ANNUAL SUMMARY OF PUBLICATIONS

Circular No. 78 contains a summary of publications issued by the Utah Agricultural Experiment Station, through its Division of Publications, for the fiscal year beginning July 1, 1928. The publications of this Station are no longer sent to a general mailing list (except in cases of libraries, state editors, county agricultural agents, state vocational agricultural teachers, and state agricultural inspectors), but are sent only on request. Therefore, copies of any of the publications listed will be sent without charge to those requesting them as long as the supply is available. However, in the case of reprints (abstracts of scientific and technical papers) the supply is very limited, and the requests for these should be confined as far as possible to those only who are especially interested in this phase of experimentation.

Check those publications desired. FILL IN NAME AND ADDRESS in space provided above (write legibly), place this circular in a stamped envelope, and return to Division of Publications, Utah Agricultural Experiment Station, Logan, Utah, U. S. A.

BULLETIN 208—AN ECONOMIC STUDY OF THE APPLE INDUSTRY IN UTAH, 1926 AND 1927.

W. P. Thomas and P. V. Cardon

A thorough analysis of the apple situation in Utah comprises this bulletin. The apple industry of this state is studied from a regional and national as well as from a local standpoint, so that apple growers are given a picture of Utah's industry in all its important stages from tree-planting to the consumption of Utah apples in distant markets. The completeness of the study reported is indicated by the following chapter headings: Trends since 1900 in apple production in the state, the northwest, and the United States; influence of excessive plantings on prices; returns to growers; the relative purchasing power of the Utah apple dollar; geography of
Utah's apples on major markets, acre-yields in Utah and competing states; relative net returns; and general outlook for apples in the state. This survey of Utah's apple industry was conducted cooperatively by the Utah Agricultural Experiment Station and the U. S. Bureau of Agricultural Economics.

**BULLETIN 209—BIENNIAL REPORT, JULY 1, 1926 TO JUNE 30, 1928**

William Peterson

Seventy different lines of agricultural research are reported in this biennial report. These investigations range from experiments in the curd character of milk and its relation to infant nutrition to studies in marketing Utah's apples and the effect of fertilizers on Utah soils. It reports substantial progress on many problems of major importance to the farmers and homemakers of the state. Included in the report is a brief tabulated summary of the experimental farms operated by the Utah Experiment Station. The general purpose of this biennial report is to present a brief review of the administrative, research, experimental, and other activities of the Station during the 2-year period designated.

**BULLETIN 210—THE MINERAL CONTENT OF GRAINS**

J. E. Greaves and C. T. Hirst

A rather comprehensive study of wheat, oats, barley, and corn grown under varying conditions in Utah shows a marked variation in their ash, calcium, magnesium, potassium, phosphorus, sulphur, and iron content. The factors causing this variation are: (1) Irrigation water applied during the growing period, (2) nature of soil on which the grain is grown, (3) variety of grain, and (4) probable locality. It is suggested that the great variations found may be of fundamental importance in the nutrition of man and of domestic animals.

**BULLETIN 211—SILAGE CORN VARIETIES FOR UTAH**

George Stewart and A. L. Wilson

Silage corn varieties were tested for six years at the Davis County Experimental Farm, Farmington, Utah. Since the soil was rather variable, precautions were taken to reduce the experimental error. The conclusion was reached that for the soil type on which the test was conducted, Boone County White was a higher yielder by 25 to 30 per cent than was Improved Learning, the variety ordinarily grown in the vicinity. The yield of ears and the degree of maturity was obtained, the grain yields being considered more important than the coarse forage yield. At the end of the experiment, Boone County White had an average yield of 16.71 ± 0.45 tons, and Improved Learning 13.22 ± 0.29. This is a difference of 3.48 ± 0.54 tons, which is 6.6 times the probable error. The odds are several thousands to one that Boone County White will regularly outyield Improved Learning on the kind of soil on which the experiment was conducted. This soil was sandy loam and gravelly loam. About half of the land in central Utah is of this type. On heavy lands Improved Learning should be continued for silage corn as Boone County White is too late. Early planting of Boone County White insures greater maturity without undue frost risk in spring.

**CIRCULAR 73—ANNUAL SUMMARY OF PUBLICATIONS**

Blanche Condit Pittman

This circular contains a summary of publications issued by the Utah Station from July 1, 1927, to June 30, 1928. In this circular the following bulletins and
circulars are summarized: Bulletins Nos. 203, 204, 205, 206, and 207; Circulars Nos. 68, 69, 70, 71, and 72. Seventeen abstracts of technical articles appearing in nine different technical scientific publications are also included in the summaries given.

