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The University Fruit Farm at Union, Nebraska

C. C. Wiggans

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The University Fruit Farm

at Union, Nebraska

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THE UNIVERSITY OF NEBRASKA
COLLEGE OF AGRICULTURE
EXPERIMENT STATION
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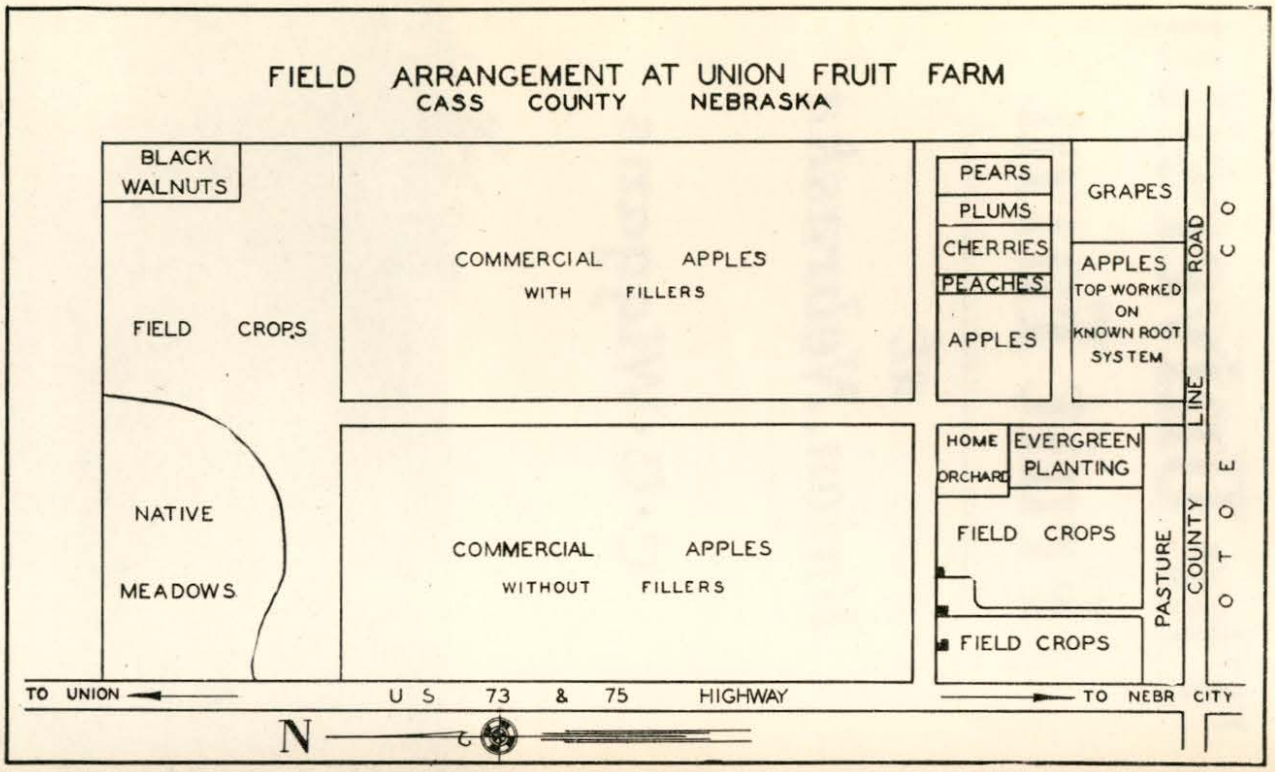
FIELD ARRANGEMENT AT UNION FRUIT FARM
CASS COUNTY NEBRASKA
BLACK WALNUTS
FIELD CROPS
COMMERCIAL APPLES WITH FILLERS
PEARS
PLUMS
CHERRIES
PEACHES
APPLES
GRAPES
APPLES TOP WORKED ON KNOWN ROOT SYSTEM
NATIVE MEADOWS
COMMERCIAL APPLES WITHOUT FILLERS
HOME ORCHARD
EVERGREEN PLANTING
FIELD CROPS
FIELD CROPS
PASTURE
COUNTY ROAD
OTOE CO LINE
TO UNION
U S 73 & 75 HIGHWAY
TO NEBR CITY
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The University Fruit Farm

C. C. WIGGANS
Department of Horticulture

The University Fruit Farm may be considered as a substation or detached portion of the Nebraska Experiment Station. It was established to assist in answering questions pertaining to fruit production, and only experiments of this sort are carried on. Supervision of this property rests with the Department of Horticulture of the Nebraska College of Agriculture. This circular has been prepared with the view of furnishing visitors to the farm with a brief outline of the experimental projects. Further information is available from either the local foreman or from the Department. Visitors are always welcome and helpful suggestions are solicited.

