nearly all of this advance has come in the last 50 years and the rate of advance is increasing. As a result of past accomplishments, man has accumulated the wealth that enables him to devote even more time to research, education, and technological advancement.

Mission for the future

Some of the patterns for the future of research in the Utah Agricultural Experiment Station seem clear. The Station is commissioned to conduct research needed to conserve and make the wisest use of our land and water resources. In spite of all other advances, land and water will likely continue to support the roots of our civilization. The crescendo of rising prices of private land and the din of controversy over use of public lands suggest that many people take seriously the recent title of "standing room only." The consequences of alternative public policies on land management and use must be anticipated and used as a guide. The inventory and research on our land resources and how to save and make better use of them must go forward.

Our limited water supply in Utah is now a major topic of concern and this concern will increase. We must find better ways to store, transport, and reuse the supplies we have. But our most substantial hope for the future lies in learning how to conserve and claim for better use a portion of the 90 percent of our state water now being lost by evaporation and transpiration.

Even the air seems to be on the verge of becoming a limiting resource, at least in some areas. Home heating, automobiles, waste disposal, and industry are all pouring vast quantities of materials into the air. Indeed, without concentrated attention to this problem there is a strong question as to
whether man is not dangerously close to poisoning himself as well as much of the rest of nature. Air pollution has been a major research area of the Station over the past ten years and these studies must continue on an even broader base.

Closely akin to air, water, and land are range, forest, and wildlife resources. The areas concerned with these are also major sources of water. Trees will furnish an increasing supply of building materials and cellulose and other ingredients for industry. These wildlands are the areas man is looking to for recreation, for a place to get away from the bustling world and rejuvenate his spirits. These are the grazing lands for millions of sheep and cattle. With the increasing interest and public pressure for varied uses of these lands, policies and management decisions must be made with great care. Public laws now before Congress indicate the need for an enhanced research program on how to manage these resources most wisely to bring maximum satisfaction for man’s varied wants.

To date a disproportionate amount of research time has been required in finding partial answers to pressing problems concerning crop plants and animals. As yields increase toward their maximum and individual plants are produced in greater concentration, these problems become more intense and difficult. In Utah we have known in a real sense the battle for survival between man and insects. What is not known is that the battle is not won. Insects and diseases took the annual proportionate toll of food crops that they did fifty years ago, the nation would be faced with famine. New insecticides control specific insects, but the versatility of nature is such that insects develop immunity to a new insecticide in about five years. Almost as soon as plant breeders develop a wheat variety with resistance to known races of smut organisms, a new race appears. Only a persistent and intensive research program can insure that man will stay ahead in this battle with the obscure and negative forces of nature.

Yet the very nature of the fight against ignorance (for that is the basic purpose of research) indicates there is a better solution to the problem than the continual development of new chemicals to replace those that have or will become ineffective. A better solution lies in more basic research to gain an understanding of the complete spectrum of life. Scientists have found that at the cellular level there are many similar processes in plants and animals. There are also differences and there is reason to believe that there are basic weaknesses and strengths in the physiology and life cycle of all forms of life that man can use to his advantage. Scientists are turning to nature with such questions as why do cells grow? Why do they divide? Why does one cell become muscle, another nerve, and a third bone? Why do cells lose vitality and die? What is the nature of the gene that controls inheritance?

Scientists at Utah State University are probing the secrets of life. We have a major center to study the nature and actions of virus particles. This has attracted international attention for its new findings about the composition and structure of virus. Other studies are devoted to the nature of enzyme action. Since enzymes are the tools by which all organisms obtain energy and produce tissues these studies are helping to unravel life’s secrets. Our geneticists are not only developing new and improved plants and animals, they are also studying the nature and mechanism of the processes of inheritance.

In line with the need for research devoted to immediate and long-term objectives, the work of the Utah Station is organized to fulfill both functions. In some cases workers or groups of workers concentrate on special studies. In all cases, even though the purpose may be an immediate practical problem, the researchers attempt to probe deep — to find the why and the how as well as the what, the where, and the when of events.

Greater attention must be focused on man, his nutrition and physiology. Perhaps of even greater importance, we need to find better ways to live together. Plans are going forward for increased research on the problems of aging as well as on those of youth. There are studies adapting food and nutritional habits to bodily changes with age and on the social and mental adjustments that come with reduced physical vigor.

