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Higher Soil Fertility Fundamental to Increased Production

Increased Production Must Come From Higher Yields Rather Than Additional Acreage

By D. W. Thorne

A gigantic “food-for-defense” program to increase next year’s production of farm products 15 percent above the six-year 1924-1929 average was set in motion by the speech of Secretary of Agriculture Claude A. Wickard, in Salt Lake City, September 19, 1941. As in World War I the slogan is rapidly becoming “Food will win the war.” The world needs more meat, fat, dairy products, fruit and vegetables, and the United States is making plans to fill the need.

A 15 percent increase in agricultural production offers a challenge to the farmers of America. Increased production involves two fundamental possibilities (1) the placing of more land under cultivation and (2) increased production on land now in cultivation. The first alternative was the source of much of the increased production during World War I. Lured by high prices for farm products thousands of acres of land in dry areas of the high plains of Oklahoma, Kansas and Texas were plowed for the first time and many more thousands of acres of poor rolling land in the South were planted to row crops. Disaster followed. The land on the high plains became the dust bowl. In the South the thin top-soil of the poor land washed away during the heavy rains. Huge gullies formed and almost entire counties were abandoned without hope of future agricultural use. Though less spectacular, similar scenes were enacted in almost every state.

Will such catastrophes as those following World War I be repeated? Huge government programs have been set in motion to prevent such action but the final answer is still largely up to the farmers. While there are small areas of good land not now cultivated, the quantity of production from such areas would be small compared with the total needed.

The possibilities of increased production on land already under cultivation are seldom appreciated. Contemplate the average acre yields of some Utah crops between 1928 and 1937: potatoes, 152 bushels; sugar beets, 12.2 tons; peas, 1.3 tons; tomatoes, 8.2 tons; string beans, 4.2 tons. Most successful farmers hope to obtain double such yields. While all soils do not have equal producing power under even the best soil management practices, few soils are producing at full capacity.

The producing power of any soil is now known to follow a law variously termed “Mitscherlich’s Law,” or “the law of diminishing returns.” This law states that maximum crop yields can be obtained only when all factors important to the well-being of the growing plant are present in optimum or “ideal” concentration and that when any one factor deviates from this optimum there is a related decrease in yield.

The problem facing each farmer, then, is to determine the factor or factors in his soil that most limits crop production. There is no general cure-all that can be applied to all farms. Every soil does not need fertilizer just as each does not need treatment for excessive alkali. But in individual cases each may be highly important.

The present soil research program of the Utah Agricultural Experiment Station anticipates the day when every important agricultural soil in the state will be accurately mapped and the fact-

(Continued on page 4)
A study of 442 farm business records of cash-crop, dairy farms in the vicinity of Ogden during 1937-39 showed labor earnings of less than $500 on 29 percent of the farms, from $500 to $1,000 on 35 percent of the farms, from $1,000 to $1,500 on 23 percent of the farms, and on the other 13 percent the labor earnings were in excess of $1,500.

Why were some farms financially profitable, while other farms subject to the same physical and economical conditions operated at a loss? Was it simply a matter of luck or chance, or was it a result of differences in the farmers who operated the farms, or were there other factors pertaining to the organization and management of the farms that explain this important problem? Undoubtedly luck or chance was sometimes a factor. Differences in farmers are also important but are difficult to measure and analyze directly. Most important of all in accounting for the variations in the financial success are the differences in certain factors associated with the organization and management of the farms. These factors reflect, in part, differences in the farm operators.

A detailed analysis was made of those farm business records in an attempt to find the reason for the variation in the financial success. It was found that the differences could not be accounted for by any one factor but that there were several important contributing factors. While it is not possible to rank the factors in order of importance, one of the most important was the size of the farm business.

### Size of Farm Business

There were 90 farms with less than 25 acres of crops. The average labor earnings for these farms were $579, while for the 45 farms with 85 or more acres of land in crops, labor earnings averaged $1,388. Between these two groups labor earnings increased about in proportion to the increase in size of farms.

The larger profits from the larger farms resulted from: (1) larger gross receipts, (2) greater efficiency in the use of man labor, (3) greater efficiency in the use of farm capital, and (4) organization of the farms so that a larger proportion of the business was in the more profitable enterprises.

### Rates of Production

A second factor of importance was the rates of production, which mean more products to sell and hence larger gross receipts. Expenses do not increase proportionately with the rates of production. The small farms were divided into two groups according to rates of production. Those in the lower half averaged labor earnings of $489 while the higher group averaged $785. The larger farms were also divided into two groups according to rates of production. For the half with the lower production the average earnings were $819, and for the higher, $1,420.

### Efficiency in Using Man Labor

One of the big advantages of larger farms is the greater efficiency of the laborers. Or in other words, on a large farm a man can accomplish more productive work in a given time than he can on a small farm. Even on farms of the same size, however, there was considerable variation in the efficiency with which man labor was used. And the more efficiently the labor was used the more profitable the farm. The relation of number of factors better than average to labor earnings on dairy farms in the vicinity of Ogden, 1937-39* shows the following:

<table>
<thead>
<tr>
<th>Number of factors</th>
<th>Number of farms</th>
<th>Average labor earnings</th>
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<tr>
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<tr>
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<td>15</td>
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</tr>
<tr>
<td>7</td>
<td>2</td>
<td>$3,596.00</td>
</tr>
<tr>
<td>Total or average</td>
<td>442</td>
<td>$881.00</td>
</tr>
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</table>

*The factors included are: number of man-work-units, crop index, pounds of butterfat per cow, man-work-units per man, percent of man-work-units in crops, price received per pound of butterfat, and man-work-units for each $1,000 of capital.