CIRCULAR 74—RULES AND REGULATIONS FOR THE FIFTH UTAH INTERMOUNTAIN EGG-LAYING CONTEST
Byron Alder

This circular contains necessary information for entering the Fifth Egg-Laying contest conducted by the Utah Station beginning November 1, 1928, and ending October 24, 1929, a period of exactly 51 weeks.

CIRCULAR 75—SELECTING DAIRY COWS
George Q. Bateman

Three aged grade dairy cows were chosen as types upon which accurate records were kept as to the amount of feed consumed, the return in milk and butterfat, the feed cost per hundred weight of milk and per pound of fat, and the amount returned for each dollar expended for feed. These records were kept during a total lactation period from freshening date to freshening date.

CIRCULAR 76—THE UTAH AGRICULTURAL EXPERIMENT STATION
P. V. Cardon

This circular briefly describes the Utah Agricultural Experiment Station under the following heads: What It Is, Some Recent Results, Some of the Many Other Studies in Progress, How Results are Made Available, and Source of Supporting Funds.

CIRCULAR 77—MEASUREMENT OF IRRIGATION WATER
George D. Clyde

This circular, which is a revision of Utah Station Circular No. 36 (1919) by O. W. Israelsen, defines and discusses the common terms used in water measurement and explains the relationship between units of volume and rates of flow. A conversion diagram is given for converting volumes to rates of flow or rates of flow to volumes. Examples are given in the use of the units of measurement. The five common methods of water measurement on the farm—weirs, submerged orifices, rating flumes, Improved Venturi flumes, and volume meters—are discussed in detail. Instructions for constructing and installing the various devices are given, together with tables for making discharge determinations. The construction and installation of simple divisors is briefly discussed. The material is in the main simply a compilation of state and federal publications on water measurement, and since it is written to meet the needs of practical irrigators and water users, technical language is avoided wherever possible.

ABSTRACTS OF SCIENTIFIC AND TECHNICAL PAPERS

Reprint 107. THE DRAINAGE OF LAND OVERLYING ARTESSIAN BASINS. By W. Gardner, O. W. Israelsen, and W. W. McLaughlin. In SOIL SCIENCE, Vol. 26, No. 1 (July, 1928), pp. 33-45. The methods of hydrodynamics are used in an effort to calculate the influence of drain tile and of wells on the water-logged condition of fine-textured soils due to hydrostatic pressure in
the underlying subsoils and gravels. The artesian regions of the Cache Valley area are given special consideration and a tentative plan is proposed for reclamation. A study is also made of the costs of such reclamation with results which seem to indicate that the water-logged condition may be relieved at a nominal cost.

Reprint 108. EFFECT OF SIZE OF SEED SET ON YIELD AND ON CERTAIN OTHER CHARACTERS IN POTATOES. By D. C. Tingey and George Stewart. In JOUR. AMER. SOC. AGRON., Vol. 20 (July, 1928), pp. 710-721. During a 5-year period, data were obtained on the effect of cutting 4- and 8-ounce tubers into sets of various sizes. Plantings were made in both lots from whole, half, quartered, and, in the case of the 8-ounce tubers, one-eighth sets. On the basis of the total net yields, probable error studies showed no significant differences. On the basis of the net marketable yields, the data indicated that 8-ounce tubers quartered are better than any other size, but not significantly better than the sets from the 4-ounce lot. Sets of the same size taken either from the 4- or 5-ounce tubers gave no significant difference. As the size of set increases the height of vines, the number of stems to the hill, the number of tubers per hill, and the total weight per hill increase, while the percentage marketable, the weight per tuber, and the number of tubers to the stem decrease.

Reprint 109. PENETRATION OF ULTRAVIOLET RAYS THROUGH CLOTHING MATERIALS, Pt. 2. By Harriet Morgan. In AMER. JOUR. PHYSIOL., Vol. 86, No. 1 (August, 1928), pp. 32-35. From the data presented it would seem that the mean interspace between the threads and weight are factors limiting the ultraviolet-ray transmissibility of clothing materials. This conclusion is in accord with the results of previous workers who have quantitatively measured the light admitted by open- and close-weave fabrics. However, that weave and weight are the only factors is negatived by the percentage of ash. This fact strongly suggests that the porosity of the fiber is a significant factor which influences the ultraviolet-ray transmissibility of clothing materials.