Utah has special economic and social problems associated with changes in agricultural practices and with the concentration of industry and job opportunities in limited parts of the state. Can communities with declining populations find new opportunities for employment? If not, how can adjustments be made to support government, schools, roads, public utilities, and other facilities deemed necessary to modern life. Research teams are needed to develop factual information that can help declining rural areas adjust toward a better future.

With its roots deep in a hundred years of research history in Utah, the Agricultural Experiment Station with a staff of about a hundred professionally trained personnel, skilled in the techniques of research, is going forward with a program that will help insure a better future for all.

Timing of insecticides

Dimethoate applied before bud formation on sugar beets controlled lygus bugs feeding on the buds, blossoms, and seeds later on. Germination of seed from these plants was excellent. This timing of insecticide applications may prove valuable on other crops as well.

Control of boxelder bugs

Three chemicals have proved of considerable value in the control of boxelder bugs. Dieldrin is effective at low rates and has a long residual action; Diazinon is effective at low rates but has short residual action; Lindane gives the quickest kill.
changes in the permanent teeth, which range from slight white striations to the development of chalky areas in the enamel. Continued consumption of excessive amounts leads to brown discolorations, pitting, and marked wear of the teeth. Adult animals receiving excessive amounts for long periods develop symptoms of chronic fluorosis. Bones and joints become enlarged, and extra bone growth may develop in different parts of the skeleton. Stiffness and lameness may occur, and secondary symptoms such as decreased milk production and rough coat often appear.

No harmful effects result when small amounts of fluorides are consumed, either in food or in drinking water.

Effects on plant life

The evidence gathered on the harmful effects of air pollutants on plants has accumulated over an extended period of time. Injured plants have been observed immediately adjacent to factories which released toxicants into the air as byproducts of their operations. Studies made under controlled conditions have shown which pollutants were responsible for specific plant symptoms, and additional studies have revealed methods of diminishing the amounts of these pollutants released into the atmosphere. Since some species of plants are much more sensitive to toxic substances in the air than are others, these plants can be used as indicators during the growing season to tell whether there have been significant amounts of a toxicant in the air.

Three substances which have caused injury in Utah in the past are sulfur dioxide, fluorides, and smoke containing chlorine. In deciduous trees and shrubs, the most common symptom of sulfur dioxide injury is the appearance of yellowish-brown to dark-brown dead areas between the veins of the leaves (fig. 1), with the tissues next to the veins remaining green. Defoliation varies with the plant species and the severity of the injury. Fluoride injury to sensitive plants is shown by the death of tissues at leaf margin (fig. 2). Injury from chlorine was seen in limited areas of Utah a few years ago when a branch of the Armed Services destroyed some materials by burning on the salt flats west of Ogden. The smoke, instead of being dispersed in non-lethal amounts in the atmosphere, stayed close to the ground and severely damaged fruit and foliage of trees along the foothills in Box Elder County. Marginal and interior areas of leaves were killed (fig. 3) and rapid defoliation followed.

Similar symptoms can result from other causes, so one should examine all possible evidence before concluding that a given symptom was caused by a specific toxic air pollutant. It has also been suggested that economically important hidden damage occurs when the toxic gases are present in such small amounts that neither defoliation nor leaf spotting occurs. This is yet to be determined, but present evidence fails to support such a suggestion.

An additional "air pollutant" of recent years, but one which may not be thought of as being in this category, is 2,4-D. Lawns are sprayed by home gardeners to destroy weeds, and most counties have an active program for control of weeds along roadsides by spraying. The fumes of 2,4-D are potent, and minute traces may cause plants several hundred feet away to display leaves curled or fernlike or with grotesque forms (fig. 4).

Controls

In the past, injury to both plants and animals has occurred near phosphate plants, smelters, brick factories, aluminum and steel mills, and other such industrial establishments where large volumes of pollutants were released into the air as byproducts of the manufacturing process. Many of these industrial organizations have now installed equipment to reduce the air pollutants. Research which will make it possible to remove more of the pollutants resulting from industrial processes is being continued.

Utah Agricultural Experiment Station workers are continuing cooperative investigations on these various sources of air pollution.

Other sources of air pollution

Municipalities themselves often are responsible for air contamination. Residents of several cities in Utah are uncomfortably aware of the burning carried on at the city dump, with the pall of smoke which envelopes everything nearby on those days when the smoke clings to the ground.