Nebraska's Fruit Industry

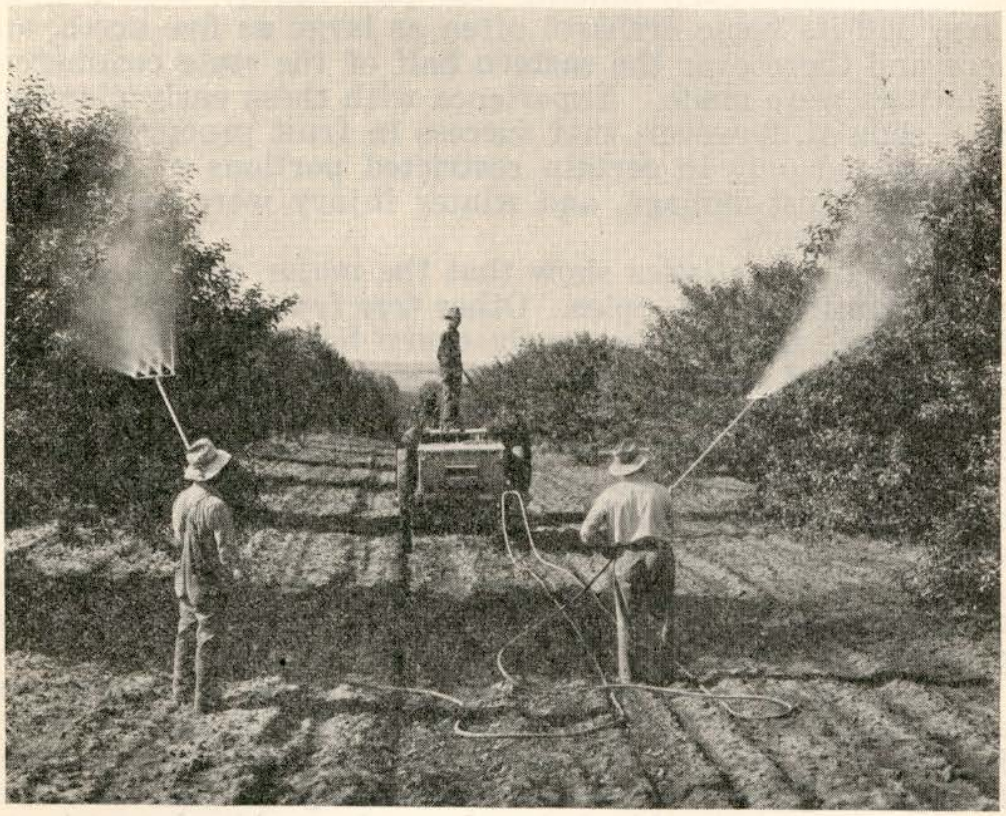
Nebraska pioneers, in common with those of other midwestern states, planted many fruit trees. Tree planting in the eighties and early nineties was quite heavy. Nearly every farm had its home orchard, often as large as five acres, and here and there over the eastern half of the state commercial plantings were made. Experience with these early plantings soon showed, however, that success in fruit production could be expected only in certain restricted portions of the state. Drought, frost damage, and winter injury were too common in other sections.

Production statistics show that the major portion of these early plantings was apples. Other tree fruits as well as small fruits were included in nearly every home orchard, but the production of these fruits has seldom, if ever, been greater than the consumption within the state. From 1890 to 1894 the yearly production of apples averaged less than one million bushels. In 1905-09 the annual apple crop increased to nearly two and one-half million bushels. From this period the annual yield declined, slowly at first and then more rapidly until 1925-29, when it averaged less than three quarters of a million bushels. Nebraska's last really large apple crop was produced in 1915.

The decrease just noted in the production of apples came about very largely because of the passing of the home orchard. In the early days of the industry about the only problems facing the grower were those pertaining to climate. Many farm orchards were planted under unfavorable circumstances and lasted only a short time. In the aggregate, however, such plantings played a very important part in the total production.

As the industry continued, production problems multiplied. Drought and winter injury took their toll. Virgin soils were virgin no longer. New varieties were introduced and market demands changed. Pests became more numerous and important. Blister canker, for instance, destroyed whole orchards of Ben Davis, the leading variety. Gradually the home apple orchard became of less and less importance and commercial plantings for the most part became concentrated in a narrow strip of loess hills along the Missouri and Platte Rivers. Here soil and climatic conditions are quite favorable for tree growth and fruit of high quality can be produced. Commercial orchards are found in these hills from north of Omaha to the Nebraska-Kansas line and a few as far west as Kearney. In the main, the plantings now in production are relatively young and during the next few years Nebraska's production should increase considerably.

