Soil Surveying Fundamental to Efficient Land-Use Planning

Recent Establishment of Planning and Action Program Has Intensified the Demand for a Basic Soil Survey Throughout the State

By D. S. JENNINGS and LEMOYNE WILSON

If more efficient use is to be made of the farm lands in Utah, by both the present and future generations, specific and detailed information regarding the character and quality of soils is necessary. No permanent system of agriculture can be built up, land values established, or equitable taxation schedules outlined until the status of the land is determined. Particularly is this information now required by many state, federal, and private agencies.

These agencies must know the location and extent of good lands; they must know whether the subsoils are deep and pervious; whether the drainage and fertility are of such a character as to permit profitable returns to settlers and make possible the development of prosperous communities. Likewise, they must know the location and extent of the soils which create potential problem areas; areas with dense clay subsoils, hardpans, alkali accumulation, or other unfavorable factors, which would result in low yields and uneconomical returns. Soil surveys and their accompanying soil maps and texts provide this information. The soil survey also serves as a basis in the equitable and proper distribution and use of irrigation water.

Probably the greatest value of the soil survey, however, lies in the help it gives the individual farmer and land operator in the formation of a proper and adequate soil-management program on his farm. Available data and information from farmers throughout the state indicate that the soil productivity has declined, on the average, about 25 percent since the soil was first cultivated. This has been owing, in large measure, to a misunderstanding of the peculiarities of the various soils cultivated and their requirements in the way of management procedure for the maintenance of productivity. When soils are studied in detail in the soil survey and the information obtained is supplemented by physical, chemical and biological studies in the laboratory and also by field experiments with fertilizers and management methods, much can be learned regarding their proper management and the information so obtained would be helpful to every farmer.

The soil map, by delineating those soil areas that possess similar levels of inherent fertility and similar physical characteristics which together influence soil productivity, can be used by the farmer to guide him in the use of specifically recommended practices.

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VIRUS DISEASE OF PEACHES SPREADING IN UTAH

Fruit from Infected Trees is Undersized, Misshapen. Bitter in Taste. Ripens Early and Falls to Ground

By B. L. RICHARDS

The peach virus disease, or so-called X-disease, was first observed in Utah on chokecherry in 1937, and on peach in Box Elder County in July, 1939. Subsequent preliminary surveys during August 1939 showed the disease to be generally distributed in high percentages throughout Box Elder, Weber and Davis Counties. During 1940, Salt Lake and Cache Counties were added to the territory of known distribution. Insofar as we are now informed, Utah County and the southern peach areas of the state are free of the disease, but spread to these areas may be imminent and may take place at any time, if, indeed, it has not already done so.

The alarming extent to which the disease occurs in the area is shown from the fact that of 20 orchards visited in Davis County during the survey of 1939, only two orchards older than four years were found to be disease free. The average incidence of infection for the 20 orchards amounted to 23 percent of the trees planted. In five of these diseased orchards, more than 40 percent of the trees were infected, and in one of the latter, a six-year-old orchard, 68 percent of the trees were diseased. The disease was so severe in this particular orchard that all of the trees were pulled out and destroyed. In 1940, orchards have been found in which as high as 75 percent of the trees are diseased, and now other growers are considering elimination of their plantings.

Fruits from infected trees or infected portions of diseased trees are undersized, misshapen, bitter in taste, ripen early and drop from the tree.

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ADEQUATE VITAMIN-C INTAKE NECESSARY TO MAINTAIN HEALTH AND BUILD UP RESISTANCE TO DISEASE.

By ALMEDA PERRY BROWN

More than three-fourths of all students tested by the Department of Home Economics showed either borderline or poor vitamin-C nutrition. One hundred twenty-seven tests were made on students to determine the vitamin-C level of the blood plasma which is, according to many authorities, an accurate index of the immediate nutrition of a person with respect to vitamin C.

Healthy people having a good supply of vitamin C (ascorbic acid) in the diet have been found to have from 0.8 to 1.0 milligram ascorbic acid to each 100 milliliters of blood plasma. Figures within this range are therefore considered as indexes of adequate vitamin-C nutrition. When the blood plasma contains more than 1.0 milligram ascorbic acid to each 100 milliliters of plasma, it is taken as an indication that the body tissues are "saturated" with vitamin C (ascorbic acid). Persons having values from 0.8 mg. down to 0.4 mg. are considered in a borderline state of nutrition with respect to this factor. Those with less than 0.4 mg. are believed to be in a seriously undernourished condition.

With these indexes in mind it will be interesting and enlightening to examine the results of the blood plasma tests made by the micro-method of Farmer and Abt on Utah State Agricultural College students.

Of the 127 tests made:

- 9 or 7.1 percent showed 1.0 mg. or more vitamin C per 100 ml. plasma.
- 19 or 15.0 percent showed between 0.8 and 1.0 mg. or more vitamin C per 100 ml. plasma.
- 60 or 47.2 percent showed between 0.4 and 0.8 mg. or more vitamin C per 100 ml. plasma.
- 39 or 30.7 percent showed 0.4 mg. or less vitamin C per 100 ml. plasma.