Burning of garbage in cities is an extensive source of air pollution. Where laws have been passed prohibiting this burning, a marked improvement in the air has followed.

Probably the greatest source of air pollution today is the automobile (fig. 5). Most of America moves on wheels and each automobile releases some air pollutants into the atmosphere. According to the research director of the Los Angeles Air Pollution Control District, 1,000 automobiles operating in an urban community release into the air each day 3.2 tons of carbon monoxide, 400 to 800 pounds of organic vapors, and 300 pounds of nitrous oxides, plus smaller amounts of other chemicals. It is well known that carbon monoxide is extremely harmful to humans in closed garages; however, it rarely becomes concentrated enough in the outside air to be hazardous. On the other hand, organic vapors and nitrous oxides react in the light to produce ozone and other oxidants which are toxic to vegetation. In recent years, ozone injury to plants has been recognized in a number of areas. As a rule the injury and the losses have been greater near urban centers and along highways where large numbers of motor vehicles are operated.
Emission of air pollutants from automobiles can be reduced by proper engine care and by the installation of pollution-abating devices. Some states may require the installation of such devices on all automobiles within a short time, and Secretary of Health, Education, and Welfare Abraham A. Ribicoff, has recommended to the automotive industry that these devices be installed on all new 1964 cars.

Surveys have been conducted in Utah to determine the extent of oxidant damage to plants. No such damage has been observed to date, probably because proper conditions for oxidant build-up have not occurred here. The increased concentration and use of automobiles in urban areas may be expected to make oxidants a problem, unless steps are taken to have pollution-abating devices installed on all automobiles.

New scientific discoveries may create new atmospheric hazards similar to that created when nuclear fission became a part of our living. Such hazards must be faced when they are developed. Today, however, all possible sources of air pollution should be examined. Their effects on life processes should be determined. Methods of lessening their damage should be devised, and devices should be developed to eliminate the pollutants from the atmosphere. This is a problem that is receiving the increasing attention of Utah Station scientists.

A LIBERAL EDUCATION
(Continued from page 7)

...ing for broader participation in the total community. More important than all this, it helped put farmers and all ordinary citizens in touch with the cultural heritage of their society in a way that no country has ever done before.

Modern universities had their beginnings in the desire of some people for a liberal education, an education that would make them free, an education that would in some significant sense enable them to transcend individual limitations of time and place and personal events, and learn something of the best that has been thought and said and experienced by great men of all times and all cultures. Only much later did society in general come to recognize that pursuit of knowledge for its own sake might lead to significant practical results.

The author of the Land-Grant system specified that the education to be provided was to be both "liberal and practical." To the extent that the farmers of America have become acquainted with history, literature, philosophy, and similar fields that have no immediate practical significance for them, to this extent have they as individual, total, personal beings come out of serfdom and into freedom, as a parallel step to their achievement of freedom as political and economic entities. To this extent are they no longer hicks as well as no longer serfs. They are developed human beings, not just rubes of substance.

If, like Plato, American society were interested in farmers only in their capacity as workers, then it would not be interested in providing for them any training other than that which would enable them to farm well. But if we are interested in farmers and in all other people, first as individual human beings, with "unlimited capacities of being, doing, and suffering," as Thomas Huxley said in his appeal for a liberal education for all, and only secondly in their capacity as workers, then liberal, humanistic training is as essential for them as it is for "gentlemen" of the genteel tradition and professional men and all others who traditionally have been thought to "need" or "deserve" such education.

His own individual stature and the widespread respect accorded the farmer in America today is one evidence that the liberal education in the Land-Grant system has been as significant as the practical, and in this centennial year, this contribution also deserves its word of recognition.

CURLY TOP IN POTATOES
(Continued from page 9)

Shapen. Frequently, the large tubers are misshapen.

Tuber-perpetuated symptoms in the greenhouse and at Oceanside, California

Tubers from plants growing in commercial fields with typical Utah haywire (current-season curly top infection) were planted in the greenhouse at Logan, Utah, and in the field at Oceanside, California, in December. Kennebec, Russet Burbank, and White Rose tubers were planted in the greenhouse while the Oceanside planting was limited to the White Rose variety. At both locations plants developed symptoms described and published in 1946 as green dwarf which since have proved to be caused by the curly top virus. One hundred-three days after planting at Oceanside, California, 25 percent of the tubers failed to produce emergent plants. Twenty percent of the tubers produced plants which exhibited green dwarf symptoms, 15 percent produced smaller plants with no definite symptoms, and 40 percent produced large, normal appearing plants.