442 records were divided into three groups on the basis of size of business and each of these groups was divided into two groups on the basis of labor efficiency. For the least efficient and the most efficient farms the average labor earnings were $466, and $709 for the smallest size farms, $709 and $995 for the middle size farms, and $1,111 and $1,340 for the largest size farms.

### Percent of Farm Business in Crops

All of the farms included in this study kept some dairy cows and most of them had other livestock; all also produced some crops. However, there was considerable variation in the proportion of the total farm business that was devoted to livestock and to crops. The farms with a high percentage of the business in crops had higher labor earnings than did the farms with a low percentage, regardless of the size of the business. The differences between the farms with high and low percentages of the total business in crops were $54, $159, and $385 for farms of small, medium and large businesses, respectively.

### Intensity of the Cropping System

The farms with a larger proportion of the cropland planted to such crops as sugar beets, potatoes, onions or fruit were more intensively cropped than those growing only such crops as hay and grain. These farms were the most profitable. During the period 1937-39 the average labor earnings on the most intensively cropped farms were higher than on the least by $185, $316 and $612 for the farms of small, medium and large acreages, respectively. The small farms were the most and the large farms the least intensively cropped. Also crop yields tended to be highest on the most intensively cropped farms.

### Number of Dairy Cows

For all farms there was not a close association between the number of dairy cows and the labor earnings. However, for the group of farms with the smallest number of crop acres the half with the most cows had average labor earnings of $720 compared with an average of $584 for the farms with the fewest cows.

(Continued on page 11)
POULTRY PRODUCTION MAY BE INCREASED THROUGH CONTROL OF DISEASE

Growers Lose 30 Percent of Crop Each Year by Disease

By D. E. MADSEN

POULTRY products are considered by the National Agricultural Defense Program as one of the so-called protective foods. Agriculture of Utah has been asked to increase its production of eggs, broilers and turkeys. There are two ways of enlarging the output of livestock products; first, by increasing the number of livestock or poultry units, and secondly, by improving management practices so that a given unit develops into a product of greater potential value.

Increasing the number of livestock or poultry units in the state by any appreciable amount is beset with some handicaps. For instance, locally grown feeds cannot satisfy a greatly increased demand. The problem of extra housing and extra equipment cannot always be immediately solved. On the other hand there is no handicap to the immediate inauguration of improved methods of rearing and maintaining poultry so that more growth, more production, and greater profits may be realized.

One important way of increasing poultry production is through the control of disease. If the poultry industry did not have its present rate of loss from disease and parasites, it is conservatively estimated that production could readily be increased 25 percent. The loss encountered includes not only the death loss but an item sometimes much more important, namely, the reduction in rate of growth or rate of production. Then, too, the loss encountered through idleness of equipment and of labor not being fully utilized is no small item. The seriousness of present day loss of egg producing hens is reflected in records kept by egg laying contests operated in various states. In 1913 the average yearly mortality in such contests was 6.3 percent, by 1936 it had increased to 30 percent. There is probably no other livestock enterprise which could survive a 30 percent death loss each year. It is amazing that the chicken industry has been able to survive such a handicap.

No doubt intensive methods used and the concentration of large numbers of birds have contributed to the present difficulty. Furthermore, force feeding for year around production of a bird originally capable of only seasonal production has created a drain on the reproductive system which may make the bird less resistant to infectious disease or cause a general organic breakdown. In the past, chicken breeders have stressed egg production through line breeding and selections. Family vigor and livability have been neglected. Many authorities are now of the opinion that breeding research should be centered more on livability.

The knowledge is not at hand to remove completely the disease hazard from poultry production. However, sufficient knowledge is known concerning the nature of several diseases so that effective control measures can be adopted.

There is one essential factor in connection with successful poultry production, a factor over which even the most exacting caretaker may have little control. This deals with the question of healthy vigorous baby chicks. It deals with the breeding and vigor of the parent stock. Chicks purchased should be from parents that are disease free or preferably disease resistant and that transmit the characteristics of livability and of high egg production.

Upper—coccidiosis, center—infectious cor–yza, lower—fowl paralysis, circle—pullorum disease

Stock Resistant to Pullorum Disease

There was no national unity in the development of a broad breeding program or pullorum control program in this country until the National Poultry Improvement Plan came into being in 1935. Most of the better breeders and hatcheries in the United States now operate under this plan. It provides for different grades of chicks with definite names assigned them so that the purchaser of chicks has definite assurance of the grade he is purchasing. It also provides for pullorum disease control. The program is supervised by the federal government and operated by state governmental agencies. This program will do much to raise the standards of poultry and egg production, and purchasers of chicks should buy from hatcheries cooperating in this national plan.