Along with the concentration of the commercial apple acreage, there has been a similar development in commercial plantings of grapes and cherries. Brownville and Omaha ship a considerable tonnage of Concord grapes nearly every year and more recently the planting of sour cherries near



SPRAYING IS A VERY NECESSARY OPERATION IN ANY ORCHARD MANAGEMENT PLAN. A POWER OUTEIT IN USE ON THE FRUIT FARM.

Nebraska City has been stimulated by the activities of a local canning factory. Aside from these two fruits and the apple, there is little or no commercial fruit production in Nebraska.

As the problems multiplied and became more complex, it was evident that individual growers could not afford the time and expense incident to detailed experiments pertaining to spraying, soil management, pruning, varieties, etc. Nebraska apple growers, through the State Horticultural Society and as individuals, sought aid from the Experiment Station. The establishment of the University Fruit Farm is an attempt to furnish such aid.

The Experimental Fruit Farm

Establishment.—The Nebraska Legislature in the 1917 session appropriated to the University of Nebraska the sum of $10,000 for "The purchase of an experimental fruit farm, away from the State Farm". The location proviso was inserted in recognition of the fact that the main station was not suitably situated for fruit work.

After due consultation with many growers and consideration of a number of tracts, final selection was made of an unimproved 80-acre farm, one and one-half miles south of Union. This has now come to be known as the University Fruit Farm. This was purchased in the fall of 1917 from H. E. Ruhmann at a cost of $125 per acre, thus using the entire appropriation.

The general character of the country surrounding the Fruit Farm is shown by the cover illustration. Except for a small rocky area, the soil on this farm is well adapted to fruit production, although at the time of purchase it had obviously been overcropped. Likewise, it was recognized that erosion was almost sure to occur on certain slopes if clean cultivation were practiced. The location was quite central so far as the fruit region was concerned and at the nearest possible point to the main station. Furthermore the farm was quite accessible, being even then on one of the well established highways. This highway has since been paved.

Support.—At the time of purchase there were no buildings or other improvements on the farm and no money available for the erection of such improvements. Some funds were secured, however, for the immediate purchase of nursery stock and two years later for building purposes. The house was constructed in 1920 under contract by W. B. Banning. The barn, machine shed, well, fences, and water system have been added from time to time and in the near future a combined packing shed and storage cellar will be needed. It is planned to locate the latter structure in the natural depression near the northwest corner of the farm.

A FINE STAND OF RED CLOVER IN AN ORCHARD FIVE YEARS OF AGE.

A small amount has been set aside each year from the general Experiment Station maintenance fund to pay the foreman's salary and other necessary expenses. The farm income, which up to date has been practically negligible, is also available for use.

Necessary equipment has been purchased from the maintenance allowance. Ordinary farm equipment was sufficient for early needs but special units adapted to fruit production are now being added. Possibly the machines of most interest are the power sprayer, the crawler type tractor with the tandem disc and other attachments, and the fruit washer. The water supply for spraying and other purposes is lifted by the windmill to the tank on the elevation east of the house.

Operation.—The general supervision of this farm from the beginning has been with the Department of Horticulture of the Nebraska College of Agriculture. R. F. Howard was Chairman and J. R. Cooper was Associate Professor at the time the land was purchased. The initial projects were planned by them and the first plantings made under their direction. The writer succeeded Professor Cooper in 1919 and became Department Chairman in 1924. F. M. Coe and later W. W. Yocum have also been connected with the work.

Local supervision, aside from that given by W. B. Banning of Union, was not available until living accommodations were furnished on the farm. George H. Ferguson was local foreman during the 1920 crop season, Ernest Beutler from 1921 to 1924, and Roy A. Mapes has been foreman since the latter

date. Local help has been used when additional labor was required.

The location and relationship of the various fruit plantings and fields are shown on the accompanying chart. In the fields marked "Farm Crops" an attempt has been made each year to produce sufficient feed for the needs of the place. Detailed information concerning the fruit plantings is given herewith.

Apples.—At the present time there are three permanent apple plantings and one of a temporary nature on the farm. The commercial apple orchard was planted mainly in the spring of 1918, but this 40-acre planting was increased to 45 acres in 1925 to 1927. Unfortunately, some unfavorable conditions were encountered with the early planting which have resulted in considerable unevenness of size and age in these trees. As stated previously the soil was somewhat thin and the humus supply should have been built up through the use of sweet clover or some other legume before any planting was done. The 1918 spring season was very dry and even with late planting and the watering of trees at planting time a poor stand was obtained. Also, nursery stock distributed in the spring of that year proved to be weak because of winter injury. The net result of the two latter factors was to give a very uneven stand, since many of the trees had to be replanted sooner or later. Then, too, the fact that for the first two years the place had to be rented for farm crop production did not insure excellent care for the trees.