Reprint 110. A FEW WESTERN APHIDS WITH DESCRIPTIONS OF THREE NEW SPECIES. By George F. Knowlton. In ANNALS ENTOM. SOC. AMER., Vol. 21, No. 2 (June, 1928), pp. 259-268. This paper discusses six species of aphids occurring in Utah, Arizona, and Idaho. Three new species are described and figured, and one new genus is erected. The six species of aphids considered in this paper occur on native vegetation, such as greasewood, rabbit brush, dogwood, spruce, and fir.

Reprint 111. THE NITROGEN-FIXING MICROORGANISMS OF AN ARID SOIL. By E. G. Carter and J. Dudley Greaves. In SOIL SCIENCE, Vol. 26, No. 3 (September, 1928), pp. 179-197. The specific subject of this article is the soil of the Nephi Dry-farm Substation, a highly productive soil active in nitrogen fixation yet containing no Azotobacter, counts made by the plate method on beef agar, Ashby's mannite agar, and synthetic agar being 19,526,000, 19,080,000, and 12,725,000, respectively, for the three media. Of the cultures isolated from Ashby media, 27 probably represent new species and varieties. A study of the morphological characteristics shows 10 Actinomyces, 8 bacilli, 8 micrococi, and 1 penicillium. The study of the physiological activities indicates that 20 of the 27 have the ability to increase the nitrogen in the soil.

Since the supply of scientific and technical reprints is limited, it is not possible to supply all requests made.

Resigned July 1, 1928.
Reprint 112. CORRELATED INHERITANCE IN WHEAT, III. KANRED x SEVIER. By George Stewart. In JOUR. AGR. RSCH., Vol. 26, No. 10 (May, 1928), pp. 873-896. In a cross between a pureline of Kanred by a pureline of Sevier wheats, both fully awned varieties, true-breeding forms with head-density varying from extremely dense to extremely lax were obtained. Intermediates did not breed true. Awn length was measured in the F3 progenies. High correlations in two families (r=±0.674±0.027 and r=0.762±0.032) were obtained between length of the awn and density of the spikes. There is a definite connection between these two characters.

Reprint 113. NOTES ON A FEW SPECIES OF NEOTHOMASIA (APHIDIDAE) FROM UTAH. By George F. Knowlton. In ENTOM. NEWS, Vol. 39, No. 8 (October, 1928,) pp. 233-235. The three species of aphids, one of which appears to be new, all belong to the genus Neotomasia and are described and figured. Only one form, N. populicola (Thomas), is abundant and widely distributed throughout Utah, southern Idaho, and northern Arizona.

Reprint 114. THE INFLUENCE OF SOLUBLE SALTS AND ORGANIC MANURES ON SOIL NITROGEN. By J. E. Greaves. In PROC. FIRST INTERN. CONG. SOIL SCI., June, 1927, Vol. 3 (1928), pp. 213-221. Work has shown that many of our western soils gain annually approximately 30 pounds of nitrogen per acre due to microorganisms living free within them. It has been found that the optimum moisture content for maximum nitrogen fixation, measured in terms of water-holding capacity, is around 70 per cent of water, and that certain salts, such as sulphates, chlorides, and carbonates, very materially increased the nitrogen-fixing powers of the soil. Some soils in pots under vegetation-house conditions and with varying salt content gained annually from 25 to 250 pounds of nitrogen per acre-foot of soil. The application of organic manures (barnyard and plant residues) increased the fixation in some cases from 30 pounds up to 300 pounds annually.

Reprint 115. SOIL MICROBIAL STIMULANTS. By J. E. Greaves. In PROC. FIRST INTERN. CONG. SOIL SCI., June, 1927, Vol. 3 (1928), pp. 222-228. Various substances, such as arsenic, sodium chloride, sodium sulphate, sodium carbonate, manure, and the mere leaching of some soils increases the bacteria in the soil as well as their activities. Often this increase can be attributed to an increase in the available plant-food. There are cases in which this will not account for the observed phenomenon. Consequently, the question is raised: Is not this limiting factor a bacteriophagic substance ultramicroscopic in size and having the characteristics of either a virus or a ferment, which limits the number and activity of the various microflora of the soil and which is inactivated or removed from the soil by the various stimulants studied? The available data are in keeping with such an idea.