Interpreting the above tabulation it is seen that only 7 percent of the tests show a state of tissue saturation with respect to vitamin C; only fifteen percent show a good or satisfactory state of vitamin-C nutrition. Thus it is seen that the tests divide themselves into two significant groups: the smaller, something less than one-fourth of the total, (7.1 percent + 15.0 percent) shows a satisfactory state of vitamin-C nutrition while more than three-fourths (47.2 percent + 30.7 percent) show either borderline or poor vitamin-C nutrition.

What does this mean in terms of health to the young people upon whom these tests were made? Except in a few cases marked by poor complexion and apparent fatigue there was nothing in their appearance to indicate subnormal health.

It is probable that there does not exist in Utah a vitamin-C (ascorbic acid) deficiency so drastic as to cause a typical case of scurvy, but the Hungarian scientist, Albert Szent-Gyorgyi, has pointed out that the absence of scurvy is not necessarily health. He illustrates this point by reference to two lots of experimental guinea pigs. Those in one cage had been made scurvy by means of a vitamin C deficient diet, the others had been given just enough vitamin C to prevent their developing scurvy. He reasoned that merely being able to sit up in a cage without apparent symptoms of scurvy does not warrant a conclusion of health. Before such a conclusion is reached the animals should be subjected to all sorts of strain, made to work, exposed to colds, toxins, infections, in order to find out at what level of vitamin-C nutrition they did best, that is at what level they received the greatest degree of protection. Other investigators have expressed this same idea, and substantiating it, clinicians have reported cases in which persons on low vitamin-C intake have gone on for indefinite periods without serious results, then through some unusual strain, such as a broken bone, a severe vomiting spell, have been plunged into active scurvy.

In recent years it has been observed by various investigators that in certain diseases the body uses much larger quantities of vitamin C than is normally used when the body is in good health. Such observations have led to the

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New Fruits for Utah Gardens
Promising New Summer, Fall, and Early Winter Apple Varieties

BY FRANCIS M. COE

Utah's apple industry has declined until it no longer adequately fills the demand for good apples for local and nearby markets. While surpluses occur in Jonathan and Rome Beauty in heavy crop years, the increasing demand for McIntosh, Delicious and early apples of good size and quality often remains unsatisfied. New plantings of those apples which are in demand are therefore needed. To furnish information on the many new varieties and bud sport strains being offered for planting, the following brief discussion of the new varieties which have fruitied in the Utah Agricultural Experiment Station orchards at Logan is presented.

New Early Apple Varieties

**Early Red Bird.** This extra early variety from Stark Brothers Nursery, Louisiana, Missouri, is of the Red Austrachan type, and ripens about a week before that popular culinary variety. The tree is large, vigorous, hardy (being a Russian apple), moderately productive, an annual bearer; fruit medium to above, fairly well colored with a red blush, good cooking quality, rather too acid for dessert purposes. It sells well before Red Austrachan is in heavy supply, but suffers neglect in the markets in competition with that variety. Suggested for trial for home use and limited planting in early locations.

**Close.** This new apple from the U. S. Department of Agriculture which has been under test for some years, is a large Red June type apple, evidently a seedling of that old favorite variety, which ripens with the early group. The tree is vigorous, upright-spreading, hardy; the apples are large, oblong conic, somewhat ribbed, well colored when allowed to become fully ripe on the tree, but drop badly and ripen unevenly like most early apples. The flavor is quite tart, and the apples become mealy when fully ripe. Limited tests indicate that this variety will probably sell readily as a fancy June type apple. The variety was named after Professor C. P. Close, a former early horticulturist of the Utah Station, who recently retired after a long career as extension horticulturist of the U. S. Department of Agriculture.

**Lodi.** A new variety of the Yellow Transparent type which resembles that variety closely, but appears to be larger in size, more spreading in tree habit, and possibly less susceptible to blight. Where Transparent is in demand, Lodi should be tried.

**Wilson June.** A large Red June type apple which follows that variety by two to three weeks and matures when attractive eating apples of good quality are scarce. Fruit is quite firm and keeps well for an early apple. Shape long conic, uneven ripening, and drops rather badly if left to color fully. This variety met with a ready demand at 90 cents a lug when carefully graded and packed for fancy eating apples. Tree upright, vigorous, hardy, somewhat tardy in bearing.

**Early McIntosh.** This promising new variety from the New York Agri-
cultural Experiment Station resulted from a cross of McIntosh and Yellow Transparent. It ripens midway between the two parents, resembles McIntosh in color, shape, and flavor, but is smaller and ripens over a long season, making it particularly desirable for home use. It is firm and keeps well for an early apple, and has the popular McIntosh flavor and aroma.

Late Fall and Early Winter Varieties

In recent years the McIntosh apple has risen to a position rivaling the Delicious in public favor and demand. Unfortunately in the warmer parts of Utah, McIntosh drops badly and does not color well during warm fall seasons. To remedy this fault and to supplement McIntosh as a high quality dessert and cooking apple several new strains and varieties of McIntosh type and breeding are offered as promising enough to warrant trial for local market and home use. They are Black Mack, Cortland, Macoun, and Sweet McIntosh.