This orchard has spaces for 1,935 permanent and 903 filler trees, the fillers being confined to the east half of the orchard. The spacing is 30 x 33 feet and the varieties run east and west. Each permanent row contains 43 trees or one acre and each filler row 21 trees or approximately one-half acre. The rows are numbered from south to north and the trees in the row from west to east. The varieties used, their relative location, and the quantity planted are shown below.

PERMANENT VARIETIES

Arkansas	Rows 1 and 2— 2 acres
Virginia Beauty	Rows 3 and 4— 2 acres
Grimes	Rows 5 and 6— 2 acres
Stayman	Rows 7 and 8— 2 acres
York	Rows 9 to 12— 4 acres
Wealthy	Rows 13 to 16— 4 acres
Delicious	Rows 17 to 20— 4 acres
Winesap	Rows 21 to 30—10 acres
Jonathan	Rows 30 to 40—10 acres
Golden Delicious (1925)	Rows 41 and 42— 2 acres
Starking (1926)	Rows 43 and 44— 2 acres
Richared (1927)	Row 45— 1 acre

FILLER VARIETIES

King David	Rows	1	to	10	4½ acres
Missouri	Rows	11	to	19	4½ acres
Duchess	Rows	21	to	26	3 acres
Stayman	Rows	27	to	30	2 acres
Grimes	Rows	31	to	34	2 acres
Wealthy (1920)	Rows	35	to	39	2½ acres
Red June (1925)	Row	40			½ acre
Golden Delicious (1925)	Row	41			½ acre
Missouri (1926)	Rows	42	and	43	1 acre
Turley (1927)	Row	44			1 acre

The variety apple planting was begun in 1920 and has been added to from time to time. This planting has been limited to one tree each of the varieties of commercial importance in the United States. Some of these are not adapted to Nebraska conditions but they were wanted for the sake of comparing their development with that of other sorts and to answer the question asked so frequently, "Why isn't —— variety grown here?"

The top-worked orchard is purely for experimental purposes. Each tree in this planting is on its own roots rather than the usual French Crab stock. These trees were obtained through selection from the bins at the nursery packing shed. After these trees became established they were then top-budded to other varieties. The plantings were made first in 1923 and continued until 1929. Top-budding has been done at various times and is practically complete at this date. The own-rooted varieties run east and west and the top-budded varieties north and south.

A temporary planting of apples was made in 1931 near the walnut planting in the northeast corner of the farm. Half of these are on their own roots and half on French crab. They are intended for root-system studies.

Cherries.—In the cherry planting are found representative varieties of the sour, semi-sweet, and sweet sorts. The main portion of the orchard consists of sour cherries. Enough Early Richmond, Montmorency, and English Morello trees have been set so that experimental pruning and spraying may be done if desired. A few other sour varieties are also included.

A later planting of the semi-sweet or Duke type and of sweet varieties was made. These are in the two west rows.

Grapes.—In the spring of 1923, seventeen rows of Concord grapes (36 plants per row) were set for experimental purposes. The rows are 9 feet apart with the plants spaced 8 feet. Two rows each of Worden and Moore Early and four plants each of a number of varieties were set at the same

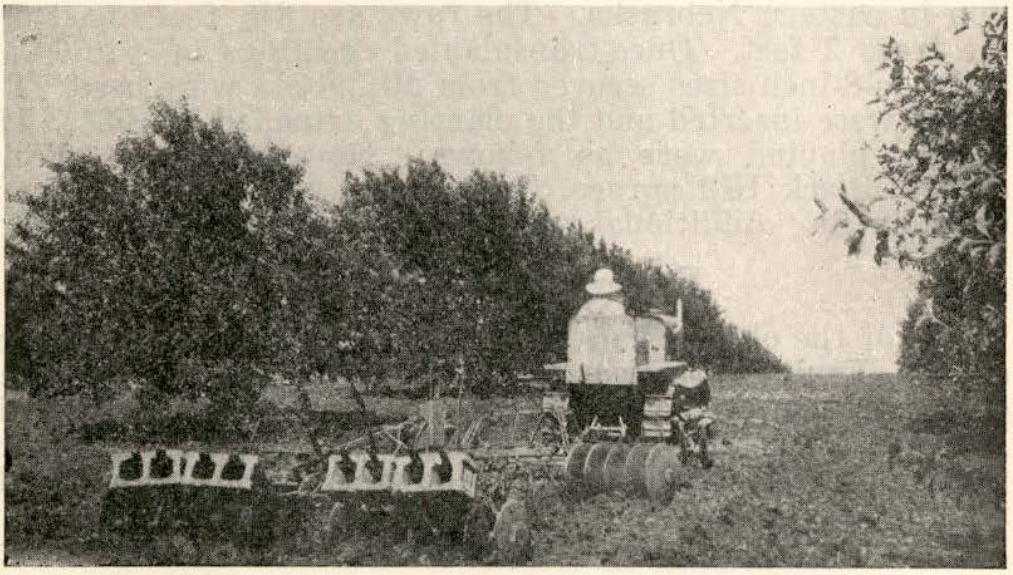
time. The variety list has been increased as new sorts of promise have become available.

