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50 Years of Research at the North Platte Experiment Station

W. W. Burr

J. C. Adams

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at the

North Platte Experiment Station

The Experiment Station, University of Nebraska
College of Agriculture, Lincoln
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M. L. Baker, Associate Director

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On the cover: Winter wheat varieties are tested at the North Platte Experiment Station. Also under continuous test are corn, spring grains, sorghums, alfalfa, and other legumes and grasses.

About the authors: This circular was prepared by James C. Adams, superintendent of the North Platte Experiment Station; L. L. Zook, former superintendent; Glenn Viehmeyer, assistant in horticulture; Myron G. A. Rumery, assistant dairy husbandman; A. R. Sharrah, former dairyman; Edward Wolfe, for many years clerk at the Station; W. W. Burr, Dean Emeritus, Nebraska College of Agriculture; Marvel L. Baker, Associate Director of the Nebraska Experiment Station; and W. V. Lambert, Dean of the College of Agriculture and Director of the Nebraska Experiment Station.

The Early Years

The North Platte Experiment Station was established in 1904 to help dry land farmers solve their problems.

W. W. Burr and James C. Adams

The North Platte Experiment Station was established fifty years ago. So many changes have occurred since then that few people remember why research in dry land agriculture was started in Nebraska and other Great Plains states. In order to get a proper perspective, it may be well to consider some early history.

The Great Plains, whose settlement became a controversial matter, extends from the 100th meridian west to the Rocky Mountains and from Canada south to the Mexican border. The area is level to gently rolling, with widely varying rainfall. There is enough rainfall for bounteous crops in the best years, but too little in the driest years.

Pioneers moving into the area from the east found no natural barriers but a very gradual change in vegetation. As they moved west there were fewer trees. The tall prairie grasses gave way to shorter species and the vegetation became less dense. These changes, if noticed, were not generally understood nor taken into consideration. Most settlers knew only the cultural practices and the crops of their former homes, and these were not adapted to the drier area. For this reason, many new farmers failed to establish themselves on the Plains, and returned to the east.

In some sections there were several waves of settlers. During the good years people moved into the region, but when dry years came many were driven out by crop failures, leaving behind them deserted homes. From each immigration a few hardy pioneers survived the crop failures and remained to await the return of better years. Most of these did not depend entirely on crop production, but had some livestock to tide them over. Those who stayed began the accumulation of information and experience that contributed greatly to a better understanding of dry land agriculture.

Failures Receive Publicity

In some areas of the Plains, settlement began as early as 1840. In Nebraska it began in the 1860's. Failures were so numerous in those early years that they received wide publicity. Congress became concerned about the problem and in 1890 a minority report of a committee on arid lands painted a drab picture. The situation even gained international notice. Some referred to it as a national scandal.

Dr. M. A. Simmons described the situation in an article for the *American Farmer*. He wrote:

"From the 98th meridian west to the Rocky Mountains there is a stretch of country whose history is filled with more tragedy, and whose future is pregnant with greater promise than perhaps any other expanse of territory within the confines of the Western Hemisphere. For many years it was marked upon the maps as a great white blank indicating an inhospitable desert. Finally as the territory bordering upon it became more thickly settled and the pressure for land became ever fiercer, the line of settlements encroached more and more upon this stretch of apparently worthless soil. Following the times of occasional rainy seasons this line of social advance rose and fell with rain and drought like a mighty tide beating against the tremendous wall of the Rockies and every wave left behind it a mass of human wreckage in the shape of broken fortunes, deserted farms and ruined homes."

During dry years local papers of the area carried stories of drought and crop failures, and the possibility of irrigation. This publicity was not favorable to the Great Plains. Many people saw only the picture of failure, and entirely lost sight of the great possibilities of the area. Some who already lived in the Plains did not believe in the future.

State's Leaders Take Action

Leaders in Nebraska knew something should be done to solve the problems of agriculture. To accomplish this and to protect themselves from further unfavorable publicity, they decided to establish an agricultural experiment station. In 1903, the Nebraska Legislature passed House Roll 277 introduced by William Meradith of Polk County. This bill carried an appropriation of $15,000 for establishing an experiment station west of the 100th meridian in Nebraska to study basic principles of crop production. The purpose as expressed in the bill was "to determine the adaptability of the arid and semiarid portions of Nebraska to agriculture, horticulture, and forest tree growing, such as the production of grain, grasses, root crops, and fruits of kinds commonly grown in the same latitude in other states; also the most economical methods of producing such crops without irrigation."

In the same year the North Dakota Legislature established a similar station at Edgeley, and the Kansas Legislature established one at Fort Hays. These and later stations, together with the Office of Dry Land Agriculture of the USDA, have made invaluable contributions to the successful development of Great Plains agriculture.

The Nebraska Legislature gave the Regents of the University the responsibility of establishing and operating the Station. It became thereby a part of the Nebraska Agricultural Experiment Station.

After examining a number of sites in western Nebraska, the Regents accepted a proposition from a North Platte Citizens' Committee to purchase a tract of 1,920 acres of land lying three miles south

(Above) These men all played a part in the Station's development. From left are Bill McDonald, member of a citizens' committee that was instrumental in locating the Station at North Platte; R. A. Rhodes, farm foreman; L. L. Zook, former superintendent; and James C. Adams, present superintendent. First superintendent of the Station was W. P. Snyder.

(Below) A crowd gathers for a field day at the Station in 1916.

of the city. The cost of the land was something over $16,000, or an average of about $8.00 an acre. The people of North Platte donated $8,000 toward purchase of the land.

The tract contained some 280 acres of level bottom land with an elevation of a little more than 2800 feet, and about 140 acres of arable tableland with an elevation of about 3000 feet. The bottom land had been homesteaded and partly broken out by 1870. The level land on the table had been broken out in 1887.

The contributions of the people of North Platte and their committee were so valuable that they deserve to be recorded in the archives of the Station. The committee consisted of William McDonald of the McDonald State Bank, Harry White of the First National Bank, George Payne of the Payne Investment Company, Tom Patterson and Butler Buchanan, real estate dealers, and Joe Hershey, mayor and hardwareman who served as chairman.

Livestock Research Is Included

Experimental work got underway in February, 1904. Although the bill authorizing the Station did not provide for the production of livestock, the staff realized the necessity of livestock production in a dry farming area. Therefore the basic early work centered about the production of crops and the growing and feeding of livestock. The first crop variety studies dealt with oats, spring wheat, corn, millet and potatoes. The program for crop work was prepared by the staff at Lincoln. The Station has always had a large measure of support from the staff of the main Experiment Station.