**Black Mack** is a bud sport of McIntosh which colors a solid, washed red without the striping often found in the parent variety. It also appears to color earlier and to give a higher percentage of extra fancy fruit. The apples are large, attractive in shape and color, have the famous snow-white aromatic melting flesh of McIntosh. They appear to drop as badly as McIntosh, but may be picked earlier on account of earlier coloring.

**Cortland.** The most successful of the earlier New York Experiment Station's

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Left, Blackjon—a new earlier and darker coloring bud sport of Jonathan which appears to yield a higher percentage of extra fancy colored fruit than ordinary Jonathan, especially on shaded branches. Right, Sweet Delicious—a promising new apple for local market and home use.
ENLARGED RESEARCH PROGRAM REQUESTED

With the increased complexity of agriculture in Utah there is an added demand on the resources of the Station. Sound land utilization, efficient disease and insect control, economic soil conservation, range rehabilitation, better adapted fruit and vegetable crops are all dependent upon constructive research. As these problems expand in scope there is an ever increasing demand for new investigations.

Requests for the investigation of new problems are constantly being received. These include appeals for investigations of the bee losses in recent years, for the control of potato diseases and pests, for soil and irrigation surveys, for better fruit and vegetable marketing methods, for more hardy fruit trees that will withstand the cold winters of the higher valleys, for improved grazing practices, for better livestock management practices to increase lamb and calf crops.

Improved Research Facilities Needed

In order that the research program may in some way be commensurate with the magnitude of the agricultural problems requiring investigation more adequate research facilities should be provided. The present research staff should be supplemented in a number of places. More and better equipment is needed in many laboratories. More land for experimental research involving soil conservation, land use, fertility, crop improvement, disease control, irrigation and other problems where soils must be used is indispensable.

At present the Experiment Station rents 140 acres of land. It is a questionable procedure to continue long-time fundamental experiments on leased land, which may be withdrawn by the lessor. Heavy losses may occur in breaking the continuity of crop and soil experiments.

It is recommended that a ten-year land purchase program be developed in which necessary experimental land may be purchased and partly financed with funds now used for land rentals.

Funds Not Adequate To Meet Needs

These needs cannot all be met with the present inadequate funds granted to the Station.

Nearly two-thirds of the funds used in the pursuit of research in agriculture in Utah are supplied by the federal government. While the average amount made available by the federal government throughout all the states is only one-third of all funds. This does not include salaries nor expenses of federal employees on the campus, which come directly from Washington, but only money appropriated directly to the Station through four federal acts, the Adams Act, the Hatch Act, the Purnell Act and the Bankhead-Jones Act. Less than 25 percent of the money used for experimental purposes comes from direct state appropriation. Only as the state realizes the value of research to agriculture progress and thereby financial success, and appropriates money adequate for the needs of the program can the Station keep abreast of the many problems facing the agriculture of the state, and thereby find solutions which will help make a prosperous agriculture and free and contented rural peoples.

Experiments at the Station have shown that common crops such as sugar beets, alfalfa, pasture, tomatoes and peas give an outstanding response to the use of superphosphate fertilizer or other fertilizer containing available "citrate soluble" phosphorus. The response is nearly universal in most portions of the southern and eastern part of the state and is frequent in most other portions. Tests show that the soils -- except perhaps in southern Utah -- are not lacking in total phosphorus content, but that their phosphorus is in a form unavailable to the plant. The decomposition of manure in the soil will react with the phosphorus which is already there to make it available to the plant, but where manure is not to be had in sufficient quantity superphosphate may be substituted, at least in part, with good results.
TILE DRAINAGE NOT ADVOCATED FOR LAND OVERLAYING AN ARTESIAN BASIN

This Type of Land Can Be Drained by Pump Wells

By WILLARD GARDNER

WATER seeks its own level and it is therefore natural to assume that it should find its way into tile drains. However, when water is confined under pressure in a water-bearing stratum “seeking its level” does not mean that it will move downward. As a matter of fact it will continue to seep upward through the overlying clay so long as the pressure is maintained. It would be possible by placing the drains sufficiently close to intercept all this upward moving water and thus prevent water-logging. However, a careful study of the theory of the movement of underground water, supplemented by model tests in the physics laboratory, leads definitely to the conclusion that drainage by means of tile drains would be wholly impracticable for many cases of this kind.

Typical results of these laboratory tests are vividly portrayed in the accompanying figure. If the reader will imagine a stratum of water-bearing gravel buried fifty feet beneath the surface by a continuous overburden of clay, with 9-inch tile drains placed at a depth of nine feet below the surface and 164 feet apart, the water seeping slowly from the gravel upward into the drains, he can get a fair idea as to the significance of the illustration.

The illustration shows a small laboratory model simulating the case described, having been constructed in such a way as to exhibit with coloring matter the course of the water as it seeps upward into the drain. The right-hand edge of the figure is midway between two drains.