Nut Plantings.—Because of the interest in recent years in nut culture, nut trees of various sorts have been planted from year to year. One or more varieties of pecans, pecan-hickory hybrids, black walnuts, and filberts have been tried. Generally these have been set as a single row along the line fences. The filberts, set along the highway, south of the house, winter-killed and have not been replaced. A few pecans are still struggling along, just south of the grapes.

The black walnuts, originally planted along the highway north of the house, were just becoming established when it was learned that they would be destroyed by road grading. Consequently in the spring of 1930 these were all dug and moved to the lower area in the extreme northeast portion of the farm. Other varieties were added also. Plans are now under way for a nut orchard, mainly of black walnuts, in this area.

Peaches.—In 1925 and the years immediately following a few peach varieties were set just west of the cherries. Only the more hardy sorts have been included since it is recognized that peach production in Nebraska is hazardous in most years because of winter temperatures and spring frosts.

Pears.—The pear orchard, begun in 1920, has been principally a test of varieties. So much blight infection has been encountered, however, that the only variety of any consequence now left is Kieffer. It is probable that in the near future all pears will be eliminated so as to lessen the possibility of blight infection on susceptible apple varieties.



FREQUENT DISKING KEEPS THE CULTIVATED AREAS FREE OF WEEDS

The following varieties have at one time or another been planted in this orchard: Anjou, Bartlett, Clapp's Favorite, Comice, Duchess, Fame, Flemish Beauty, Garber, Gold Nugget, Howell, Kieffer, King Karl, Koonce, Lawrence, Lincoln, Pineapple, Rheil's Best, Rossney, Seckel, Sheldon, Tyson, Theo Williams, Vermont Beauty, Winter Bartlett, and Winter Nelis. Two trees of each sort were planted except in the case of Flemish Beauty, Garber, Kieffer, and Lincoln, four trees of which were used.

Plums.—The plum planting, also begun in 1920, was likewise planned primarily as a variety test. In the east row were eight trees each of Abundance and Burwood and in the next row eight trees of Omaha. The second row was later filled with varieties originated by the Minnesota Experiment Station. The third and fourth rows contained representative American varieties, the fifth European and Japanese sorts, and the sixth South Dakota or Hansen originations. Each tree is properly labeled with name and number.

Home Orchard.—This planting, set in 1920, was designed to serve as a representative planting for home use. Apples, cherries, plums, pears, grapes, gooseberries, currants, raspberries, and blackberries are to be found there. The original planting also included strawberries but these have been moved several times. The vacant spaces have been utilized for garden purposes and more recently for giving a good start to pine seedlings for later use elsewhere. The area used totals approximately three-fourths of an acre.

Evergreen Planting.—A number of species of firs and spruces were set in 1930 for the purpose of learning something concerning the possibilities of Christmas tree production in eastern Nebraska. The rows are 3½ feet apart and the trees 2 feet. Once-transplanted seedlings of 4-to-6-inch and 6-to-8-inch sizes secured from Minnesota were used. Replants were inserted and the planting extended in 1931. The species planted were as follows: Norway spruce, White spruce, Black Hill spruce, Colorado spruce, Balsam fir, and Concolor fir. Additional rows are to be added in later years.

Experimental Projects

One of the objects back of the acquisition and development of the Fruit Farm was that it would serve as a practical demonstration of the possibilities of apple growing along the Missouri River in eastern Nebraska. To this end experimental projects have been held down in number and in the main, so far as apples are concerned, are confined largely to long-time experiments. Thus the results of a pruning or soil

A VIEW IN THE COMMERCIAL APPLE ORCHARD AT THE UNIVERSITY FRUIT FARM.

management experiment may not be known to the fullest extent until the orchard reaches maturity.

Data concerning tree development, yield, etc., have been taken each year for every tree that has been planted. These are recorded in permanent form. However, since results to a large degree are to be measured by yields, very little tangible material is yet at hand. Ordinarily, the commercial apple planting should have reached production at approximately ten years. While considerable bloom has been present during the past several years, but few apples have been produced because of unfavorable weather during the blooming season. The first apple crop of any consequence is being produced this year (1931) but several fine grape crops have been harvested, the average yields for the period 1928-30 being from 12 to 15 pounds per plant.

Below is given a brief resumé of the various projects now under consideration. In most instances these are simply phases of still larger problems which have been receiving attention at the central station. More detailed information is available from either the Department of Horticulture or the foreman of the Fruit Farm.