The first cooperative experiment by the new Station was with the Payne Investment Company of North Platte and was concerned with the effect of dehorning steers under range conditions. The Payne Investment Company furnished the cattle and paid the University 25 cents per month for pasturing them. Payment was made in the form of improvements on the outside fence and by supplying water for the cattle.

Late in 1905 the Office of Dry Land Agriculture, USDA, entered into a cooperative agreement with a number of states, including Nebraska, for the investigation of the problems of dry land agriculture. This work became a permanent part of the program of the North Platte Station.

The University and the Office of Dry Land Agriculture also entered into an agreement with the Physical Laboratory of the Bureau of Plant Industry, USDA, for a study of climate and environment. It was recognized that results obtained from crop rotation and cultural experiments could not be satisfactorily interpreted without a systematic and thorough study of the physical factors—both soil and climate.

To procure weather data, standard equipment was installed to keep records of rainfall, temperature, wind velocities, and rate of evaporation. This information was secured at all of the dry land stations in the Great Plains and supplemented data from regular Weather Bureau stations. It has been of great value in determining the variability of weather elements and the frequency and intensity of drought periods during the past 75 years.

H. E. Weakly, assistant agronomist at North Platte, in later years studied the growth rings of native cedar as affected by rainfall. The study projected the weather record back over 400 years to 1540, and indicated that before the region was settled there had been numerous drought periods of greater intensity and duration than have since been recorded.

For determining soil moisture, the Physical Laboratory furnished all of the necessary equipment. Moisture determination was to be done by the ordinary gravimetric process for sampling and drying. In planning the work it was decided to take the soil samples on certain plots to a depth of three feet at regular weekly intervals. As the work progressed, deeper samplings were found necessary.

The first rotation systems included only spring-sown crops except where alfalfa or bromegrass was grown to maintain the organic content of the soil. A few rotations had either rye or peas as a green manure crop. Some received applications of barnyard manure, and in many rotations summer fallow had a part. As it became evident that winter wheat was the most important grain for the North Platte area, experimental work was also begun with this crop.

In 1908, 10 acres of bottom land, 10 acres on the tableland and 5 acres in the canyons were set aside for a study of growing trees.

Constant Demand for New Work

There was constant demand for the addition of other lines of work that might contribute to the building of permanent homes in the community. In 1913 the first irrigation well was put down. In 1913 a dairy herd was started which became an important part of the Station's program. In 1919 a poultry department was added.

Much research work is cooperative on both state and federal levels. Dry land agricultural research has been cooperative with the USDA continuously since 1906. Swine breeding studies were started on a cooperative regional level in 1937. The Station staff works closely with representatives of many departments of the University of Nebraska. Some work, such as crop variety testing, is carried on in conjunction with similar projects at other dry land research stations. From 1938 to 1949 the Soil Conservation Service maintained personnel at the Station to make studies on establishment of grass stands and the use

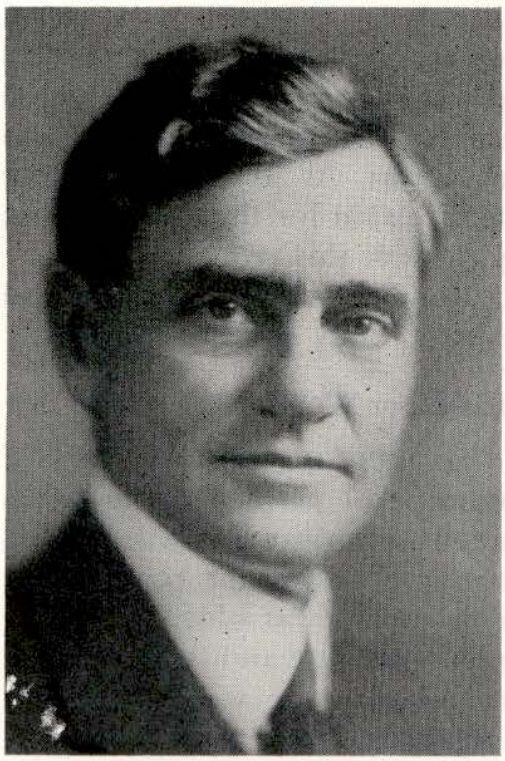
of equipment for harvesting grass seed. Paul Ehlers, representing Outstate Testing for western Nebraska, has been stationed at North Platte since March 1, 1947.

In 1934, because of the need for a power plant near North Platte, 207 acres of the original purchase was made available to the Platte Valley Public Power and Irrigation District in exchange for 305 acres of land in the west half of section 34. This broke the 30-year continuity of research on the dry land plots.

The State Game, Parks, and Forestation Commission leased 14 acres of Station land in 1943 to be used as a site for fish ponds. As compensation, the Commission agreed to furnish irrigation water to a similar area. In 1946, 40 acres of University land in the northeast corner of section 21 was exchanged for about 70 acres of poorer land owned by the Commission in Section 17.

W. P. Snyder First Superintendent

W. P. Snyder, a graduate of Nebraska University with a master's degree in animal husbandry from Michigan, served as superintendent of the North Platte Experiment Station from 1904 until his death July 20, 1934. During the 30 years of his service a sound foundation was laid for research work that was to follow. He was an aggressive and capable administrator. He has been remembered through the years for his analysis of agricultural conditions and occasional brusk remarks to those who chose to differ with him. In him, Nebraska lost a man with vision.



W. P. Snyder

Mr. Snyder was succeeded as superintendent by L. L. Zook who since 1915 had been agronomist at the Station. He has left a large contribution to dry land agriculture by his studies in cropping practices, rotations, and variety studies. Wasting few words in conversation, Mr. Zook chose rather to put his thoughts in writing where he was very capable. He served until March 1, 1946 when he was replaced by James C. Adams, the present superintendent. Mr. Zook returned again from February 1, 1952 to March 1953 while Mr. Adams was on leave of absence in Rome, Italy serving with the Food and Agriculture Organization of the United Nations.

The excellent contributions that the Station has made toward the permanency and profitableness of the agriculture of the region is a lasting tribute to these administrators and their staffs.

The Station has had many men on its staff who have become outstanding in their fields of endeavor. W. W. Burr, agronomist from 1906 to 1912, received recognition for his soil moisture studies at the Station. He later became Dean of the Agricultural College and Director of the Experiment Station. Other former agronomists include George F. Sprague, Nelson Jodon, Orrin J. Webster, and H. E. Weakly who is now superintendent at the Newell, South Dakota Station.