An interesting feature of extremely practical importance is the fact that seven of the ten paths shown lead to

NEW FRUITS

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introductions, Cortland is well liked by growers who have planted it in Cache Valley. It resembles McIntosh closely in fruit characters and is often sold and accepted as McIntosh although the flesh is hardly as tender and melting. The trees bear earlier and more heavily, and hang better than the parent variety. They are annual bearers, and tend to set in clusters. Cortland is from a cross of McIntosh and Ben Davis and is worthy of trial for local market use.

Macoun. A seedling of McIntosh, Macoun closely resembles the parent variety in fruit characters, but differs in ripening somewhat later, keeping better, and hanging better to the tree. The fruits color better, more solidly, and reach a darker lustrous red color which makes them especially attractive. They are firmer and stand handling better than the tender McIntosh fruit, and are slower in softening. These characteristics make the variety appear promising to follow McIntosh on the market and out of storage.

Sweet Apples

Utah needs a good red sweet apple to take the place of the old fashioned Golden Sweets and others now dying out in the older plantings. To bring sweet apples once more to Utah homes, the Station suggests two new varieties for trial—Sweet Delicious and Sweet McIntosh.

Sweet Delicious. This new sweet apple from the New York Agricultural Experiment Station is from a cross of Deacon Jones by Delicious. It is rounder than Delicious, of good size, meaty, a good bearer and good keeper. Suggested for both home use and local market trial.

Sweet McIntosh. This new McIntosh seedling from the New York Agricultural Experiment Station is a large flat sweet apple of excellent quality. As it does not color well in the Station orchard at Logan, and drops rather badly, it is suggested for home use, although it may be successful in a limited way for local market where its sweet flavor may appeal to consumers in spite of its light pinkish color. The tree appears to be vigorous, hardy and productive.

Delicious and Jonathan Budsports

Starking, Richared. Shottwell Delicious. These three budsports of Delicious appear to be replacing the older striped Delicious in new plantings because of their solid and earlier coloration, which appears to amply justify preferring them to the original Delicious. So far no accurate comparisons have been possible to determine whether one of these budsport strains is preferable to the others. Planters should be warned, however, that these budsports will not pollinate the Delicious nor each other, hence some other good pollinizing variety of the same blossoming season such as Jonathan, Golden Delicious, or Winter Banana should be planted for pollinizers.

Blackjon, Jonared. These new budsports of Jonathan appear to color earlier and better than the common Jonathan, especially in the lower branches permitting earlier harvesting and less trouble with breakdown in storage.

Inadequately drained land; one-half drain section corresponding to a drain-spacing of 164 feet. (Taken from a technical article published by Dr. Ddn Kirkhctm of the soil physics laboratory in the 1940 Transactions of the American Geophysical Union, p. 592.)
The foundation of progress in agriculture as in any other industry is research. Research has resulted in knowledge now daily applied in soil treatment, in irrigation practices, in dealing with insect pests, in breeding new varieties of plants, in animal improvement, in better farm practices, and in better land-use planning. Research undertaken by the Utah Agricultural Experiment Station has been outlined to solve specific problems facing Utah agriculture, among them the problems of irrigation, dry farming, range management and animal production, control of insect pests and plant and animal diseases. The prosperity of the state is dependent upon the success of these agricultural enterprises.

Agricultural research is a necessity, not a luxury to be marked for elimination, or materially decreased support, every time the state or nation is faced with an emergency. Money spent for research is an investment. Any critical examination of returns obtained from the public’s investment in agricultural research in the past 40 years will show it has given and still is giving excellent returns. Present annual expenditures will undoubtedly yield high returns.

The total spent for agricultural research by the United States Department of Agriculture and the 48 states was only about 20 percent as much as that spent last year by the industrial organizations of this country. A study of the amounts spent by industry and by the state and federal research agencies shows that not only is private industry spending more than five times as much for research annually than are the agricultural agencies, but that industry has spent as much or more during the past three years than the combined agricultural agencies have spent during the past forty years.

The progress of research is necessarily slow. Experiments must be carried over a period of years before definite conclusions can be drawn. On the average, it is about eight years before a successful research project attains the profit stage. Moreover, its success may be based on fundamental discoveries that were a half century or longer in development.

Utah’s Varied Agricultural Area

Utah has a small but varied agricultural area. Only about 2.5 percent of the total land area of the state or less than one and a half million acres is used for irrigated agriculture. About one percent of the area is in dry farms. A little less than one half (47.4 percent) of this cropped land is in alfalfa and an additional 12 percent in grass and wild hay. Not quite one third (31.8 percent) of the total acreage is in grain. Sugar beets occupy 4.4 percent and potatoes 1.5 percent of the cropped acreage. This leaves less than 5 percent for vegetables, fruits and all other crops. About 92 percent of the land of the state is designated as grazing land which is valuable only for the grazing of livestock. Therefore, any research program must take these facts into consideration in planning points of attack.

Utah has a mean average temperature of 48 degrees F., but the temperature varies in different parts of the state from 59 to 38 degrees. The
Problems of Economic Runners

The length of the growing season between the latest killing frost in spring and the earliest autumn is from 185 to 200 days in "Utah's Dixie"; 150 to 160 days in the principal agricultural valleys; and 80 to 90 days in the higher agricultural valleys. The average growing season for the state is about 128 days or approximately from May 20 to September 25.