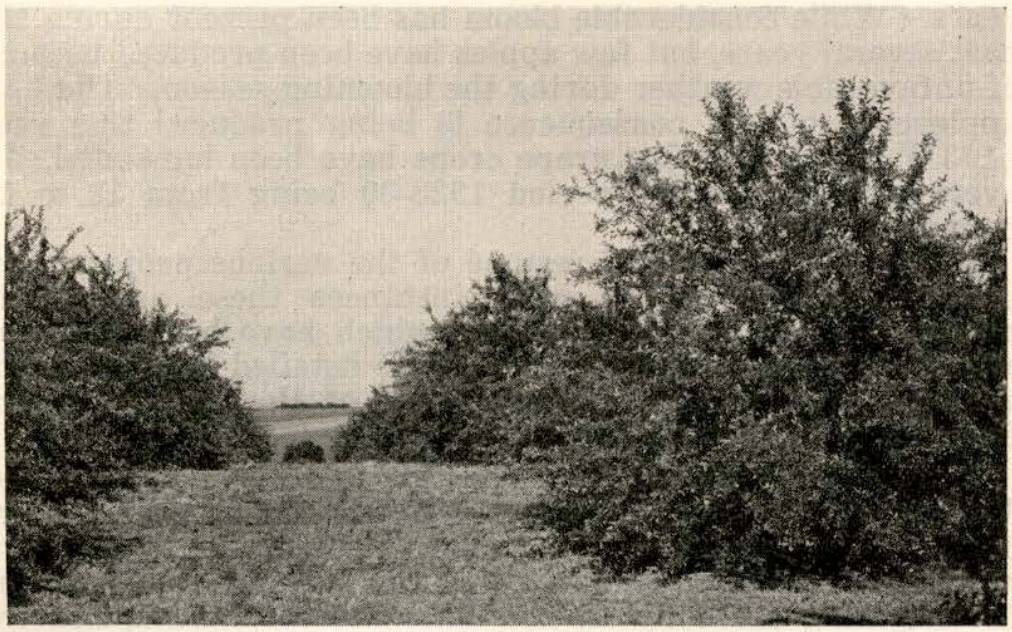
1. *Varieties.*—The variety question is an ever present one. Variety merits are discussed pro and con at nearly every horticultural meeting. The modern tendency is to limit the number of varieties by discarding the less valuable ones and investigating carefully all new ones before planting heavily. Variety plantings are worthless so far as already established

orchards are concerned, but they are of much value for the guidance of future planters. By noting carefully the behavior of varieties under different cultural conditions, the yield, rate of growth, disease resistance, and market and storage values, it is hoped that something of value may be forthcoming.

2. *Permanents vs. Permanents and Fillers.*—One-half of the commercial apple orchard contains filler trees and the other does not. These extra trees were planted equidistant from the permanent trees. Filler varieties are expected to fruit heavily in early years and often are short-lived, small-sized trees. The expectation in making this planting was that these trees would be a profitable investment before they needed to be removed.

Unfortunately, the value of this experiment will be impaired because of the replanting which has been necessary. Already, however, it has gone far enough to indicate that such varieties as King David and Stayman are of doubtful value as fillers unless a spacing wider than 30 x 33 feet is used for the permanent trees.

The filler portion of the orchard has produced only one cultivated crop. Two rows of potatoes were planted in each diagonal space in 1920. Otherwise it has been under either cultivation or alternate cultivation and red clover sod. For the past several years one middle has been cultivated and the adjacent one kept in sod. Every two years this condition has been reversed. Such procedure has almost entirely eliminated the erosion problem.



THE SOD BLOCK—UNIVERSITY FRUIT FARM COMMERCIAL APPLE ORCHARD.

In the permanent portion competition between the trees themselves has been reduced to the minimum. However, for the first six or eight years this ground was cropped. In 1918 corn was grown. This was followed in 1919 by a seeding of oats and red clover. The clover was allowed to stand until 1921, when corn was again used. After one or two crops of corn the land was divided into different blocks for use in another project but some corn was grown until 1927. The use of the red clover in 1920 resulted in very severe Buffalo tree hopper injury, which dwarfed somewhat the early growth of many trees. Evidences of this injury may still be seen on the upper side of the lower branches of such trees.

3. *Orchard Soil Management.*—This project, outlined in 1920 and begun in 1921, has been confined to the west half of the commercial apple orchard. The original plan called for the use of corn in the major portion of the orchard for the first five years. This area was then to be seeded to red clover and later on divided into two areas. One of these areas would be allowed to go into permanent sod and the other reseeded to red clover as often as necessary to maintain a fairly good clover sod. In another block clean culture was to be practiced until late June and then soy beans seeded for a cultivated legume cover crop. In still another block continuous clean culture was to be practiced, with trees in the even numbered rows receiving each year a moderate application of manure.