After the purchaser has been supplied with vigorous chicks with inherent capacity for livability and good egg production, it becomes his sole responsibility to grow them under approved practices so that loss from disease will be kept at a minimum. It is not uncommon for poultry producers to omit some important detail in the care of

(Continued on page 10)
Agricultural Experimentation Points Way to Greater Production

Agriculture is now gearing itself to meet the needs of a defense production, a production that will not only supply the increased food needs of a nation again at work, but will also furnish enough to feed 10 million Britons. However, this is not being done so much by increased acreage or increased livestock numbers, other than poultry and hogs, as was true in the last war, but by increased efficiency in production. The Department of Agriculture has warned against bringing large acreages of marginal land under cultivation, against building more barns and poultry houses, against greatly increasing the numbers of beef cattle, or the introduction of other long range programs. Increased production is to come by increased yields per acre or per animal unit.

Agricultural experimentation during the past half century and more has pointed the way by which this can be accomplished. More scientific practices, better methods of production, new methods in the control of disease and pests, developed at the various experiment stations through years of research, have made it possible to so increase production. They have shown how to increase crop yields by increasing the fertility of the land through the use of manure and commercial fertilizers, by the use of certified seed, by better tillage methods, by greater attention to the control of weeds, insect pests and plant diseases.

Experiments have demonstrated that increased dairy production may be attained by better feeding and management. Carrying capacities of pastures have been enormously increased by fertilization and rotation feeding. The addition of silage and grain to the dairy ration has been demonstrated to increase milk production.

Other experimental work has shown the possibility of poultry production increases through better methods of feeding and more care in selection and sanitation to avoid disease.

Because of the advances made in every phase of agriculture through the application of practices developed as a result of discoveries made by the agricultural experiment stations, it will be possible to meet the demands made by defense.

And when the peace comes the program that has made agriculture strong in war will also make it easier to meet the adjustments of peace.

If the time comes when production must be curtailed, defense increases have not been based on a greatly increased capital investment, but on intensified use of available facilities. The adjustments to a decreased demand should not be so difficult to make, nor should they upset the farm economy as have the changes caused by world upsets in the past.

SOIL FERTILITY
(Continued from page 1)

Soil factors determined which are most likely to limit production of every important crop on each soil. The realization of these objectives is in the future and will require the active support of farmers and of local and state organizations. In the meantime many factors important in crop production have been studied in a general way. The data obtained show that the following factors should be checked carefully by every farmer:

Cultivation

This is the first prerequisite to crop production. Improper cultivation may injure the fertility of soils. Fine textured soils, such as clay or clay loam, may be seriously harmed by tillage when too wet or too dry. No soil should be cultivated more than is essential for weed control and the maintenance of good tilled.

Moisture Control

This includes proper drainage as well as irrigation. Many soils have high water tables which injure plant growth while in other cases too much or too little irrigation water may be a limiting factor. Yellowing of plant leaves is frequently a sign of excessive moisture. On the other hand, many plants that become dry during periods of rapid growth are permanently stunted.

Crop Rotation

It is almost impossible to grow any one crop on land year after year and maintain high yields. For most Utah farms alfalfa is the heart of rotation. Alfalfa should ordinarily occupy land at least one-third of the time.

Organic Matter

Practically all Utah soils need greater reserves of organic matter. Farm manure has increased crop yields in Utah more frequently than any other soil treatment. Careful handling of farm manure, turning under of crop residues and growing alfalfa in rotation will usually maintain a favorable organic matter status. In some instances, however, there is a need for growing such green manure crops as sweet clover for soil improvement.

Mineral Nutrients—Fertilizers

Some Utah soils are lacking in essential plant nutrients. Fine textured soils low in organic matter are frequently lacking in available phosphorus and respond well to soluble phosphate fertilizers. Orchards and small fruits grown on sandy or gravelly soil often respond well to nitrogen fertilizers such as ammonium sulfate. In a few instances fruit trees suffer from lack of available iron and zinc in the soil. In such cases special treatment is required and specialists should be consulted.

Alkali

Soluble salts frequently accumulate in low-lying soils, particularly where there is a high water table. In most instances drainage and heavy irrigation are sufficient to remove excessive quantities of soluble salts. In some cases, such as in soils impregnated with black alkali, special soil treatment with sulfur or gypsum may be advisable. Alkali is an important problem on about one-third of the cultivated soils of Utah. Where present it should receive first consideration in any soil improvement program.

This is an ideal time to pay careful attention to a soil building program. Farm produce is needed to feed war-torn nations. At the same time relatively high prices for farm produce means greater returns from each dollar invested in boosting soil fertility.
Scientists Seek Tomato Varieties Resistant to Verticillium Wilt

Reduction of Tomato Diseases Important in Program of Increased Production

By L. H. Blood
U. S. Bureau of Plant Industry

Verticillium wilt in Utah are tomatoes, potatoes and eggplant, all members of the potato (Solanaceae) family. Repeated cropping of an infested soil with any of these plants will soon increase the concentration of the fungus until the crop will become so badly diseased and yield so poorly that it will cease to be profitable. This has happened with the tomato crop on old farms in the districts of Davis and Weber Counties where tomatoes were first grown for canning. The wilt fungus has become so concentrated in the soils of most farms in those districts that the tomato will produce only a very light crop of poor quality. Canning companies are moving portions of their contracted acreage from such districts to districts less intensively cropped with tomatoes. This action is wise from the standpoint of the companies, but it removes one of the principal cash crops from the abandoned districts and works a hardship on the farmers who are so unfortunately victimized by the disease. There is a limit to the number of new districts that may be used for tomato production in this state and when they are all used further avoidance of the disease in such a manner will be impossible.