Nonemergence, delayed emergence, and dwarfing were characteristic of the diseased plants grown in the greenhouse. Some plants remained dwarfed, some after a delayed early growth developed into tall, dark green, upright, single large stemmed plants, and some developed into slightly stunted plants, while others were healthy. Slightly less than 18 percent of the Russet Burbank and White Rose and 0.7 percent of the Kennebec sets produced healthy plants. Sets of some tubers produced both diseased and healthy plants which is evidence that the virus did not occur uniformly through the tubers.

Typical curly top symptoms developed on tomato plants which were...
grafted on to potato plants exhibiting green dwarf symptoms in the greenhouse.

**Tuber-perpetuated symptoms in the field at Logan**

Kennebec and White Rose tubers harvested at the same time as those that were planted in the greenhouse were saved for planting in the field. Emergence was less than 40 percent 112 days after planting. Most of the nonemergent plants developed short, thick sprouts that did not grow further. Those plants that did emerge ranged from extreme dwarfing (fig. 5) to normal growth. Many of the plants had the characteristic green dwarf growth, but instead of being dark green the color ranged from light green to yellow, while some plants developed symptoms approaching those of current-season infection.

When tomatoes were drafted on to potato plants exhibiting any of the tuber-perpetuated symptoms, typical curly top symptoms resulted in the tomatoes.

**Tuber-perpetuated symptoms expressed in the second generation**

If plants produced tubers in the greenhouse, these were harvested, stored to break the rest period, and then planted in the field. Again in the field there was delayed germination.

In addition to non-emergence and late emergence some of the second generations plants expressed tuber-perpetuated curly top symptoms and the curly top virus was transmitted to tomatoes by grafting.

**ALFALFA SEED CHALCID**

(Continued from page 11)

Adjacent areas. The July 28 to August 6 decline was probably due to the delayed response of chalcid numbers to the earlier dip in alfalfa flowers between full bloom on the first crop and full bloom on second crop. Although first crop forage was not cut from the field there were two distinct bloom periods corresponding to first and second crop.

August 6 to August 15 — This lull in chalcid numbers (150 to 175 to 150 per 100 sweeps) corresponds to the flower lull between first and second bloom periods. The two-week average life span of chalcids does not permit a continuous carry over of high chalcid numbers whenever there is a break in the supply of flowers.

August 15 to August 31 — The sharp increase in chalcid numbers (150 to 2000 per 100 sweeps) during this period represents the increase in numbers and in migration from second generation chalcids which developed on second crop seed. The seed was harvested August 21 to August 31 and further sweepings were not made. Sharp declines in numbers following August 31 are recorded in figs. 1, 2, and 3.

Comparisons among figs. 1 to 3 show similar peaks and valleys in chalcid numbers although they may come at varying times and peak at different numbers.

Sorenson found that spring emergence began between May 1 and May 15 and continued through July 15. First brood began to emerge about July 20 and the second brood about a month later. The emergence of these two broods is related to the peaks in chalcid numbers portrayed in figs. 1 through 3 of this report.

Because the chalcid flies from field to field effective control necessitates community or area action. We suggest as Sorenson did originally the following practices before May 1: (1) burn chaff stacks, (2) feed or destroy all screenings, (3) eliminate other host plants particularly volunteer alfalfa in fence rows, waste places, and on ditch banks, (4) cultivate to bury infested seeds that have fallen to the ground. In addition the grower should irrigate for fast seed set.

**GRAZING STEEP SLOPES**

(Continued from page 13)

Table 1. Changes in elevation of the soil surface following grazing of mountain slopes by cattle

<table>
<thead>
<tr>
<th>Percent slope</th>
<th>Change (inches)</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>5.39</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>3.04</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>4.09</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>56/33/23</td>
<td>2.28</td>
<td>.04</td>
<td></td>
</tr>
</tbody>
</table>

Surface do not indicate soil loss. They are an indication of the amount of soil that has been loosened so that it could be moved downslope by gravity or water.

As cattle moved about the pastures, litter at the soil surface was displaced, shattered, or pulverized. Before and after photographs were used to record changes (fig. 4).