In the main these original plans have been adhered to rather closely. Corn was grown for the specified period—fewer rows being used as the trees increased in size. Seeding to clover followed and sufficient natural reseeding occurred so that it was unnecessary to renew the clover-sod portion until this year (1931) when this block was disked preparatory to reseeding in the spring of 1932. In the sod block the only expense since seeding has been to mow frequently enough to prevent excessive weed seeding. Blue grass is now beginning to come in in a few areas.

Considerable difficulty has been encountered in securing good stands of soy beans in the cultivated legume block because of the destruction of the soy-bean seedlings by cottontails and jack rabbits. Consequently no soy beans were planted this year (1931) but this block will be seeded to sweet clover in 1932. It is planned to handle this clover so that at no time will there be an excessive growth of this crop. It will be plowed under and reseeded each spring. In the cultivated block, the manure applications have not been continuously regular because sufficient manure has not been available. It was used for the first few years, however, during the period when the quantity per tree did not need to

be large. Quite destructive erosion has occurred in this area and this led to the introduction of rye as a winter cover crop in 1930. Considerable difficulty with blight, especially in 1931, has been encountered with Jonathan in this block. Some infection has also been present in the adjacent cultivated legume cover-crop area and increasingly smaller amounts in the sod blocks. It is now (1931) planned to give up this treatment and replace it with a combination of cultivation and winter vetch.

Division of this area into the various blocks is from south to north so that trees of each variety are included in each treatment. The clover sod area is next to the highway with the continuous sod next. Then comes the cultivated-legume cover-crop block with the continuous clean-culture area adjacent to the filler portion of the orchard. The cultivated blocks were deliberately placed on the high ridge so as to avoid washing as much as possible.

4. *Fertilizers.*—Along with soil management studies always comes the question of commercial fertilizers. Considerable quantities of nitrogen-carrying materials are now being used by Nebraska orchardists. In order to secure some information as to the relative value of several different materials and also as to the effect of applying this fertilizer at different seasons of the year, an experiment was begun in 1930. The trees selected for this work are in the continuous sod block. The idea back of the selection of these was to replenish their nitrate supply, which presumably was being diminished by the growth of the sod. No results, of course, are as yet available from this experiment.

5. *Pruning.*—Pruning is a practice as old as fruit growing and arguments are still advanced for or against certain practices. The filler apples offered an exceptional opportunity to study the effects of the severity and time of pruning upon tree growth and productiveness. Accordingly, therefore, this area was divided into seven blocks with three rows in each block. The blocks run north and south, thus containing trees of each filler variety. The project was outlined in 1921.

The following table indicates the pruning systems followed, the blocks being numbered from west to east.

Block I—Modified central leader—average March pruning.
Block II—Central leader—average March pruning.
Block III—Unpruned—no pruning of any sort.
Block IV—Thinning and heading back—heavy March pruning.
Block V—Thinning only—light March pruning.
Block VI—Thinning and heading back—heavy June pruning.
Block VII—Thinning only—light June pruning.

Naturally as the trees reached bearing size, continued heading back was out of the question. However, light and heavy cutting in March and June as well as no pruning have been maintained. The trees now presenting the outstanding appearance are the unpruned ones. These are very full of brush and very shortly will present some problems so far as spraying and harvesting are concerned.

6. *Spray Tests.*—With the apple trees now ready to bear it will be possible to conduct all tests of spray materials and methods in this orchard. This year a preliminary test of some new fungicides is under way and at the proper time the codling-moth-control experiments conducted for the past five years at Shubert will be shifted to the Union plantings.

7. *Root Stocks for Apples.*—In recent years so much interest has been aroused by some preliminary reports in root-stock studies that it seemed worth while to outline such a project for Nebraska. This was done in 1925 and certain phases of it are now under way in the own- or scion-rooted orchard at Union. Various varieties on their own root systems have been top-budded to other sorts so that the effect on growth and productiveness can be noted.