Reprint 116. A GENETIC RECOMBINATION FOR THE EXPRESSION OF AWNS IN WHEAT. by George Stewart and D. C. Tingey. In AMER. NAT., Vol. 62 (November-December, 1928), pp. 532-539. Marquis wheat, an awnless variety, was crossed with Federation, another awnless variety, and a peculiar recombination obtained. An almost perfect 1:2:1 ratio was obtained for awnless, intermediate, and awned forms. The F3 breeding behavior was used as a means of
classifying F2 plants. Since large progenies were grown, the recombination was definitely established. Besides the one major factor difference there was evidence of minor factors.

Reprint 117. THE INFLUENCE OF IODINE UPON THE GROWTH AND METABOLISM OF YEASTS. By J. E. Greaves, C. E. ZoBell, and J. Dudley Greaves. In JOUR. BACT., Vol. 16, No. 6 (December, 1928), pp. 409-430. The growth and metabolism of yeasts are extremely slow in a mineral salt-sugar solution such as Mayer's cultural fluid. Heavy seeding, the presence of impurities such as may occur in commercial beet sugar, and bacterial (and especially mold) growth was found to accelerate yeast multiplication. Small quantities of iodine (1 p.p.m.) either as elementary iodine or as the salt of sodium, potassium, or calcium, accelerates the yeast growth. The relationship of iodine to Wildier's bios and the possibility of iodine-cultured yeasts as a means of furnishing iodine to man is considered. The results indicate that iodine is essential to yeast growth and metabolism.

Reprint 118. NOTES ON A FEW SPECIES OF MACROSIPHINI (APHIDIDAE) FROM UTAH WITH DESCRIPTIONS OF TWO NEW SPECIES. By George F. Knowlton. In PAN-PACIFIC ENTOMOL., Vol. 5 (October, 1928), pp. 79-84. Sixteen species are discussed, several of which are frequently of economic importance on agricultural crops such as alfalfa, sweetpeas, garden peas, wheat, oats, and potatoes.

Reprint 119. DEVELOPMENT OF STORAGE DISEASES IN SUGAR-BEETS RESULTING FROM HOOK INJURY. By C. M. Tompkins and S. B. Nuckols. In PHYTOPATH., Vol. 18 (November, 1928), pp. 939-941. The hooked knife commonly used in topping sugar-beets in Utah, Idaho, Washington, and California serves as a source of unnecessary injury to the beet root. Under favorable conditions of temperature and humidity various fungi enter the knife wounds and quickly produce decay. When beets are held in commercial storage piles from 25 to 40 days or longer a loss of not less than 10 per cent in weight and sugar content is frequently sustained. Phoma betae Frank is the principal wound invader; several species of parasitic Fusaria have also been isolated. It is recommended that the use of the hooked knife be abandoned and that the Colorado system of beet topping be substituted.

Reprint 120. NOTES ON A FEW SPECIES OF MYZINI (APHIDIDAE) FROM UTAH WITH DESCRIPTIONS OF TWO NEW SPECIES. By George F. Knowlton. In CANAD. ENTOM., Vol. 61 (January, 1929), pp. 9-15. The occurrence in Utah of ten species of aphids belonging to the tribe Myzini is discussed. Figures of a number of these, together with descriptions of two new species belonging to the genus Capitophorus, are given. A few forms of considerable economic importance, such as the black cherry aphid, the green peach aphid, the gooseberry witchbroom aphid, and a common currant aphid are briefly discussed.

Reprint 121. THE USEFULNESS OF CAPILLARY POTENTIAL TO SOIL MOISTURE AND PLANT INVESTIGATORS. By L. A. Richards.

6Graduate Research Assistant and Graduate Student, respectively, Department of Bacteriology and Chemistry.
7Assistant Pathologist and Associate Agronomist, respectively, Bureau of Plant Industry, U. S. Department of Agriculture.
8Graduate Student, Department of Physics.
SUMMARY OF PUBLICATIONS

In JOUR. AGR. RSCH., Vol. 37, No. 12 (December, 1928) pp. 719-742. This article discusses the problem of determining the availability of water for the use of plants. The soil character which measures this availability has been termed the capillary potential. It is a technical term devised by the physicists; inasmuch as it is not commonly used by soils and plant investigators because it has arisen from the technical analytical methods of the physicists, an attempt is made to show that it may be used to advantage as an aid in various soils and crops studies. It relationship to other soil characters is discussed and data presented showing specifically its connection with the moisture percentage of the soil.