The state has a general average precipitation of 19 inches, consequently irrigation from impounded waters or mountain snows must be depended upon for the growth of all crops outside of 500,000 acres of dry-farm land where crops, mostly wheat, are grown every other year. About 50 percent of the annual precipitation occurs from January to May, inclusive, and 25 percent from June to September.

Scope of the Research Program

These varied conditions throughout the agricultural area of the state require a broad research program to be adopted by the Station. And although the Station has neither personnel nor financial resources to attack all the problems needing solution the scope of the work is wide. There are 76 major problems on which investigations are now being conducted in cooperation with various federal and state agencies. Some of the more outstanding results of the experimental work on these projects that can be put to use immediately by farmers to improve their agricultural practices are listed in the next few paragraphs.

1. The Physics Department, as a result of long years of empirical research, has discovered information that may completely revolutionize drainage systems now in use. It has shown first, that land which is waterlogged as a result of artesian pressure can be drained economically only by vertical pump wells. In other types of waterlogged

land the tile drains should never be placed immediately next to an impervious layer if a maximum drainage flow is desired.

2. Studies in agricultural economics have shown that farm income and the success of the farm business in Utah are closely related to crop yields and rates of production from livestock. Farms, to be successful, must have greater total yields, either through the addition of more land, increased yields per acre, or more intensive use of present acreage by growing more intensive crops or raising livestock.

Among the factors accounting for success in sheep and cattle ranching, two of the most important are lowered death loss and higher lamb and calf crops.

3. Effective methods of weed control have been found by the Agronomy Department whereby most of the noxious weeds of the state may be controlled. These methods may be used alone or in combination according to the condition: (1) chemicals (sodium chlorate, atrazine, and carbon bisulfide seem the most promising) used only on small areas because of cost, (2) clean cultivation for two years gives good control with a minimum of cost, (3) combinations of cropping and cultivation. Some perennial crops involving grass mixtures or such plants as smooth brome and Reed canary have shown promise as being able to compete favorably with whitetop and morning glory.

4. More has been accomplished in the soil survey and land classification work during the past biennium than any other like period in the past. Five hundred and twenty square miles were surveyed in the Uinta Basin, 228 square miles in Utah County, 270 miles in the Beryl-Enterprise Area and 804 square miles in Sevier, Sanpete, Juab, and Millard Counties.

5. Strawberry clover has been found by the Agronomy Department to be suitable for planting in wet locations including those with some alkali.

6. Investigations by the Animal Husbandry Department on the feeding of ewe lambs on the farm the first winter have shown that such lambs gain more, produce more and better grade wool, and are more efficient in breeding.

7. Chlorosis in Concord grapes in Utah can be controlled by grafting of the Concord scions on vinifera rootstocks. This remedy for the control of chlorosis in grapes was found by the Botany and Plant Pathology Department after years of study.

8. Varieties of tomatoes have at last been developed that are resistant to curly top (western yellow blight) disease. However, these strains do not have the qualities of a commercially desirable tomato. This is now the problem of the plant breeders working on this project—to produce a tomato with an adequate degree of resistance with commercially desirable qualities. Work is also progressing on the production of a tomato resistant to Verticillium wilt.

9. A new process has been evolved by the Bacteriology and Biochemistry Department whereby the Jerusalem artichoke may be used as a source of raw material for the fermentative production of dextro-lactic acid for use in food and beverage products and poultry and stock feeds.

10. One percent rotenone bearing derris and cube dusts have been found by the Entomology Department to be effective insecticides for the control of the pea aphid in Utah.

11. Motor lubricating oil has been

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What is a Soil Survey

Soil surveying consists of the examination, classification and mapping of soils in the field. The soils are examined systematically in many locations. Test pits are dug, borings are made, and exposures, such as those in road or railroad cuts, are employed in order that subsoil as well as the surface may be studied in detail. The color, structure, porosity, consistence, texture, and content of organic matter, gravel and stones are noted. Drainage, both internal and external, and other external features, such as relief, or lay of the land, are taken into consideration, and the interrelation of soils and vegetation is studied. Then samples of the soil are taken to the laboratory to determine the degree of alkalinity or acidity, and also to make other chemical analyses.

The Soil Maps

The soil surveyor makes three maps of the area. The first shows the location of each of the soil types, phases, and miscellaneous land types, in relation to roads, houses, streams, lakes, section and township lines, and other local cultural and natural features of the landscape. This map classifies the soils according to their inherent physical and chemical characteristics just as animals and plants are classified into species or varieties and does not indicate directly their agricultural-use value. This classification does give, however, a fundamental basis upon which the soils may be classified according to their potential agricultural value. The second map indicates the alkali content of the soils throughout the area. The third is a land classification map and is based upon the information contained in the first two. It presents a classification of the soils according to their present and potential agricultural value for general farming under irrigation in which the grain crops, alfalfa, beets, potatoes and similar crops predominate. The land classification map includes six classes of land. Classes 1, 2, and 3 make up the total of arable land. Classes 4, 5, and 6 are non-arable; however, class 4 land is largely temporarily non-arable, and may at some future time be improved sufficiently to be rated as arable land. This classification may not apply in certain cases for specialized crops.