M. L. Baker, animal husbandman from 1930 to 1941, is Associate Experiment Station Director for Nebraska and is a nationally recognized authority on livestock nutrition, breeding, and management. Other former livestock staff members include L. N. Hazel, now at Iowa State College, and Albert Clawson who is completing his doctorate at Cornell. Cletus Reinmiller, Wesley James, and Carl Ervin have transferred to other occupations.

R. A. (Pop) Rhodes has been farm foreman for more than 40 years and has contributed immensely to the operation of the Station. H. A. McComb for 24 years served as horticulturist. A. R. Sharrah was dairyman for more than 30 years and produced Holstein cows that made national production records. Ed Wolfe was clerk for 22 years.

The present staff includes besides the superintendent, Guy Baker and Josef Jackson in the animal husbandry department; Myron Rumery, dairy and poultry; Glenn Viehmeyer, nationally known for his chrysanthemum breeding, in horticulture; Robert E. Ramig, Milton Greenwood, and Paul Ehlers in agronomy; and Bert Somerhalder, irrigation engineer.

Research with Crops

Agronomists at North Platte have studied crop varieties and cultural practices for half a century.

L. L. Zook

A PRIMARY PURPOSE for an experiment station west of the 100th meridian was to determine what crops were adapted to the soil and climate of the region and to increase crop yields by the development of better seed and soil management practices. Crops under continuous test now include winter wheat, corn, spring grains, sorghums, alfalfa, and other legumes and grasses.

Wheat

Winter wheat had been introduced into Kansas and eastern Nebraska when the North Platte Experiment Station was established, but its adaptation had not been determined in western Nebraska. The first tests were with spring wheats. These showed the superiority of durums over common varieties in yield and drought resistance. When winter wheat was successful in early tests, it rapidly replaced spring varieties. Thus, durum never became extensively grown and common spring wheat dropped to a secondary role as a replacement crop for winter wheat that failed to survive winter conditions.

An important contribution by the Station has been the production and distribution of pure seed of the best winter wheat varieties.

Corn

Secondary in western counties, corn has maintained a fair balance with winter wheat on the dry farms further east and is an important annual crop in all irrigated sections.

Station tests have shown the necessity for using different cultural practices for corn on dry land and under irrigation.

On dry land early growth is retarded and moisture conserved for later plant development by planting in lister furrows. Under irrigation, with moisture not a limiting factor, surface planting stimulates early growth and contributes to maximum production. Manures and fertilizers must be used with care on dry land, but may be highly beneficial under irrigation.

Early Station tests demonstrated the superiority of adapted or locally grown seed over that introduced from distant corn belt sections. Varieties producing well in these trials were Calico Dent, and Substation White Dent developed from Silvermine. Good records were also produced with flint and flour varieties, some of which came down from native Indian sources. These varieties performed well in com-

An excellent stand of irrigated corn. Station tests have shown the necessity for using different cultural practices for corn on dry land and under irrigation.

parison with the first hybrids, but have all been surpassed by the better hybrids of more recent development.

Oats and Barley

Oats and barley have been under continuous tillage and varietal trials at the North Platte Station. Although secondary to winter wheat and corn, their special purpose uses have prevented their elimination. Trials at the Station demonstrated the value of early seeding and use of early varieties. As with winter wheat, seed of a succession of varieties has been grown and distributed.

Sorghums

Because of special drought enduring characteristics, the sorghums have long been recognized as valuable dry land crops. In Station trials, yields of grain sorghums have exceeded corn yields by substantial amounts in years of low rainfall. Sorghum varietal tests at the Station have made available information on types best adapted for special purposes and at times seed of new varieties has been produced and distributed until available from commercial sources.

Legumes

No other legume has approached alfalfa as a hay and soil building crop on the valley land of the state. Its acreage was being rapidly expanded in the central and western sections when the Station was established. Its utilization was but little understood and one of the important contributions of the Station was the inauguration of feeding and pasture trials by which the high value of the crop for all classes of livestock was demonstrated.

The Station has cooperated with the Plant Pathology and Agronomy Departments in the development and establishment of Hardistan and Ranger alfalfas. In recent years only Ranger has been grown on Station fields.

Many other legumes, including clovers, vetch, lespedeza, peas, and beans have been under trial at this Station. None of these has offered serious competition to alfalfa in the production of high quality forage under irrigation. Sweetclover has been useful in adding nitrogen to the soil, but its stimulating effects on crops following it have been expressed more in vegetative growth than in increased grain production. There is need for a more successful dry land legume than has yet been produced. The search for this continues.

Crop Rotations and Tillage

A project continuous since the early years of the Station is that of dry land rotations and tillage. In cooperation with the USDA, this

is linked with similar investigations in all of the Great Plains states. The standard crops of the region are grown in various sequences under the usual and experimental methods of tillage. Results of this work have been published in several bulletins. Some of these results are as follows:

1. Soil organic matter and nitrogen declined under all crop rotations and tillage practices in which nonleguminous crops were used.

2. The most rapid decline in organic matter was under continuous cropping of corn, least rapid under continuous cropping of small grains, and intermediate in rotations of row and close-drilled crops.

3. The importance of summer fallow in creating soil moisture reserves for certain crops such as winter wheat, sorghum, grasses, and legumes was demonstrated. The early plowing or black fallow methods have been replaced by subsurface tillage to leave maximum amounts of crop residues on the surface for reduction of moisture loss and protection from wind and water erosion.

4. Tillage after harvest of small grains is important only to the extent that moisture losses are reduced by destruction of weeds and volunteer grain, and should be done in a manner that will leave the surface protected by crop residues.

5. In trials for winter wheat, no gains in yield were made from tillage to depths of more than 7 inches.

6. Sweetclover, alfalfa and grasses in rotations reduced organic matter depletion and stimulated growth of succeeding crops. Because of the higher moisture requirement of heavy vegetative growth, grain yields have increased only in favorable years, and decreased under limited late-season moisture so that average yields have not been greatly affected.

7. Benefits from use of annual crops for green manures have been limited, as increases that might have resulted from added fertility have been offset by the moisture lost in producing the green manure crop.

8. Recent trials of commercial fertilizer on dry land have not yet produced conclusive results, but indicate that benefits will be closely associated with moisture fluctuations and the state of fertility of the soils where used.

Soil Moisture Studies

The Station helped to establish principles of soil moisture conservation under dry land conditions.