**Protective soil cover decreases**

Because cattle tend to congregate in certain locations within the pastures, the effects of trampling are more pronounced in some areas than in others. However, the general effect of cattle on litter cover was to decrease the soil protection afforded by litter and rock and to increase the area of bare soil. The average increase in bare soil in pastures with slopes of 68, 60, and 56 percent was 11.8, 5.6, and 8.9 percent. Since range condition is lowered and erosion hazard increased as exposed bare soil increases, these changes in litter are not desirable. They should be minimized.

Results obtained during the first season of use in the experimental pastures indicate the direct effect of cattle on slopes. The full meaning of these effects can be determined only after several seasons of study. Observed changes in vegetation, soil, and litter must be evaluated in terms of the effects of summer storms and spring snowmelt on soil surfaces that have been disturbed.

28
A limited acreage of Kennebec, a potato variety released in 1948, is being grown in Utah for seed production and commercial potatoes; however, there is an increased interest in the state in growing this variety for chipping purposes. Nationally this variety ranked third in certified seed production in 1961.

Utah growers have encountered some difficulty in producing seed of this variety due to its susceptibility to curly top. Kennebec is more severely damaged by curly top than the Russet Burbank or White Rose varieties. A commercial field of Kennebec severely damaged by curly top in 1958, the year large populations of beet leafhoppers moved from the desert breeding grounds to the cultivated farms of Utah, is shown in fig. 1. The Russet Burbank and White Rose varieties were also damaged by curly top in 1958, but not so severely as the Kennebec variety. During this same season approximately 85 to 90 percent of Utah’s tomato crop was destroyed by curly top. Kennebec seed fields are frequently damaged by curly top during seasons when the flight of beet leafhoppers is relatively light and little curly top occurs in the Russet Burbank and White Rose varieties.

**Tuber-perpetuated symptoms in the greenhouse**

Not only is the Kennebec variety more severely damaged by curly top in the field than the Russet Burbank and White Rose varieties, but the damage is carried over to the tuber-perpetuated plants (fig 2). More than 97 percent of the seed pieces planted in the greenhouse from tubers produced on diseased plants either failed to grow or produced severely stunted plants. The corresponding percentages for the Russet Burbank and White Rose varieties were 51 and 56 percent, respectively. Only one (0.7%) Kennebec plant appeared to grow normally.

**Tuber-perpetuated symptoms in the field at Logan, Utah**

Kennebec and White Rose tubers harvested at the same time as those planted in the greenhouse were saved for planting in the field the following spring. One hundred-twelve days after planting, many tubers had not yet produced sprouts long enough to emerge from the soil. Most of the nonemergent plants developed short, thick sprouts that did not grow further. Al-
though the percentage of emergence of both varieties was low, emergence was 39.8 percent for White Rose compared to 30.2 percent for Kennebec.

Tuber-perpetuated symptoms in the second generation

If plants produced tubers in the greenhouse they were harvested, stored to break the rest period, and then planted in the field. Again in the field there was a marked delay in germination. Sixty days after planting, 20.5 percent of the Russet Burbank, 40.8 percent of the White Rose, and only 3.2 percent of the Kennebec had emerged. Eventually (after 112 days) the percentages were 83.4, 79.6, and 10.5 for the Russet Burbank, White Rose, and Kennebec, respectively.

A COMMUNITY RESOURCE
(Continued from page 17)
a few examples. A little imagination on this subject goes a long way.

Special attractions

Most communities have special attractions. Tours, lectures, historic and scenic sites are all of interest to some sportsmen who might stay a day longer or take advantage of such opportunities during off hours. These attractions are also of interest to the sportsman's family. A well satisfied hunter or fisherman may return another year with his family for a vacation, or he may become a permanent resident.

He may even return to establish a business

Well-placed brochures describing a community's attractions are impressive in telling sportsmen and others what a community has to offer. This is an opportunity for service organizations, civic groups, and chambers of commerce.

There is a danger in attracting more sportsmen than the wildlife resource will support. The objective, however, is not to attract more, but first to provide adequate services for present visits.

In some areas there may be a neglected resource, and reason to attract more people. This should be considered carefully in the planning stage. A good example is the cisco in Bear Lake. For many years little interest was shown in these small fish. The late winter cisco run is now a real attraction, drawing thousands of people to the shores of Bear Lake with no adverse effect upon the resource. The same is true of white fish, which can provide off-season winter fishing but has not attracted much sportsman attention. Promotion would be helpful in two ways: by making better use of the resource and by attracting people to communities during the slower winter months.