The Verticillium wilt fungus damages the tomato plant by invading the water conduction (vascular) tissues of the root and stem. Once inside the vascular system the fungus grows rapidly at the expense of the plant and partially chokes off the vessels that are upper—Healthy tomato plant. Lower—Tomato plant infected with Verticillium wilt. Note the drooping tips and open character of the plant with the crown leaves destroyed exposing the fruit to the direct rays of the sun and to the possibility of sun scald (Continued on page 8)

for December 1941
HIGHER MILK PRODUCTION THROUGH IMPROVED MANAGEMENT METHODS

BY GEORGE Q. BATEMAN

The government has asked for a 13 percent increase in milk production in Utah to help meet the needs of the national emergency. This represents an increase of approximately 73 million pounds of milk over the 1941 estimated production of 559 million pounds. This increased production will come, first, by an increase in the number of cows milked, and second, through improved methods of feeding and management of the low producing dairy herds of the state.

The number of dairy cows milked in the state during 1941 is about 98,000 head. By increasing this number 2,000 head, milk production can be increased 11 million pounds provided these cows produce at the same level as the average cow of the state (5,600 pounds of milk). The remaining increase, 62 million pounds of milk, must come through better methods of feeding and management.

The dairy cows of the state have the potential ability to produce more than the 62 million additional pounds, provided they are fed and cared for properly. Three things are essential, however, if this increase in production is to be accomplished:

Cows Must Be Fed More Alfalfa Hay

(1) Dairy cows must be fed all the roughage they will consume during the winter months. Many cows are not allowed enough alfalfa hay for satisfactory production.

Better Pastures

(2) Pastures must produce more feed. This may be accomplished by use of fertilizers. The application of 200 pounds of treble superphosphate per acre in the fall and 10 tons of manure (containing the liquid portion) during the winter months increased the feed production of pastures at the Dairy Experiment Farm as much as 50 percent per year for a three-year period. Use of fertilizers combined with good methods of management and rotation grazing will insure an abundance of summer pasturage.

Late in the summer and fall cows should be allowed alfalfa hay and other feeds in addition to pasture. Records of milk production kept by receiving plants show that there is a drop of as much as 40 percent in the amount of milk delivered by dairymen in October as compared to the amount delivered in June when pasturage is abundant. Eighty percent of this drop in production can be prevented by improving the pastures and by feeding additional feeds when pastures become short.

Grain Feeding To Increase Production

(3) Cows producing in excess of 0.8 pound of butterfat per day should be fed grain according to production. (Information on feeding grain to dairy cattle may be procured by writing to the Utah Agricultural Extension Service and requesting Mimeograph sheet 384)

Information as to the increase in milk production that can be expected when grain is added to a ration of alfalfa hay and pasture has been worked out at the Utah Agricultural Experiment Station (Reported in U. S. Dept. Agr. Tech. bul. 724). It was found that when a group of 12 dairy cows was fed alfalfa and pasture as the only feeds for complete lactation periods that these cows produced an average of 8,938 pounds of milk.

In this same experiment it was found that when corn silage was added to the alfalfa hay and pasture ration, milk production was increased 543 pounds per cow on the average or approximately 6 percent. In addition the cows when they received silage were in better condition throughout the lactation period as shown by a uniformly higher body weight.

When these same cows were fed alfalfa hay and pasture plus chopped barley, fed according to milk production, at the rate of 1 pound of barley to each 6 pounds of milk produced, they produced an average of 11,086 pounds of milk or an average increase of 2,148 pounds per cow, or 24 percent increase in milk production.

When they were fed a ration of alfalfa hay, corn silage plus pasture, and in addition grain was fed more liberally, or at the rate of 1 pound of grain to each 4.4 pounds of milk produced, milk production averaged, 12,866 pounds per cow as compared to the 8,938 pounds when alfalfa hay and pasture fed. This increase of 3,928 pounds of milk per cow amounts to an increase of about 44 percent as a result of feeding a more complete ration.

An increase in milk production of 24 percent on 75,000 average Utah cows producing 5,600 pounds of milk would amount to a total of 100 million pounds of milk. This would exceed the amount required by 38 million pounds.

There is no doubt that dairy produc-
DAIRY PRODUCTS FOR DEFENSE

BY A. J. MORRIS

Of all the farm commodities of which increases are needed," said Secretary of Agriculture Claude R. Wickard, "the most urgent need is for milk. We need to consume more dairy products in this country for improved health and strength and the British will need tremendous quantities of cheese, evaporated milk and dried milk. To reach the production goals for 1942 the greatest effort will be required in dairying."

The dairy industry has already partially responded to this call as the following figures indicate: The United States Department of Agriculture reports 66,035,000 pounds of cheddar cheese produced in September, 1941. This is an increase of 24 percent over the September, 1940, production and 70.2 percent over the September, 1930-39, average. The American Butter Institute

14,149 pounds of milk containing 431 pounds of butterfat in the same period of time

High producing cows when on pasture consume large amounts of grasses and clovers providing the herbage is abundant and from 3 to 6 inches high. When pasture production is low, it should be supplemented by feeding alfalfa hay or other feeds. Cows producing at a high level should be fed grain in addition. This cow consumed an average of 115 pounds of herbage and 10 pounds of chopped barley while producing 54 pounds of milk per day

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of manure (containing the liquid portion) on fertilized sward resulting from the application had made a growth of from 5 to 7 inches to 3 inches. Applications of phosphate and points out that the January-September cheese production totaled 542,400,000 pounds in 1941, or 14.5 percent over the 1940 production and 48.9 percent greater than the 1930-40 average.