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VARIATION IN PROTEIN PERCENTAGE OF
WHEAT THE RESULT OF ENVIRONMENT

Moisture, Temperature and Soil Are Important Factors
in Determining Quality in Wheat

By A. F. BRACKEN

Millers and farmers generally know that quality as determined by protein percentage is a variable characteristic of wheat. It may show changes from year to year, from farm to farm, and from area to area. Much experimental work has been done to determine the factors responsible for these differences and, while all of the results are not in agreement, yet the information now available is sufficiently conclusive to explain most of the variations found to occur in the protein content of bread wheats.

The protein content of wheat is determined to a large extent by the environment in which the crop is grown, that is the climatic and soil conditions.

It has been found that protein largely accumulates in the wheat kernel during the early stages of growth with the percentage of starch increasing with maturity. This being true, it is obvious that any external conditions which prolong maturity will tend to increase the amount of starch and decrease the protein percentage. Conversely, an environment which hastens maturity favors the production of wheat of higher quality. Either lack of water or high temperatures acting alone or in combination, before and at the time of maturity, forces the crop to ripen rapidly, thus tending to increase quality. This condition is characteristic of the dry farms of the Intermountain Area and the wheat belt of the Great Plains. In humid sections, such as found in Europe, in the eastern wheat area in the United States, and under irrigation in the West, wheat of lower protein percentage is usually produced owing to greater moisture supplies. It must be stated, however, that high quality wheat is not always produced on the dry farms and wheat of low protein percentage under irrigation. This was true during the past season. No rain of any value to dry-farm wheat fell from the last of April until the crop was ripe, and temperatures during the latter part of June when winter wheat was ripening were unusually high. The low moisture supplies combined with high temperature ordinarily would be considered favorable for the production of dry-farm wheat of high quality. On the contrary this year’s crop was generally of poor quality with protein falling as low as 8 percent. On the other hand some of the winter wheat grown under irrigation was in demand because of high quality. This indicates that in addition to climate, the soil must be considered as a factor controlling, in part, the protein content of wheat.

Effect of Soils

Since protein formation is largely dependent upon nitrogen, it is obvious that soils well supplied with available amounts of this element may produce wheat of high quality, provided climatic conditions are favorable. A number of experiments have been reported showing the effect available nitrogen has on quality as well as the yield of wheat. Most of the data indicates that when available nitrogen in the form of sodium nitrate, calcium nitrate, or ammonium sulfate is supplied to soil significant increases occur in the protein percentage and yield of wheat.

In respect to the relationship between soil moisture and available nitrogen it has been found that a high moisture content in the soil with enough available nitrogen for maximum growth and development of the wheat plant results in high yields of wheat with a high percentage of protein. A high or optimum moisture content in a soil having considerable nitrogen available for the plant in the early periods of growth, but not enough during the fruiting and ripening periods for maximum production, results in a high yield of wheat with a lowered protein content.

During the past season sufficient nitrogen was available on the dry farms to support a comparatively high yield but the amount was not enough to give the crop a high protein content; in spite of weather conditions which are usually considered favorable for the production of high quality grain. On the other hand, if yields had been lower with not so much vegetative growth, quality of the wheat would have been higher. In other words, high yields are usually associated with lowered quality and low yields with higher quality, however, reversals of this may occur.

When winter wheat grown on irrigated land has a high protein content one of three possibilities may account for the response. The land may have been previously manured, or alfalfa may have been grown previously, or in event neither of these conditions prevailed the added moisture supply stimulated nitrification to a point that sufficient nitrogen was available, along with favorable atmospheric conditions, to favor production of high quality grain.

Alfalfa Increases Nitrogen in Soil

Even though application of nitrogen can be depended upon generally to increase yield as well as quality of wheat, such treatment likely would prove unprofitable under most conditions because of the high cost of the fertilizer. A more practical solution of the problem is the application of barnyard manure in amounts of 5 tons or more to an acre or inclusion of alfalfa in the rotation. At the Nephi Dry-Land Station wheat grown on land receiving no manure had a protein content of 11.5 percent, on land receiving 5 tons manure the protein content was 13.67 percent, and on land receiving 10 tons of manure each alternate year the protein content was 15.22 percent. However, it must be admitted that this type of treatment is limited, particularly on dry farms. Growing of alfalfa appears to offer the best practical solution to the problem. Land on which alfalfa has been grown for two years has been found to produce increased quality of wheat for the eight following seasons. Alfalfa, however, apparently does not produce a maximum nitrogen accumulation until grown for four or more years on the same land. Under such conditions a favorable residual effect on quality of wheat should be more pronounced and continue over a longer period of time.

In addition to environmental conditions which are responsible for influencing the protein content of wheat, varieties vary in this respect. At the Nephi Dry-Land Station differences of 1.5 to 2.0 percent have been found to occur between varieties with Turkey, Utah Kanred, and Kharkof usually high.
AGRICULTURAL RESEARCH

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found more effective as a moistener of poisoned bran in bait for Mormon cricket control than water. Tests also indicate that sodium fluorosilicate and sodium fluoride are better as poisons for cricket baits than paris green and sodium arsenite because they are not repellant to crickets as are the latter two poisons.