W. W. Burr

With the first attempts to grow crops in western Nebraska it became evident that available moisture was the most important factor in crop production. Profitable cultivation of the dry land was limited by the amount and efficient use of rainfall. There were a few minor tracts of sandy or eroded land that showed a deficiency in fertility, but on the whole soil fertility was adequate.

Rainfall in the area varies widely from year to year, ranging from a shortage for crop production to a fair degree of sufficiency. Plants get their moisture from the soil. The problem, therefore, is to get as much rainfall as possible into the soil and hold it for use by the crops. The Station began its soil moisture investigations in cooperation with the USDA in the spring of 1907.

The soil at the Station farm where the studies were made is a very fine sandy loam, similar to the tableland soils of the region. The mechanical character is uniform to a considerable depth, permitting moisture storage and root penetration in accordance with available rainfall and crop capacity. Surface and subsoils are differentiated mainly by the higher organic content and darker color of the surface layers.

The soil is relatively low in organic matter but is easily tilled because of the low percentage of clay and high percentage of silt and very fine sand. It does not crust badly except after heavy snows.

The first soil moisture determinations were made to a depth of 3 feet. It was quickly evident that 3 feet was not deep enough to encompass the zone of probable effect of tillage and cropping. Sampling to a depth of 6 feet was followed by later exploratory samplings to 10 and 15 feet. These revealed that the principal moisture fluctuations as affected by surface tillage and crop root development occurred in the upper 6 feet of soil. Except for special studies, a 6-foot depth was adopted as standard sampling procedure.

Soil moisture work at the Station contributed substantially to the establishment of the principles of the conservation and use of soil moisture under dry land conditions. Findings were published in Experiment Station Bulletins 114 and 140, and in Research Bulletin 5. Further studies of moisture storage as affected by tillage practices and cropping systems were published in Station Bulletins 193, 279 and 362, and USDA Technical Bulletin 1007.

Moisture Must Be Caught and Held

Getting water into the soil—the first principle of moisture conservation—was found to be largely a matter of keeping the surface in shape to catch and hold the water that falls until it can soak into the ground, thereby reducing runoff to a minimum.

Once in the soil, water is lost either by evaporation or through use by growing vegetation. Evaporation losses are greatest from a moist surface and decrease rapidly with increasing depth of the moisture.

Water used in growing farm crops is not lost as is water used by weeds. Getting rid of unwanted vegetative growth conserves moisture and is all that is ordinarily required to keep the surface loose and receptive to rainfall. However, certain types of soil tend to bake and crack badly during dry spells. On such soils extra cultivation is necessary even though there is no vegetation to destroy.

There are many variations in the application of the simple principles of moisture storage. Light sandy soils require relatively little cultivation to keep the surface receptive. The finer-textured soils require more. Between these two extremes are all graduations of soils.

It was found that soils in the North Platte Station area have a water holding capacity of approximately 16 per cent of their dry weight. Of the water stored in the soil, a little more than half was found to be available to crops.

Summer Tillage Most Efficient

Of the various methods of storing water in the soil, summer tillage has proved most efficient, not because a high proportion of the rainfall is held, but because the stored moisture is frequently very important in determining crop yields.

During 24 years of study of summer tillage there was retained in the soil 10 to 40 per cent of the rainfall of the different seasons. The average amount of seasonal rainfall held during the 24 years was 26½ per cent. Most water was stored during years of abundant rainfall and satisfactory distribution. In those years the upper six feet or more of soil would be filled to field carrying capacity. In the driest years there was less than 3 feet of moist soil.

The amount of water that can be stored in the soil during a given period depends to a large extent on the character of the rains. In fact, the distribution of rainfall is fully as important as the total amount. Water is accumulated more rapidly when the rains are frequent and the surface does not become extremely dry.

Summer fallow is considered good insurance against crop failure in western Nebraska and is a generally accepted practice west of the 100th meridian, particularly in preparation for winter wheat. It has not proved a satisfactory preparation for corn but has been reasonably satisfactory for spring small grain and forage crops.

A higher average acre yield of all crops was produced at the Station on summer-tilled land than with any other method of annual cropping. However, increases were sufficient to compensate for the loss of land during the year of fallow only in seasons of subnormal rainfall. In the years of higher rainfall, all methods of production tended to give good yields.

While summer tillage is the practice usually considered in connection with water storage, other tillage methods have been found beneficial. For example, tilling small grain stubble to prevent weed growth and to stir the surface has generally been effective.

Later work carried on by the University in cooperation with the USDA shows a big advantage for a type of tillage that will keep the crop residue on the surface to protect the soil. The results of this study were published in USDA Farmers Bulletin 1997.

Although soil moisture is still the most important limiting factor in crop production at North Platte, there is increasing evidence to indicate that available nitrogen is also becoming a limiting factor. Accordingly, a new experiment is being conducted at the North Platte Station to study the effect of soil moisture level at planting time on the response of wheat and corn to applications of nitrogen fertilizer. It is hoped that the results obtained will be of value for recommending nitrogen fertilizer in relation to soil moisture supply.

Irrigation

Water on the land is Nebraska's insurance against drought. Irrigation research is of first importance.

JAMES C. ADAMS

PERIODS of low precipitation and resulting crop failures have impressed upon Nebraska farmers the importance of irrigation in farming. Starting in the drier portions of western Nebraska this interest has now spread to the state's eastern borders. Water on the land and an intelligent knowledge of its use is Nebraska's best insurance against drought. Irrigation research is now of first importance.

To help meet the need for irrigation research data, the North Platte Experiment Station started in 1946 to broaden its research program. Trained personnel were added to the Station staff and two fields consisting of approximately 90 acres of land were selected for experimental use. Plans for more technically controlled irrigation studies are being prepared. A controlled supplemental water supply by six- and eight-inch underground pipes with risers connected to the hydroelectric power plant penstock is now available.

A new electric pump completed in 1953 supplements the well first installed in 1917 on Station land. This 1917 well was remodeled in 1925 and again in 1938. Another new well was installed on leased land in 1952 to replace an older well.

These newer, more efficient sources of water supply could not have been visualized in 1904 when the Station was started. Then, the South Side Ditch was expected to furnish water for supplemental irrigation. This came to an abrupt ending on February 28, 1907 when the ditch company's assets were sold by Sheriff Miltonberger to satisfy mortgage obligations.

First Irrigation Well in 1913

Turbine-type pumps, put in hydraulically dug wells, were not known in 1913 when A. Abercrombie and R. A. Rhodes sandbucketed down the first irrigation well on the Station to furnish water to Field 13. C. J. McNamara, local engineer, made the first topographic map on this field and assistance on its plot layout was given by H. C. Diesem, irrigation engineer from the U. S. Office of Experiment Stations. Crop rotations and comparison of irrigated vs. nonirrigated crops were studied.