September production of evaporated milk was 42 percent larger than that for September last year and 82 percent larger than the 5-year (1935-39) September average.

Condensed milk production shows an increase of 21 percent over September last year and 101 percent over the 5-year September average.

According to the U. S. Department of Agriculture 69¼ million pounds of American cheese, 19½ million pounds of dry skim milk, 900,000 pounds of dry whole milk, and about 5 million cases of evaporated milk have been purchased since the beginning of this Dairy Products for Defense Program up to September 7, 1941.

The goal of production in the United States requires an increase: in milk of 14 percent in 1942 over 1940; in cheese 54 percent; in condensed and evaporated milk 54 percent; in dry skim milk for humans 116 percent. In the western states the increases are 57, 53, and 58 percent, respectively.

Utah's goal will require an increase in milk production from 543 million pounds in 1940, to 559 million in 1941, to 630 million in 1942. This is a 1942 increase of 16 percent over 1940 and 13 percent over 1941. Utah's 1942 goals in cheese, evaporated milk and dried milk have not been set but indications are that they will show a large increase over 1941.

In spite of the fact that the government has been buying all the cheese of the No. 1 grade, it has not been able to fill the defense needs. More "acceptable" cheese, canned and dried milk are needed. To be "acceptable" these products must meet definite minimum standards of quality and sanitation.

The immediate problem of Utah dairy farmers and manufacturers in producing "dairy products for defense" is threefold: Sanitation of milk production, plant sanitation, and making or processing cheese, evaporated milk and dried milk of satisfactory composition and grade.

Sanitation of milk production requires: (1) Clean milking quarters free from surplus manure, dust, (2) Disease-free cows, (3) Clean cows which have been brushed and then the side, flank, belly and udder wiped with a damp cloth. Dirty cows are the cause of most of the present rejections of milk and dairy products because of extraneous matter or sediment found in them. It only takes one minute to properly clean a cow if she has been well bedded; (4) Milking into covered buckets or utensils which keep falling hairs and dirt from entering the milk, (5) Milking with dry hands, (6) The use of seamless and rustless, clean, sterile utensils, buckets and cans. Avoid open seams. Prevent the accumulation of grease and milk stone. Use a brush and a good soda washing powder to wash utensils after they have been rinsed with clear warm water. Sterilize with scalding water, chlorine rinse or enclosed steam. (7) No straining is necessary if above precautions are used. Milk is no cleaner than the dirtiest thing it touches. It is better to keep sediment out of milk than to strain it out because the soluble material from sediment still remains to contaminate after the particles have been removed. Which will we have, "clean or cleaned milk?" (If strainers must be used only the single service cotton disc strainers are acceptable.) (8) Prompt cooling as
Damage to a tomato crop from *Verticillium* wilt may be avoided or reduced by the use of (1) virgin soil, (2) a highly fertile soil, (3) a soil that has been in an adequate rotation system, or (4) varieties of tomatoes that are resistant to the disease. The use of resistant varieties of tomatoes is the most effective measure for the control of the disease, but as yet there are no resistant varieties suited to Utah conditions.

**The Use of Virgin Soil**

Wherever virgin soil, or soil that has not grown tomatoes before, is available in tomato-producing districts it should be used and the soil previously planted to tomatoes should be cropped with plants not susceptible to *Verticillium* wilt for as long a time as possible.

**The Use of Highly Fertile Soil**

If it is necessary to use soil that has grown tomatoes within the past few years, it should be heavily fertilized. Fertilizer will not prevent the losses from the disease, nor will it take the place of crop rotation as a control measure, but high fertility will tend to increase the yield from a given acreage in spite of the disease. On the other hand, fertilizer applied to an infested soil will not produce the same returns as an equal amount applied to a non-infested soil. Infested soil of high fertility may, however, produce a profitable crop, whereas infested soil of low fertility will not.

Proper Crop Rotation for Tomato Production

Crop rotation will tend to reduce or keep at a minimum the damage caused by the disease. An adequate rotation period will vary with the degree to which the soil is infested at the time rotation is adopted. Soils that are badly infested should be kept out of tomatoes, or any susceptible crop, for a period of 10 to 15 years before being used again. Soils that are being used for tomatoes for the first time should be placed in a 5 to 8 year rotation to avoid a rapid development of the fungus in the soil. Shorter rotation periods will not prevent the fungus from gradually increasing in concentration and the disease from becoming progressively more severe as the years go by.

Long crop rotation periods are difficult, if not impossible on most of the small farms of the intensively cultivated districts in Utah, without periodically leaving the tomato entirely out of the cropping system for a number of consecutive years. Such a program would entail the loss of one of the most valuable cash crops for those periods and work a definite hardship on the farmers involved.

**Resistance to Verticillium Wilt in the Tomato**

A real and lasting solution to the problem can be obtained only by the development of strains of the tomato that are highly resistant or immune to the disease. The research program of the Experiment Station has emphasized this phase of the problem in an effort to achieve a solution.