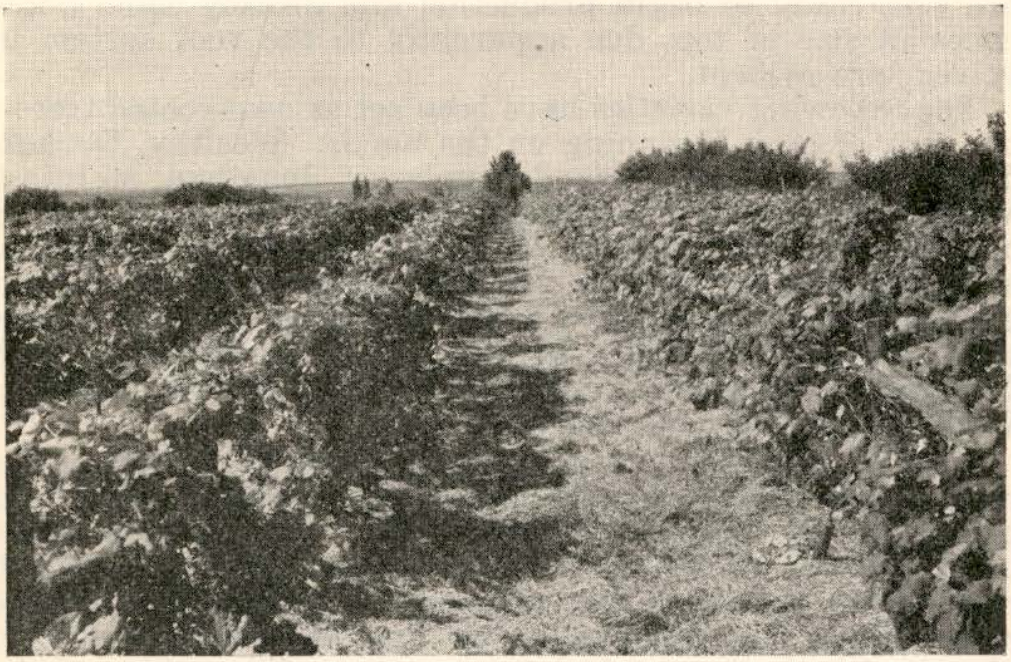
Because of difficulty in securing the scion-rooted material the trees are not uniform in age. The first trees set, however, are just ready to begin production and already some differences in size of top, due apparently to the root system involved, are evident.

The following varieties have been set as own-rooted trees—one row of each beginning on the north: Wealthy, Duchess, Yellow Transparent, Livland Raspberry, Jonathan, McIntosh, Virginia Beauty, and Hibernal. The ninth row has a number of other varieties, each on its own root system. Beginning at the west end of each of the first eight rows, two trees of each have been top-worked to the following varieties: Jonathan, Winesap, Delicious, Grimes, Arkansas, Stayman, York, McIntosh, Yellow Transparent, Duchess, Golden Delicious, Wealthy, and Virginia Beauty.

8. *Root Systems of Fruit Plants.*—Relatively little information is available upon the root-system development of fruit plants in the Missouri Valley region. An excellent opportunity will be presented by some of the Union plantings to make some studies of this character. Already some grape-root systems have been excavated and later work is contemplated with the top-worked trees and possibly some of the filler sorts. Also a new planting of apples was made in 1931 for this specific purpose. These are located near the northeast corner of the farm.

9. *Vineyard Soil-management Studies.* — The Concord grapes set in 1923 have been used in a study of several different systems of soil treatment. Plats have been arranged so that there is a buffer row between the various treatments. The following plats have been under observation and crop yield records have been made since 1928—the rows being numbered from east to west.

Row 1—Buffer.
Rows 2 and 3—Straw mulch (north half) and straw mulch plus sodium nitrate (south half).
Row 4—Buffer.
Row 5—Culture (early) followed by mulch in late season.
Row 6—Buffer.
Row 7—Scraping, no cultivation.
Row 8—Buffer.
Rows 9 and 10—Clean cultivation.
Row 11—Buffer.
Rows 12 and 13—Cultivation plus cover crop (soy beans).
Row 14—Buffer.
Rows 15 and 16—Cultivation plus sodium nitrate (south half) and cultivation plus ammonium sulfate (north half).
Row 17—Buffer.



GRAPES DEVELOP EXCEPTIONALLY WELL ON THE LOESS SOIL OF THE FRUIT FARM. A VIEW IN THE MULCHED BLOCK.

Factors being considered in this experiment aside from total yield are:

1. Number and size of clusters.
2. Number and length of new canes.
3. Number and length of laterals.
4. Leaf size.
5. Soil moisture.
6. Amount of nitrate in the soil.

The planting is quite uniform and has been yielding well. After the 1931 data are available, the results to date will be published.

10. *The Evergreen Plantation.*—This planting, started in 1930, is primarily to obtain information concerning the rate of growth of various conifers in eastern Nebraska. The possibility of the commercial production of Christmas trees for local markets will also be considered. Necessary replants were added in 1931 and some extension of the plantings was made.

The following list indicates the location of the various species. The rows are numbered from east to west.

Rows 1 to 10—Norway spruce.
Rows 11 to 15—Balsam fir.
Row 16—White spruce.
Row 17—Black Hills spruce.
Row 18—Concolor fir.
Row 19—Colorado spruce.
Rows 20 to 22—Norway spruce.
Row 23—Mixed.

Yearly measurements of increase in height will be made. Some fertilizer blocks will also be laid out a little later after the trees have become well established.

[3½M]