A second well was installed in 1914 and the first one abandoned. This well was more successful than the tile line installed to convey water upgrade from it to Field 13. The tile risers were often broken by machinery, necessitating frequent repairs. However, this system

was used until 1917 when a third and larger well and pump were installed under the supervision of E. E. Brackett of the University.

From 1913 to 1934 irrigation research was under the supervision of Supt. W. P. Snyder. He was assisted in 1913-14 by William Osborne, 1915-16 and again from 1918 to 1923 by L. L. Zook, in 1917 by Tanjor Black and from 1924 to 1934 by Harry E. Weakly. Following Mr. Snyder's death in 1934, Mr. Weakly had charge of the irrigation research until his departure in early 1946 to become Station superintendent at Newell, South Dakota.

Much of the irrigation data obtained after 1917 consisted of cost studies on pump irrigation and comparisons of irrigated and non-irrigated crop yields. Some study was made on the influence of pumping on water levels. Published data are given in Experiment Station Bulletins 227, 271, and 301.

These cost studies stimulated pump irrigation and were widely used. Previously, lifting water more than 50 feet for crops had not been considered economical. The data also showed the value of using generous quantities of water and the value of its off-season storage in the subsoil. Some varietal studies of crops under irrigation were made.

Program Is Expanded

In 1946 James C. Adams came to the Station as superintendent from the Platte Valley Public Power and Irrigation District where he had been working on irrigation development. Recognizing the need for more irrigation data, fitted to use on crops and soils in central Nebraska, a move was started to interest persons in the University in an expanded research program. Robert E. Ramig, soil scientist, was added to the Station staff on July 1, 1947. Bert Somerhalder, irrigation engineer, was made available by the College of Agriculture on April 1, 1951. Myron Rumery has assisted with irrigated dairy pasture studies since 1947. Additional assistance has been given by representatives from the Agricultural Engineering and Agronomy Departments at the University in Lincoln.

Irrigation research work started or strengthened since 1946 includes bromegrass-alfalfa pasture studies for dairy cows, 1947-50; preliminary studies on effects of varying intensities of fertility, available moisture and plant population in relation to maximum yields of corn, 1947-48; bromegrass-alfalfa pasture for beef steers, 1947-50; reclamation of seeped and alkali land, 1951-53; sprinkler vs. gravity irrigation for alfalfa, 1951-53; water infiltration studies, 1950; irrigation to assist emergence of sugar beet plants, 1947-48; irrigated annual pastures for dairy cattle, 1953; studies of irrigated varieties of oats, barley, corn, and other crops, 1947-53.

A lateral built on the contour feeds water through siphon tubes onto land being irrigated for spring planting.

Horticulture

Station horticulturists improved the Chinese elm and have achieved prominence in chrysanthemum breeding.

GLENN VIEHMEYER

THE AREA that became the North Platte Experiment Station was not planted to trees or shrubs at the time of its purchase, except for a small group of cottonwood trees. As buildings were added during the early years, initial plantings of trees, shrubs, flowers, and gardens were made. These were of secondary importance as compared with the work of building and getting the research program under way.

In 1908, a cooperative agreement was signed with the U. S. Forest Service for studies on deciduous and coniferous tree plantings on the benchland, the higher tableland and in the canyons. Emphasis was being placed on tree planting in Nebraska and knowledge of adapted species for the drier portions of the state was needed.

Erwin Hopt was employed from 1909 to 1910 as the first horticulturist. His contributions consisted of plantings of several hundred fruit trees and continuation of the forestry program already started.

In 1914, H. A. McComb became the horticulturist, remaining until 1918 when he left to become a county agent. He returned in 1923, remained until his retirement in 1943, and was succeeded by Glenn Viehmeyer, the present horticulturist.

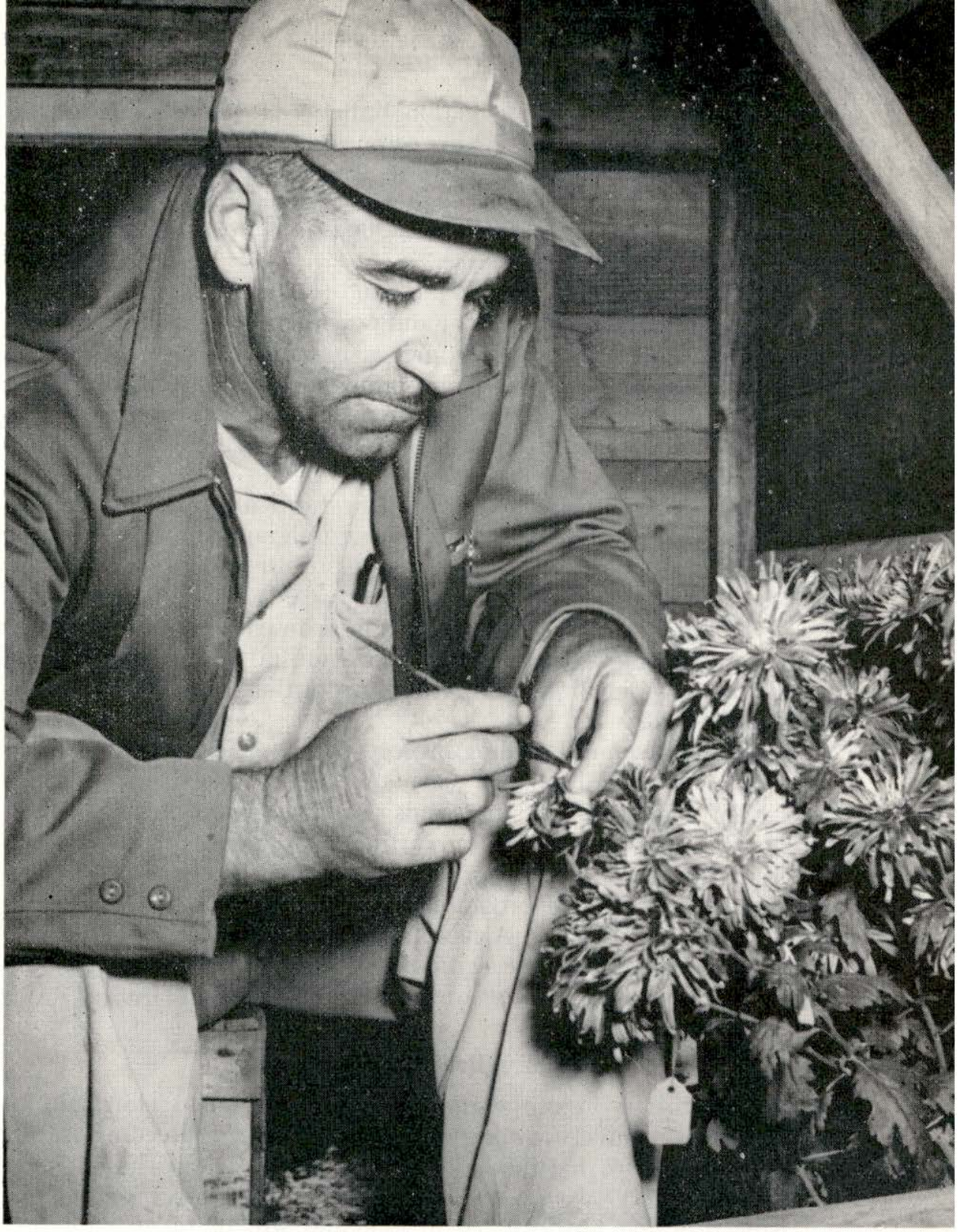
Under Mr. McComb's direction plantings of evergreens and junipers were increased in the hills south of the main Station buildings. He also was responsible for the older conifers and hardwood plantings on the Station grounds.