Tests of several hundred varieties and strains of commercial tomato (*Lycopersicon esculentum* Mill.) on the heavily infested trial grounds at Farmington and Roy, Utah, have revealed none that possess a suitable degree of resistance to the disease. Two varieties, Riverside and Essar, recently released from California possess some resistance to the disease, but are unsuited for production in Utah. Mr. Shapovalov, of the United States Department of Agriculture under whose direction the varieties were developed, is attempting to make selections from them suitable for Utah conditions.

Immunity to *Verticillium* wilt has not been found among any of the wild or cultivated species, varieties or strains of the genus *Lycopersicon*. A strain of *L. esculentum* Mill., Peru Wild No. 665, and one of *L. pimpinellifolium* (Jusl.) Mill. (currant tomato) both from the Urubamba valley in southern Peru possess the highest degree of resistance found in the genus. Hybrids of commercial tomato with Peru Wild No. 665 grown on the trial grounds and now in the fourth generation have yielded some promising selections that bear fruit of a uniform deep red color from 2½ to 4 inches in diameter. Further single plant selections are being made from these progenies in an effort to pure line the largest fruited strains. These same progenies are being back-crossed and out-crossed to commercial varieties in an effort to increase the size of the fruit, and re-selected on the trial grounds for resistance. If the research project is continued, a tomato highly resistant to *Verticillium* wilt should be ready for release in a relatively short time. Such a tomato could be grown on infested soil with the assurance that the maximum crop that the soil is capable of producing without interference from the wilt disease would be realized.

**Verticillium Wilt**

(Continued from page 5)

used to conduct the water and nutrients obtained from the soil upward to where they may be used in the growth and development of the crop. A plant with its food and water transporting tissues lowered in efficiency cannot produce the crop that the soil is capable of supporting. The activity of the fungus causes a lowering in the growth rate, a dwarfing of leaves and stems, a reduction in the set and size of the fruit, and a yellowing and dying of the large basal leaves that serve in protecting the fruit from the direct rays of the sun.

Infected plants produce on an average from 30 to 60 percent less than normal plants of the same variety. Occasionally plants are completely destroyed by the disease. The 1941 epidemic caused a reduction of over 50 percent in the crop on many acres in the infested districts of Davis and Weber Counties. Over one hundred thousand dollars are lost to the tomato growers of Utah every year from the effects of the disease.
INSECT CONTROL IMPORTANT IN INCREASED CROP PRODUCTION

Production Can Be Increased 10 Percent By Effective Insect Control

Illustrations of what can be accomplished if the results of research in insect control are put into effect generally, promptly, intelligently and cooperatively.

With better prices for farm products, agriculturalists can well afford to spend sufficient funds on insect control to protect adequately the crops. Usually this can be done with marked profit to the growers. The more successful farmers are those who, besides understanding and practicing the principles of production, manage to reduce controllable farm losses. Injury by most insects falls into this class. Farm products not affected by pests are of higher quality, higher yield, and bring in greater net returns upon the market.

The defense program already has to some extent reduced the amount and increased the price of dusting and spraying equipment. Some insecticidal materials imported from other countries are becoming less abundant and more costly. With shipping preference given to defense materials, importation of insecticidal materials may be further curtailed, unless their need and importance is fully recognized, and preference in shipment afforded the more urgently needed products, such as rotenone bearing derris and cube root.

Some insecticide manufacturing plants in this country may be turned into munitions factories. If this occurs, some changes in insect control will be necessary, to use available and less expensive insecticides wherever suitable, restricting the use of rarer materials to the pests not controllable by more abundant materials.

Shortage of farm labor has, in some cases, already made difficult the prompt and effective control of insects in a few localities of Utah during the season of 1941. Transfer of additional men to our armed forces and defense industries will raise new problems which will need to be solved by the farmers of this area. However, the present problems can be met and largely overcome, as have past problems that have arisen each year, requiring intelligence, study and cooperation.

With the facilities and information available, the crop production program of this country must and will go forward. The less toll taken by insects, the more surely we will meet the crop production objectives set by the government.

Adequate equipment, the right insecticide, and proper timing are essential to successful insect control.

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chicks or to ignore completely or partially principles of sanitation. When losses occur from disease the hatchery is unjustly accused of selling diseased stock or selling stock lacking vigor and vitality. It occasionally happens that a few pullorum germs are introduced to a group of baby chicks, either by way of the hatchery or by way of older infected fowls on the premises. Ordinarily chicks have a certain degree of resistance against mild exposure to this disease. However, when chicks become chilled or overheated, and are allowed to become hungry or thirsty, or if sanitary equipment and regular cleaning are not maintained, conditions become favorable for a serious outbreak of pullorum disease.

Coccidiosis

By making monthly blood tests of breeding stock it is possible to eradicate completely pullorum disease from flocks after 2 to 5 such tests. In the case of most chicken diseases such definite means of eradication are not possible. Coccidia parasites, for instance, are present in all commercial flocks of chickens. If the birds are not exposed to too many of these parasites at one time they gradually build up a resistance and the parasite is no longer able to survive in any appreciable numbers in the intestine. In the case of coccidiosis, therefore, control is not a question of eradication but of moderation in infection exposure. Overcrowding of birds during the developing period is almost certain to result in damaging coccidial infection. Providing roomy quarters which are maintained in a sanitary condition does much to keep infection at a minimum. Since clinical coccidiosis is believed by some authors to be a contributing factor in the development of fowl paralysis and its manifest syndromes, certainly every precaution to prevent its occurrence should be taken.

Poultrymen should not allow themselves to be victimized by salesmen offering for sale coccidiosis remedies. No such remedy exists.