12. Cheese cloth covers to protect tomato plants over the period of spring dispersals of leafhoppers have been found to reduce substantially the amount of curly-top injury. They also protect the plants from late frosts. Although the initial cost of the covers is rather high they may be used for a number of years.

13. Placing two tomato plants in each hill gave 44 to 59 percent reduction in curly top damage during 1939 experiments and produced yields sufficiently greater to pay for the extra plants used.

14. Tomatoes do not decrease in vitamin C value with storage either at room temperature or in the refrigerator. Tomatoes from vines supported on poles were found higher in vitamin-C content than those from vines not supported presumably because of the greater amount of sunlight received by the tomatoes on poles. These conclusions are the results of a study conducted by the Department of Home Economics.

15. Methods of preservation of Utah fruits and vegetables by freezing is a new project being sponsored by the Station in cooperation with the U.'s. Bureau of Agricultural Chemistry and Engineering and a number of commercial concerns. These frozen products are being used in beverages, ice creams and sherbets, as well as for table use. Peaches, apricots, cherries, Satsuma and Santa Rosa plums, raspberries, strawberries and boysenberries are among the most promising fruits for freezing.

16. Final measurements by the Horticulture Department of sweet cherry trees at the end of nine seasons' growth show the marked superiority of Mahaleb rootstocks over Mazzard and Stockton Morello for cherry trees in this region.

17. Turkey feeding experiments have demonstrated to the growers in the state that Utah-grown feeds are cheaper and just as good when measured in terms of finished weights, in condition of birds at market time, in pounds of feed required to produce a pound of gain or in livability. Mashes containing 17 to 18 percent of protein gave as good results as mashes containing a higher percentage.

18. Too early and too heavy grazing on range lands reduce the density of the plant cover, the seed produced, the root depth, and the weight of the roots. The Range Management Department also found that the quality of sugar and starch stored in the roots of late grazed plants was materially greater than that in the early grazed, thus giving such plants a poor food reserve to begin growth the next year.

SOIL SURVEYING

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which require or may grow vigorously in certain soil types not well suited for general farming purposes. For example, some of the fruit crops may grow well and be productive on gravelly soils that are not well suited to general farming, and which are not given a high potential productivity rating.

The United States Department of Agriculture through the Bureau of Plant Industry and the Soil Conservation Service cooperates with the State Agricultural Experiment Station in making these surveys. Other government bureaus have assisted with this work from time to time as well as the State Planning Board, which has been of material assistance through its WPA projects during the past few years.

Present Needs

The need for soil survey work in Utah has rapidly increased during recent years. This is shown by the fact that numerous requests are being made to the Experiment Station for this type of work.

The most insistent demands are made by local county planning committees. Urgent requests have been received recently from Iron County, Box Elder County, and Davis County. Other agencies that require soil survey information and are asking for the extension of the work include such state and federal agencies as the State Planning Board, the Soil Conservation Service, the Farm Security Administration, the Bureau of Agricultural Economics, the Bureau of Reclamation, and other organizations engaged in various types of economic planning.

As previously noted, soil surveys were started and partially completed in connection with the Colorado River-Great Basin Project. This work should be completed and the maps and reports published at the earliest possible time. These areas are: Sanpete County, Sevier County, the Juab Valley and the East Millard County Area.

The soil survey work has been conducted in Utah with limited funds and personnel, and as a result many requests for the extension of the work have not been met. It is evident that the time has arrived for increased funds for this work if the needs of the state are to be met.
VIRUS DISEASE OF PEACHES
(Continued from page 1)

It is interesting to note that trees once infected do not recover, neither are they completed killed by the disease, but live on and constitute reservoirs of the infectious virus that threaten neighboring trees and finally the entire orchard.

The exact cause of this new peach disease was not known prior to 1940. Experimental studies in Bountiful this year, however, have yielded results and it can now definitely be announced that this malady is transmissible and contagious, and that it is caused by a definite virus similar in nature to those viruses that cause such animal diseases as hog cholera, mesails, small pox, hoof and mouth disease, and to the virus or degeneration diseases of the potato.

As was indicated previously, there is some evidence that this same virus which affects the peach also affects the chokecherry and possibly other members of the stone fruit group.

It might be of interest, at this point, to call attention to the fact that no research studies have ever been made on fruit diseases in the State of Utah. This fact explain why such diseases as this virus disease of the peach frequently attain proportions of great magnitude prior to detection or discovery. It is unnecessary, therefore, to stress the need for money to promote such investigations on fruit diseases in Utah.

Workers in the United States Department of Agriculture have become

VITAMIN-C NUTRITION
(Continued from page 2)

theory, now grown into practical certainty, that in some way, not entirely understood as yet, vitamin C assists the body in resisting infection. Among those diseases in which vitamin C requirements are increased are diphtheria, tuberculosis, rheumatic fever, tonsilitis and common colds, in fact many diseases which are accompanied by an elevation in body temperature.