Of particular significance in the development of a tree planting program for western Nebraska was Mr. McComb's introduction, increase and distribution of the Chinese elm, *Ulmus pumila.* He was fortunate in securing superior foundation material through the Office of Foreign Plant Introduction. Some of these original trees, planted in 1915, are still alive.

Using this initial material, Mr. McComb instituted a program of improvement by mass selection that has resulted in one of the better strains of Chinese elm for the Great Plains. This strain has been widely disseminated by Nebraska nurseries and has played an important, though often little recognized, role in windbreak and farmstead plantings in Nebraska.

Woody Plants Are Studied

As Station horticulturist Mr. McComb collected and made initial tests on hundreds of woody plants. Results of these tests were published



Fifteen new chrysanthemum varieties have been introduced by the Station. Here Glenn Viehmeyer pollinates one of the thousands of seedlings that are being used in the search for better varieties.

in North Platte Experiment Station Bulletin 41. Plants found adaptable for public use include Peking cotoneaster, *Cotoneaster acutifolia*; privet, *Ligustrum vulgare,* P. I. 26767, from Crimea, planted in 1915; and Russian thorn, *Crataegus ambigua,* planted in 1938. Of these, the cotoneaster has been introduced. Russian thorn and privet are being increased for early release.

Other contributions by Mr. McComb included extensive studies with vegetables, and with annual and perennial flowers. From his limited breeding program with peonies a selection has been made that is being considered as a possible introduction. He also studied orchard crops. One of the orchards was destroyed when the hydroelectric system was built and the bench plantings were lost in the 1940 Armistice Day blizzard.

Under Mr. Viehmeyer's direction the horticultural investigations have been changed largely from a testing program to one with major emphasis on ornamental and small fruit breeding. Between 1943 and 1953 over 300 varieties of small fruits were placed on trial. Sixty varieties of grapes, including American bunch varieties and the French-American hybrids were put under trial. Cultural studies that include special training methods and winter protection of tender varieties are being made.

A chrysanthemum breeding project that is achieving national and international recognition was started in 1944. Fifteen introductions have been made from the thousands of plants grown. Primary objectives of this project are hardiness, earliness, and higher quality chrysanthemums for the Great Plains. Greenhouse varieties have been incorporated in the breeding program, giving better flower qualities without the loss of hardiness. A new flower type, "Carnation Flowered," has been introduced and recognized by the National Chrysanthemum Society. Color ranges for this form and for the spider and quilled forms are now being bred.

Many Breeding Projects

Other projects in cooperation with the Cheyenne Horticultural Field Station include strawberry breeding; raspberry breeding and selection to produce hardier and better fruiting varieties; and aster breeding to select varieties resistant to the virus disease, aster yellows.

Rose breeding was initiated in 1953 and will be increased. Other activities in the field of horticulture include the testing of new lilies from modern breeders (and a limited breeding program); cooperation in a regional program of testing woody ornamental plants; the increase and introduction to the nursery trade of woody ornamentals of proved hardiness; and exploratory hybridization of the better florists' carnations with hardy Dianthus species to produce hardy, high quality garden carnations.

Livestock Investigations

Animal husbandry work has been concerned with more efficient use of feeds produced in the area.

MARVEL L. BAKER

LIVESTOCK are kept on farms and ranches to market pasture and harvested crops. The animal husbandry work at North Platte has been concerned primarily with the more efficient use of feeds produced in that area. Results have had wide application and contributed materially to the development of today's livestock industry.

Swine

North Platte was among the earliest stations to show the value of alfalfa hay and pasture for swine. Feeding alfalfa either as meal, chopped or as hay with corn resulted in faster and cheaper gains for growing and fattening swine. Its value in rations for brood sows was shown in early studies.

Extensive investigations with alfalfa pasture demonstrated its value for brood sows and for growing and fattening swine. Its use consistently reduced the cost of pork production.

Work with protein supplements kept pace with their availability. The value of mixed supplements for dry lot feeding was established.

Pioneer studies were made on the cost of producing and growing pigs to a weight of 50 pounds. Extensive studies showed that old sows farrowed larger litters than gilts and their pigs reached an average weight of 50 pounds about ten days earlier. However, they weaned only a fraction of a pig more per litter than the gilts. The lower feed costs for the gilts and their larger gain in weight more than offset other advantages of the older sows. It was found that fall pigs could be produced about as satisfactorily and economically as spring pigs provided they were properly housed, properly fed, and not crowded.

The relative value of the various grains and of wheat shorts for feeding swine was determined. It was established that grinding the small grains for swine was advantageous but soaking grains did not increase their value.

Since 1937 much of the swine work at North Platte has been breeding research in cooperation with other North Central agricultural experiment stations and the Regional Swine Breeding Laboratory of the U. S. Department of Agriculture with headquarters at Ames, Iowa.