Infectious Colds or "Coryza"

A disease of chickens which annually causes much economic loss is infectious colds or "coryza." Beginning with a muco-serous discharge from the eyes and nostrils, it is followed by sneezing, respiratory "rattling," and sometimes swelling about the face. It differs from laryngotracheitis in that clots of bloody fibrin are not found in the trachea (wind pipe). A yellow cheesy exudate may form around the opening to the wind pipe (larynx), in which event death from lack of air is likely to occur. The disease is apparently contagious and is most likely to occur soon after pullets are removed from range and placed in laying houses. Often there is a definite history of overheating or overcrowding preceding the outbreak. In the early fall when birds are first confined to laying houses, the mistake is often made of closing up the house too tight during the night. Any condition producing unfavorable ventilation may be sufficient to lower the resistance of the respiratory tract and if the coryza germ is present, trouble ensues.

Breeding cockerels or hens added to the flock from outside sources may introduce the disease even though they appear to be in good health. This danger may be partially overcome by segregating the additions for a time and placing with them several random picked birds from the main flock. If no symptoms of coryza are observed within 2 weeks, the additions may be regarded with reasonable certainty not to be coryza carriers.

When the outbreak is recognized early before many birds are affected, some producers have checked its serious spread by immediate and permanent removal from the flock of any bird showing respiratory symptoms. However, when a considerable portion of the flock become affected, such a procedure becomes impractical.

Inasmuch as recovered birds may be carriers of the disease, it is always advisable to allow no contact between pullets and older fowls. In some instances the disease reappears in the pullets each fall despite precautions exercised by the caretaker. Under these circumstances, when losses have been heavy, producers have been advised to dispose of all chickens on the premises 3 to 6 weeks prior to the purchase of chicks in the spring. In the interim, the poultry houses should be thoroughly cleaned and disinfected. Considerable success in removing virulant types of coryza infection from premises has been reported following such a radical depopulation procedure.

Vaccines and medicines have not been found effective in controlling this disease. Additional vitamin A, which can be most cheaply provided with bright green leafy alfalfa or fresh leafy plants in season, is useful in building up the resistance of the respiratory system against infections.

Lymphomatosis

Losses from the "lymphomatosis complex", continue to exert a greater drain on the industry than any other one disease. Some of the characteristics of this disease (if it is only one disease) are lameness, leg paralysis, internal tumors, water-bellies, blindness, and large livers. Although this lymphomatosis complex has received considerable study by various state and government experiment stations, no effective means of control has yet been developed. Certainly no medicine, vaccine nor mineral is now available which will cure or prevent this disease. The most promising development to date regarding control is the finding that some families of birds are more resistant to the disease than others. It seems likely that the future will see the development, on rather a wide scale, of breeding stock which is capable of surviving exposure to this disease. Most of the work conducted to date suggests that an infective agent is responsible for at least some of the phases of this disease complex.

Vaccine Available for Fowlpox and Laryngotracheitis

Space here does not permit the discussion of diseases such as fowl-pox and laryngotracheitis. Effective vaccines for these diseases are available but the indiscriminate use of such vaccines is unwise. It is well to consult some authoritative source before embarking on a program of vaccination. Vaccination should be carried out before the pullets come into production and should be executed under the direction of a qualified veterinarian.

It should be emphasized that sufficient knowledge is already at hand to increase egg production without increasing the size of the poultry unit. This can be accomplished by holding in check diseases which have been proved controllable. Methodical planning, constant attention to details and quick effective action in emergencies will produce results.

Mr. Herbert G. Folken, formerly assistant state representative of the Bureau of Agricultural Economics in Iowa, has been appointed Bureau of Agricultural Economics representative for Utah to take the place of Dr. Dilworth Walker, who has resigned to return to the University of Utah as head of the Department of Economics and acting dean of the School of Business Administration.
sulfuric acid to soften the hard seed coats. This permits the seed to absorb water and germinate. It is then planted in the greenhouse or in a cold frame where the young plants are provided with optimum conditions for growth until they are about 6 weeks old. They are then transplanted into well-isolated and protected seed increase plots. The purpose of the isolation is to protect the genetic purity and value of the strains, and to prevent contamination through mechanical mixture or by crossing with the common unimproved alfalas growing abundantly on practically every farm in the irrigated regions of Utah. The best isolation for small plots of the new alfalfa strains has been found in town lots, where there is comparatively little alfalfa growing. For larger plots or commercial fields, satisfactory isolation has been found in the dry land regions where wheat is the major crop and where much of the land is still uncultivated.

The isolation of the new strains from other alfalfa also affords them protection from insect pests of alfalfa, particularly the Lygus bugs which are known to damage the buds and flowers and to interfere seriously with seed setting. After the first or second year, however, the new plantings become so infested with the *Lygus* that seed production is less certain and yields are frequently greatly reduced. *Lygus* infestation is partially controlled on the smaller plots in town lots by frequent application of insecticide dust. This cannot be done economically in commercial seed fields, because of the high cost of insecticides and the necessity for frequent application.