Stefánsson, the explorer, whose experience with scurvy qualifies him to speak with authority on the disease, has described the early symptoms of vitamin-C inadequacy to be laziness, and irritability which manifests itself in unwarranted argumentativeness. Hess, a New York pediatrician who during his lifetime doubtless had as

much or more experience with various degrees of vitamin C deficiency than anyone else in the United States, describes as early symptoms "tiredness," shortness of breath, unwarranted fear or apprehension, and a peculiar muddy pallor of skin.

This then, is the health significance of low blood plasma vitamin-C levels among students: the chance of lowered efficiency through constant fatigue, a threat of impaired bodily function in the resistance to infection, and the probability of impaired mental health through a continued feeling of irritability and of apprehension.

Over most of the state nitrogen fertilizer may be added to, or substituted for, manure for better growth of grasses, grains, fruits, small fruits, vegetables and similar products. Ammonium sulfate is the most widely used inorganic nitrogen fertilizer

associates in the Bureau of Plant Industry and by plant pathologists in the states where the studies were carried on.

During the course of this survey, it became evident that the fruit industry in several northwestern states is faced with a serious economic problem owing to the prevalence of contagious virus diseases that spread through the orchards and cause losses in crop production, in orchard trees, and in nursery stock. Particularly the peach and some other stone fruits are threatened at the present time.

Intelligent control of virus disease in fruit trees can be based only on thorough research into the symptom manifestations, varieties and ages of trees affected, susceptible and immune hosts in horticultural and wild plants, rate of spread, parts of the plant infected, incubation period of the disease in the tree, and many technical points that are studied in both field and laboratory. Experimental plots where large numbers of nursery trees may be subjected to artificial inoculation under controlled conditions are essential to such research.

Not only the studies on virus diseases already wide-spread, but also investigations on new virus diseases before they get beyond immediate control, are of the utmost value to the fruit industry.

In the half century since the Experiment Station was established the results of experiments conducted have been published in 293 bulletins, 114 circulars, and 76 leaflets. In addition numerous articles have been written by staff members for publication in scientific journals, farm magazines and newspapers.

These publications have dealt with a wide variety of subjects including crop and livestock production, soil management, irrigation and drainage, rural, social and economic conditions and home economics. Many of the bulletins and circulars are still available and may be obtained free of charge. A list of available publications may be obtained upon request at the Bulletin Office of the Agricultural Experiment Station.

here and is especially adapted to Utah soils because of its rather acid residue.
FEEDING OF EWE LAMBS DURING THEIR FIRST WINTER IS RECOMMENDED

Feeding Produces Larger Gains, Greater Wool Yields, Longer Staple, Lower Death Losses and Higher Fertility

By ALMA C. ESPLIN, MILTON A. MADSEN and RALPH W. PHILLIPS

Increased cost of production of meat and wool has made necessary an increase in production per sheep if a profit is to be made. Fifty years ago, sheep in Utah returned a profit to the operator with four and five pound fleeces and 30 to 40 percent lamb crop. The cost of production per sheep was 25 to 75 cents while now it is approximately $5 to $7 per sheep.

Profitable management today must include feeding and breeding in all details. The elimination of dry ewes (ewes not regularly producing lambs) must be practiced, and ewes should start production in their second year.

The first phase of the study was conducted to determine the effects of feeding range ewe lambs during their first winter. During each year a group of 50 lambs was marked and maintained in the original range herd as controls, and 25 ewe lambs were placed in each of three groups for feeding. The lambs which were fed during the winter were returned to the original herd in the spring. The results show:

1. Greater gains were made by the lambs which were given special feed during their first winter. Groups that were fed gained 21, 27, and 25 pounds, compared with 10 pounds in the range group.

2. Most of this advantage in weight was lost when these lambs were put on range the following summer, since they weighed only slightly more than the range lambs at breeding time. Gains from the beginning of the feeding period to breeding were 36, 39, and 37 pounds in the groups that were fed; and 35 pounds in the range group.

3. Greater yields of unscored and scoured wool were obtained from the lambs which were fed. The yields of scoured wool were 4.1, 4.0, and 3.7 in the groups that were fed, and 2.6 pounds in the range group.

4. The staple was significantly longer in fleeces of the lambs which were fed, averaging 2.34, 2.26, and 2.19 inches in these groups as compared with 1.87 inches in the range group.

5. Death losses were less in the group receiving special feed during their first winter, being 1.3 as compared with 10.0 percent in the range group. Losses from the beginning of the feeding period until breeding time the following fall were 8.0 percent in the groups that were fed, and 18.0 percent in the range group.

6. The percentage of ewes lambing at two years of age, of those alive at breeding, was 64.7 in the groups that were fed, and 45.5 in the range group. This significant difference in lamb yields was obtained as a result of feeding during the first winter, even though the greater gains in weight owing to feeding had been lost by the beginning of the breeding season. (See items 1 and 2 above).

The increased yields of wool and lambs in the first year did not pay cost of feed under experimental conditions but was sufficient to pay under favorable conditions on farms. Increase in wool yield and length of staple, lower death losses, and heavier lamb crops in the succeeding year point to a need for early maturity in range ewes in Utah.

College series No. 602

Ewes being put through counting chute at cooperators ranch