Beef Cattle

Beginning in December 1905, a five-year study was made on the value of alfalfa in the wintering ration for growing steers. These studies

were among the first on the wintering of range calves, yearlings and two-year-olds. Alfalfa hay or combinations of alfalfa with either prairie hay or sorghum hay produced larger winter and larger total gains than either of the carbonaceous roughages alone. The average weight of the calves at the beginning of the wintering period was approximately 450 pounds; the average weight of yearlings off grass in the fall ranged from 726 to 785 pounds for the different lots; that of two-year-olds from 930 to 1083 pounds; and that of three-year-olds in August from 1092 to 1251 pounds.

Many years of work with wintering calves has been conducted at North Platte. Most of this work involved wintering calves to gain about 1.5 pounds per head daily or even more as they were destined for summer feeding either in dry lot or on pasture. Sorghum silage, corn silage, sorghum hay, chopped sorghum fodder and stover and alfalfa hay all proved to be satisfactory roughages, if supplemented to provide adequate levels of protein and enough total digestible nutrients for the levels of gain desired. Alfalfa hay, dehydrated alfalfa, cottonseed cake or meal, soybean pellets or meal, linseed cake or meal, safflower meal and tankage fed to provide approximately the same protein intake all proved satisfactory sources of protein. Various combinations containing urea as a partial replacement for protein also proved satisfactory.

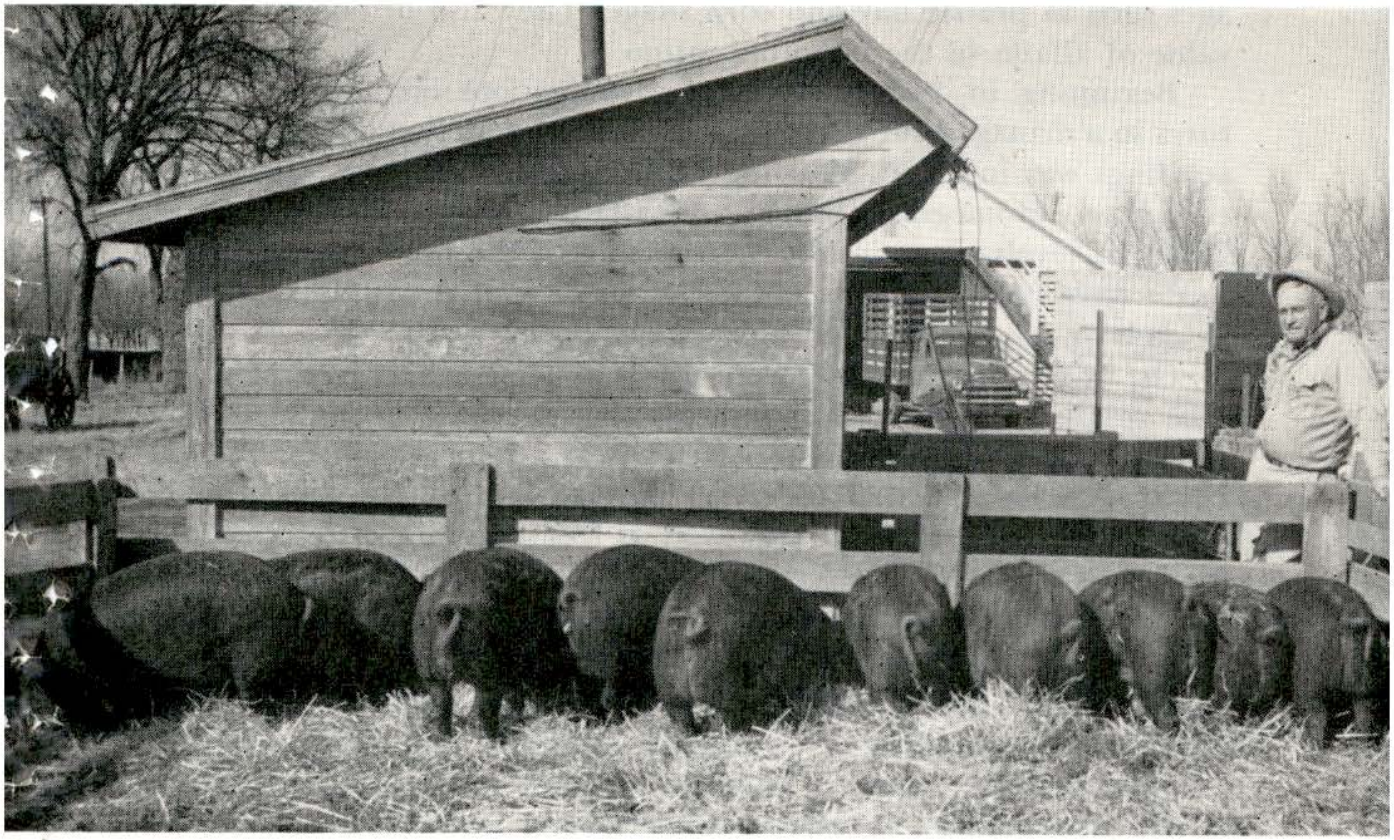
At levels of 3 to 5 pounds per head daily, various concentrates were approximately equal from the standpoint of producing liveweight gains on growing calves.

Approximately as good results were obtained where cobs replaced about half the dry matter from corn silage as where silage was fed as the only roughage to growing calves. In this case 1 pound of cobs replaced about 3 pounds of silage. The calves fed silage were given 1 pound of soybean oil meal and the calves fed cobs and silage 1.75 pounds per head daily.

A limited amount of work failed to show any advantage from adding trace or minor elements to a ration of corn silage, soybean oil meal, and ground shelled corn for wintering calves.

In two years' work with yearling steers grazed on native grass pasture, the feeding of 4 pounds of supplement (4 pounds corn; 1.5 pounds soybean oil meal, plus 2.5 pounds corn; or 4 pounds soybean oil meal) during approximately the last half of the grazing period produced some additional gains. The economy of this would depend upon price relationships. In these trials there was no apparent advantage from feeding soybean oil meal in comparison with corn.

FATTENING CATTLE. In 1910-11 and the following year, weanling calves were fattened on various rations. These studies showed the advantage of adding protein to rations containing carbonaceous rough-



North Platte was among the earliest stations to show the value of alfalfa hay and pasture for swine. Since 1937, much of the swine work has been breeding research. Pictured here with a pen of Durocs is Guy N. Baker, animal husbandman at the Station.

Research at North Platte indicates that the feeds usually available on Nebraska farms can be used satisfactorily for beef cattle if consideration is given to protein and energy contents.

ages such as prairie hay and corn silage. They also demonstrated the value of alfalfa in the fattening ration.