Normally alfalfa does not set seed abundantly in the year of planting. However, by the use of special methods and careful attention to cultural requirements and insect control, the seed of new and improved strains has been increased from a few grams or ounces in the spring to as much as 40 to 50 pounds by fall. These initial quantities of seed have been used for the establishment of trial plots in nurseries of the agricultural experiment stations of many states. The new strains are there studied and compared in forage yield, disease resistance, winter-hardiness, habit of growth, and general performance, with practically all of the old standard varieties of alfalfa under a wide range of climatic and soil conditions. Strains that have proved their worth in preliminary tests, are advanced to where they are recommended for trial in commercial plantings on the farms.

More than one-half of the irrigated land in Utah is planted to alfalfa. It has been the best feed crop for general livestock production in the state, both in yield per acre and in the amount of digestible nutrients per unit weight. Prior to the onset of the bacterial wilt disease some twenty years ago, alfalfa grew well and produced abundantly under irrigation on all soils of reasonably good fertility. Since then the bacterial wilt or root-rot has materially reduced stands, acreage and total yields on many farms in all parts of the state. Through the persistent efforts of the Alfalfa Improvement Conference, new strains are being developed that hold forth promise of great improvement in alfalfa culture and production in many states.

An isolated spot in the Bear River valley which has been sown to an improved and wilt resistant strain of alfalfa. Extensive areas of native vegetation and uncultivated land, and its isolation from fields of other alfalfa makes this an ideal place for growing foundation seed of an improved strain whose purity and value it is desired to protect.

WILT-RESISTANT ALFALFA

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SUCCESS OF FARMS

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When only the farms, 208 of them, with butterfat in excess of 260 pounds per cow were considered, the average labor earnings were highest with the most cows for all three size groups.

**Number of Factors Better Than Average**

The six factors discussed above: size of farm business, rates of production, efficiency in the use of man labor, percent of the farm business in crops, intensity of the cropping system, and the number of cows, were probably the major factors accounting for the variation in the financial success of the farms. To be better than average in any one of these increased the chances of being more successful than average. But the best results were obtained by those farms that were better than average in all or nearly all of these factors. Each of the 442 records was rated on the basis of the number of factors, out of seven, that were better than average. No attention was given to which of the seven was better. The number of farms and the average labor earnings are shown in the table for the group of farms falling in each class.

These data indicate that it was necessary to be better than average in more than 3 factors in order to get average labor earnings. To be better than average in 5 or 6 factors practically insures financial success.
A NEW WHEAT VARIETY RESISTANT TO SMUT, RUST AND MILDEW DEVELOPED AT STATION

By D. C. TINGEY

A new variety of spring wheat resistant to loose and covered smut, rust and mildew is one of the latest developments in wheat breeding at the Station. The new variety was developed in cooperation with the Division of Cereal Crops and Diseases, U. S. Department of Agriculture.

The rust epidemic this season gave the variety a good opportunity to prove itself resistant. The common varieties, such as Federation, Dicklow, Erect and Baart, growing beside the new variety at Logan and elsewhere in the state, were all heavily infected with rust, whereas the new variety was completely free. As a result of the rust some of the spring wheat throughout the state was badly shrunk and materially reduced in yield. Although rust is considered to be a disease of minor importance in the state, except in a few sections, it has occurred in epidemic proportions four times in the last eight or nine years.

In addition to being resistant to diseases the new wheat also has strong straw so does not lodge readily and is resistant to shattering. Farmers growing it need not fear the loss of grain by shattering if harvesting is delayed. As a result of the non-shattering characteristics, it will also resist hail injury.

The new variety resulted as a hybrid from a cross between Hope and Federation.

Hope wheat, the one parent, is of little commercial importance in the United States because of poor yield and low quality, yet it has been used extensively as a parent in breeding work. Some years ago when breeding experiments for loose smut resistance began at the Utah Station, Hope was found to be immune to this disease. It is also highly resistant to stem rust, leaf rust, and mildew, and, when spring seeded, resistant to covered smut.

Federation, the other parent, introduced into the United States from Australia, is well known in Utah. It has been a leading variety in the state for nearly 15 years. It has the undesirable characteristics of being susceptible to all the above diseases, and tends to shatter if harvesting is delayed.

The new variety, which has not as yet been named, seems to have inherited most of the good qualities of both parents. The variety resembles Federation in general characteristics.

From 1938 to 1941, inclusive, the yields at Logan for Federation were 62.3, 64.7, 60.0, 42.2 bushels; for the new variety 69.2, 73.5, 75.7, and 57.1 bushels, respectively. It is apparent that in each of the four years tested the new variety has yielded higher than Federation. The average difference was 11.6 bushels. This year with the rust prevalent it yielded nearly 15 bushels more per acre. Tests in other parts of the state have shown similar results.

This year seed of the new variety was increased and at present there are about 40 sacks available for distribution for the coming season of 1942. This seed will be released under contract to prospective growers of certified seed through the State Crop Improvement Association. The fields will be inspected during the summer and if the variety continues to prove satisfactory the seed will be certified and released for general distribution in 1943.

Dr. Victor L. Israelson, who recently received his Ph.D. degree from the University of Wisconsin, has been appointed to fill the vacancy in the Department of Agricultural Economics left by Professor H. H. Cutler, who is spending the year in graduate study at the Iowa State College. Dr. Israelson is a brother of Dr. O. W. Israelson, research professor of irrigation and drainage.

Max Beal has been appointed to the new position of research assistant professor of agricultural marketing. Mr. Beal is a former student of this institution, has had three years of graduate study at the University of Wisconsin, and has worked in the marketing research division of Swift and Company.

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