Wildlife can be a significant community resource, but crass commercialism must be prevented. Too often the preliminary results indicate that mole drainage can be used successfully in the reclamation of heavy soils.

The obstacle of artesian aquifers

The shallow artesian aquifers of Cache Valley have long been considered to be a major obstacle to the solution of the drainage problem. The pressure in the aquifer causes the water to move upward in the soil rather than down. This upward movement, although of little consequence so far as the amount of water is concerned, does make leaching and drainage more difficult. Two schemes are now in progress to attack this problem; one concerns drainage, the other salt removal.

With the system of piezometers now available on the farm the effect of the artesian pressure on drainage will be tested by pumping the irrigation supply well completed last year. This well was deliberately placed in the shallow aquifer (located 40 feet below the ground surface) so that the relation of the artesian pressure to the drainage problem could be fully explored. A power line was built to the farm and a turbine pump installed in the well during the summer of 1961. When the well is used for irrigation this coming summer, information on its effect on drainage can be obtained, thus a dual purpose will be served.

Salt removal

To solve the salt removal problem, reverse leaching was tried on a small scale in 1961. Four inch tile lines 45 feet long were placed in the soil at a depth of 30 inches. The lines were enclosed in a gravel envelope 10 inches deep and then backfilled. A stand pipe extended from the lines to a point 36 inches above the ground surface. Water was added to the standpipe and forced up through the soil from the tile, and allowed to run off the surface. The salt was thus moved up through the soil and off the surface. Preliminary results show that the reverse leaching
was more effective in salt removal and used less water than conventional leaching in this pilot experiment. The tile lines used in this type of leaching might also be used for water application. This possibility will also be explored.

Other work now being carried on at the Cache Irrigation and Drainage Farm includes: The development of instruments and records for continuous measurement of groundwater levels and artesian pressures, surface irrigation experiments involving length of run-size of stream relations as influenced by intake rate and other soils characteristics, measurement of the upward flow from the artesian aquifer, sprinkler irrigation as a means of water management, and soil, crop, water management studies.

**RETAILING CHRISTMAS TREES**

(Continued from page 21)

displayed individually. A wide variety of colorful accessories such as wreaths and painted trees helped promote tree sales. These items attracted buyers of traditional trees and were profitable to handle in themselves. In addition, most dealers offered an additional attraction to buyers by giving extra boughs away to customers. Usually these were trimmings or cut trees cut up.

**Pricing**

Retail prices for Christmas trees were highly variable. Many dealers had no set pricing plan but based their price more on an appraisal of the customer than on an appraisal of the tree. The majority, however, had set prices which varied directly with species, size, and quality.

A rule of thumb used by many dealers was that retail price should be 100 percent more than wholesale. This large mark up was justified by the short season and large element of risk involved.

The range and average wholesale price per tree by species reported by the retailers sampled in 1960 are:

<table>
<thead>
<tr>
<th>Species</th>
<th>Usual range in price</th>
<th>Average price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinyon pine</td>
<td>$1.75 - 2.50</td>
<td>$2.00</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>1.25 - 1.60</td>
<td>1.40</td>
</tr>
<tr>
<td>Subalpine fir</td>
<td>1.75 - 2.25</td>
<td>2.00</td>
</tr>
<tr>
<td>White fir</td>
<td>1.75 - 2.50</td>
<td>2.00</td>
</tr>
<tr>
<td>Blue spruce</td>
<td>2.50 - 3.50</td>
<td>3.00</td>
</tr>
<tr>
<td>Ponderosa pine</td>
<td>2.25 - 3.00</td>
<td>2.60</td>
</tr>
<tr>
<td>Lodgepole pine</td>
<td>1.75 - 2.25</td>
<td>2.00</td>
</tr>
</tbody>
</table>

By applying the markup of 100 percent to get retail price, then it may be reported that the average retail price for natural, unmodified Christmas trees in Utah for 1960 was about $4.00 per tree. This is in agreement with the results of the consumer survey phase of this study which indicated that the average family paid $4.00 for a Christmas tree. Since the supply of trees was lower in 1961, the average price this season would probably be somewhat higher.

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**research reports**

**Supplement protects sheep from halogeron**

Sheep losses caused by eating the poisonous range weed halogeron can be prevented by use of dicalcium phosphate, a common feed supplement. Sheep fed alfalfa pellets containing 5 percent of dicalcium phosphate are protected against the poisonous oxalates in halogeron. The amount used is about ten times greater than that used in feed to supply normal requirements of calcium.