Reprint 123. WHITE-SPOT OF ALFALFA AND ITS RELATION TO IRRIGATION. By B. L. Richards. In PHYTOPATH., Vol. 19 (February, 1929), pp. 125-141. White-spot of alfalfa occurs throughout the United States but is especially severe under irrigated conditions of the west. In general, the disease is characterized by small, dead, and bleached areas of the mesophyll giving a distinct spot of injury. The disease is most severe in first-crop alfalfa but occurs also in second- and third-crop alfalfa. Observations and experiments during 1926 and 1927 show clearly that the trouble is caused by an unbalanced water condition in the plant induced by irrigation, especially when heavy irrigation follows a period of drought. Early, light, and more frequent irrigation is suggested for control.

Reprint 124. MOVING WATER OVER MOUNTAINS IN ADVANCED IRRIGATION. By George D. Clyde. In HYDRAULIC ENGIN., Vol. 5 (April, 1929), pp. 17-22. For the purpose of collecting and diverting water from one watershed to another, at high elevations, mountain feeder ditches are used as collecting channels. In Utah there are many of these ditches for diverting water, above 9000 feet elevation, from the Colorado River watershed to the Great Basin. The precipitation above this elevation falls largely in the form of snow. The water content of the snow cover averages from 18 to 24 inches each year. The location, with respect to the slope, exposure, drifting, and topography, is important as affecting the yield, operation, and maintenance of these ditches. The success of the feeder ditch depends upon its being open and capable of carrying the runoff when the flow begins. But little data are available on the yield of mountain feeder ditches. Some measurements made in 1928 indicate that the yield is from 16 to 56 per cent of the snow cover at the beginning of the melting season.

Reprint 125. THE MINERAL CONTENT OF GRAIN. By J. E. Greaves and C. T. Hirst. In JOUR. NUTRITION, Vol. 1, No. 4 (March, 1929), pp. 293-298. The maximum, average, and minimum ash, calcium, magnesium, potassium, phosphorus, sulphur, and iron contents of 175 samples of wheat, 120 samples of oats, 110 samples of barley and 75 samples of oats are reported. Variation in the mineral content of different samples of each grain is great. The variation was due to irrigation water, the nature of the soil on which the grain was grown, and the variety of grain. In the case of wheat, a crude measure of the effect of each factor is given. The calcium, magnesium, and sulphur contents of
these grains are higher than those usually reported for grains grown elsewhere. The phosphorus content is lower; consequently, the proportion of calcium to phosphorus is higher than usually reported. The question is raised whether these factors will not materially modify the nutritive value of grains grown on these highly fertile calcareous soils.

Reprint 126. THE PHOSPHORUS OF GRAINS. By J. E. Greaves and C. T. Hirst. In CEREAL CHEMISTRY, Vol. 6, No. 2 (March, 1929), pp. 115-120. The total phosphorus of wheat, oats, and barley varies widely with the soil on which it is grown, the quantity of irrigation water applied during growth, and the variety. In wheat the total phosphorus varied from 0.21 to 0.46 and the inorganic phosphorus from 0.013 to 0.04. The total phosphorus of oats varies from 0.27 to 0.45 and the inorganic phosphorus from 0.021 to 0.051. The total phosphorus of barley varied from 0.24 to 0.044 per cent and the inorganic phosphorus from 0.015 to 0.051 per cent.

Reprint 127. TEMPERATURE CONTROL APPARATUS. By L. A. Richards. In JOUR. OPT. SOC. AMER. & REV. SCI. INSTR., Vol. 18, No. 2 (February, 1929), pp. 131-137. This paper describes in detail the construction of a new form of apparatus particularly adapted for the control of temperature in laboratory experiments in air or water bath. An electrical contact is made and broken in response to temperature changes through a platinum-mercury junction in an atmosphere of hydrogen, completing a circuit through an ordinary inexpensive relay so modified as to deliver current through heating coils of special type, the construction of which is also fully described in the article. The method has proved particularly successful for an airbath of about 100 cubic feet capacity for plant and soils experiments in the physics laboratory. The various adaptabilities of the equipment are fully described.

Reprint 128. INHERITANCE STUDIES IN SEVIER x ODESSA WHEAT CROSS. By George Stewart and Harold Price. In JOUR. AMER. SOC. AGRON., Vol. 21, No. 5 (May, 1929), pp. 493-512. F2 and F4 generations of this cross revealed distinct segregation as to awns, spike density, and grain color. Length of culms, number of culms, and number of spikelets did not group themselves into definite segregation groups. Spike density and awn length were studied particularly in relation to their coefficients of variability. When all of the progenies were set in one table they arranged themselves in a ratio of 1:2:1. The F2 segregation in grain color was somewhat masked, but a check on F4 established a one-factor difference.

Blanche Condit Pittman,
In Charge, Division of Publications.

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