Halogeron may contain from 3 to 30 percent oxalates, which may kill sheep in 10 hours by depleting the blood serum of its calcium content or by forming oxalate crystals in the kidneys.

Dicalcium phosphate apparently ties up the oxalates in the intestinal tract or is readily absorbed by the blood to replace calcium removed by the poison.

—Wayne Binns

**Chemicals in agriculture**

Without agricultural chemicals, production of commercial quantities of many common vegetables would practically cease. Diseases such as blight would wipe out entire crops of potatoes and tomatoes. Insects would regularly take half or more of the yields of many other crops. Winter vegetables from the South and Southwest would virtually disappear from our markets.

Commercial production of apples and pears could not continue without insecticides and fungicides. Peaches and cherries would become rare delicacies. What little citrus fruit we had would be riddled with maggots of the medfly and Mexican fruit fly.

Without chemicals, a shortage of feed grains could well curtail production of meat, poultry, and milk. Our livestock, fighting a losing battle against diseases, parasites, and insects, would be generally unthrifty. The six major external parasites of cattle, hogs, sheep, and poultry alone, if not controlled by chemicals, would add about $100 million to the nation's meat bill.

If we weren't using chemicals, it is doubtful whether foreign buyers would be interested in our farm products at all. But that wouldn't matter, because we wouldn't have enough to export anyway.

Without chemicals, we could no longer feed our families on a fifth of our income. Adequate nutritional quality in our diets might be hard to come by at any price. Reverberations of the rising cost of food would echo throughout the economy with a shattering...
effect on our entire standard of living. But it is safe to say that without the use of chemical pesticides, agricultural production as we know it today would simply not be possible. — Assistant Secretary of Agriculture Frank J. Welch.

**Improved collars and cuffs for men’s shirts**

Longer lasting collars and cuffs on men’s cotton wash-wear shirts may result from a cotton interliner treated to give it wash-wear qualities and then bonded by an adhesive to outer layers of untreated cotton cloth. The finished fabric not only has wash-wear qualities similar to those of the treated interliner but also has the high resistance to fraying or abrasion that is ordinarily associated with cotton.

Samples made with the treated interliner were stiffer than the usual soft collars and cuffs, but they were less stiff than starched cotton collars and cuffs.

These new collars and cuffs were developed at the Southern Utilization Laboratory of the U. S. Department of Agriculture at New Orleans, Louisiana.

**Significant inputs in agriculture**

Although in actual dollars it doesn’t bulk very large . . . the most significant inputs that were made in American agriculture, I believe, are those spent in the establishment of the U. S. Department of Agriculture and the Land Grant College System, and their subsequent programs of research and education.

Few, if any, investments in our history have yielded so high returns as the dollars invested in agricultural research and teaching. They made possible the technological revolution in agriculture that has increased productivity per hour by 240 percent in the last 25 years. The benefits of these gains have been universally spread among all our citizens in the form of low food prices in relation to nonfarm incomes. — J. W. Trapp

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**CONTRIBUTIONS TO RESEARCH**

November 1, 1961 to February 1, 1962

- **National Institutes of Health**
  - $270,048 for spectral analysis of plant virus infection processes
  - $25,515 for a study of the effects of radium on stream biota below uranium mills

- **Damon Runyon Cancer Fund**
  - $4,600 for a genetic analysis of tumorous head and melanotic tumors in Drosophila melanogaster

- **Thomas T. Taylor**
  - $1000 for varietal trials of flowers and shrubs

- **Commercial Solvents Corporation**
  - $500 to investigate the value of zinc bacitracin for laying hens

- **Foremost Dairies, Inc.**
  - $500 for study of the use of lactose in cultured dairy products

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**NEW PUBLICATIONS**

  - This publication describes the squarrose knapweed and methods for its control with herbicides.

  - The purpose of this study was to determine the relative feasibility of surface and sprinkler methods of irrigation under different physical and economic conditions. Facilities evaluated for the surface method of irrigation include unlined ditches, concrete-lined ditches, and gated pipe; for the sprinkler method, portable and permanent main lines and alternative sources of power — electric, diesel, or gasoline motors.

Copies of either of these publications may be obtained free by writing to the Bulletin Room, Agricultural Science Building, Utah State University, Logan, Utah.