Beginning in 1929, a series of investigations on the use of pastures in a management system based on the production of well finished yearlings was initiated. Yearling cattle were fed grain on alfalfa, native grass, bromegrass, brome and alfalfa and on Kochia pasture. Different levels of grain also were used. On the nonlegume pastures cattle were full-fed grain, half-fed grain or grazed without grain for 70 days or longer and then finished in dry lot.

On alfalfa pasture they were given at least a half feed of grain. The results of these studies indicate that if forage is ample, any of these pastures may be used satisfactorily as a replacement for the hay fed in dry lot and that the more pasture is used, the less grain is required per unit of gain. However, as feeding grain is deferred, the marketing date also is deferred. As a result the cattle feeder needs to consider not only actual cost of gains but also the probable relative advantage of different marketing dates or seasons.

In dry lot feeding investigations, corn and sorghum silages proved satisfactory as roughages. Six pounds of alfalfa hay with grain or 4 pounds of alfalfa plus 0.5 pound of soybean oil meal, 2 pounds of alfalfa plus 1 pound of soybean oil meal, or 1.5 pounds of soybean oil meal fed with silage and grain, all produced approximately the same average gains.

Coarsely ground wheat or rye were almost as good as corn where fed with alfalfa hay to fattening calves. Where fed as half of the grain allowance with corn, they were worth as much as corn. Dried beet pulp was found to be of equal value pound for pound with corn, where fed as one-third or half of the concentrate allowance to fattening yearlings. Grain sorghums were worth approximately 90 per cent as much as corn for fattening steers. Molasses to the extent of 2 pounds per head daily was worth as much as corn for fattening steers. As the level of molasses fed was increased, its value in comparison with corn decreased.

The work at North Platte indicates that the feeds usually available on Nebraska farms can be used satisfactorily for beef cattle if consideration is given to their protein and energy contents in comparison with established requirements for given levels of performance. Infrequently certain mineral requirements and carotene also may need to be considered.

Breeding cattle. Several years' work in which breeding heifers and cows were carried on different planes of nutrition during the winter season indicates that with young cows fed average good quality prairie hay, 1 pound of cottonseed cake per head daily during the winter season will result in heavier calves at birth and at weaning; also

that the results of nutrient deficiencies may be cumulative. The most probable nutrient deficiencies were protein and phosphorus. The effect of such deficiencies may be reflected in reduced calvings. Heifers calving as two-year-olds performed satisfactorily, provided they were fed adequate winter rations while they were still growing.

Horses

Beginning about October 1, 1907, studies on the value of forage rations for growing horses were made. One lot was fed alfalfa hay in winter and grazed on alfalfa pasture in summer; a second lot was fed alfalfa hay and grazed on native grass pasture in summer; and a third lot was fed prairie and sorghum hay in winter and grazed on native grass pasture in summer. For three years the increase in weight for the three lots respectively was 680, 611 and 540 pounds. It was concluded that the use of alfalfa pasture at least after the first summer was not profitable but that the feeding of alfalfa hay was desirable.

Sheep

Some work with fattening lambs was done at North Platte. Combinations of wheat or rye with corn proved to be approximately equal to corn where fed with alfalfa hay. Either wheat or rye was reasonably satisfactory as the only grain.

For a number of years, a purebred Corriedale flock has been maintained. It has been used in sheep breeding investigations. It is now planned to use it as the basis for "farm flock" studies.

Dairy Management

Established in 1913, the Station's herd has earned a nation-wide reputation for production.

MYRON G. A. RUMERY, A. R. SHARRAH, AND EDWARD WOLFE

EARLY DAIRYING in western Nebraska consisted of milking a few beef and scrub cows to provide milk for the family and labor on the place. As an agricultural industry it was unheard of. Perhaps this influenced the Nebraska Legislature to appropriate $17,500 in 1913 to establish a Dairy Department at the Experiment Station that would make information about dairying available to farmers. The Department's herd was to serve as a demonstration of management and breeding as well as a source of breeding stock.

The North Platte herd was started with five Holstein heifers from the Gregory and Borden herd at Howell, Michigan in 1913. These foundation animals—purchased for $1,000—were selected by Dean E. A. Burnett, Prof. J. H. Frandsen of the College of Agriculture, Supt. W. P. Snyder of the North Platte Experiment Station, and H. W. Norton of Michigan. One of the heifers produced red calves so she was eliminated from the herd. All of the females in the present herd are descendants of two cows.

A young bull, Sir Stevens Pontiac Concordia, was leased and used in the herd during the winter of 1914. None of the offspring of this breeding remained in the herd.

The first herd sire purchased was King Gerben Lincoln, 124930. He carried the same King Segis breeding as that of the four foundation heifers and was bred by the Dairy Department of the Nebraska College of Agriculture. Many of this bull's progeny have remained in the herd through the years.

The herd has been managed in a rather consistent manner since its establishment. The loose housing method has been used all of the time. The stanchion barn was used only for a milking place. Two-, three-, and four-time milking has been practiced but all of the cows have been milked twice daily since 1937.

The rations have generally consisted of corn silage, alfalfa hay, and rather simple concentrate mixtures of ground corn, beet pulp, wheat bran, and a high protein feed.

Institutional records of milk and butterfat production have been kept since the herd was established. Seven-day official tests were first made on the foundation heifers in 1916. Seven- and 30-day tests were continued on each of the purebred females unless there were complications following calving. The seven- and 30-day testing became less popular about 1920 so the herd was placed on semiofficial advanced registry testing which has been continued to the present time.

Many Bulls Sold to Breeders

The influence of the dairy work at the Experiment Station is indicated by the following facts:

A total of 345 Holstein bulls have been sold to breeders and farmers in Nebraska, many other states, and one foreign country. Many buyers have returned to purchase other bulls over a period of 25 years.

Dawson County won a purebred sire contest conducted in Nebraska several years ago. Eight of the ten winning sires were bred at the Experiment Station and the other two were sons of station-bred bulls.

This herd of Holsteins has established a nation-wide reputation for production. During the years of semiofficial testing, 22 cows were bred and developed that made 39 records of 800 pounds of fat or more; 8 cows have 16 records of 900 pounds of fat or over; and 4 cows have made 6 records of 1,000 pounds of fat. One cow, Beauty Girl Gerben ReBecky 470406, has 2 records above 1,100 pounds of fat. She is the only cow ever developed in Nebraska that has produced 1,100 pounds of fat. At one time she held the world's record for the largest production for three consecutive lactations.

Sixteen cows have made lifetime production records of 100,000 to 187,000 pounds of milk. N P Katherine Kilt 2060184 was recently given the Meritorius Lifetime Production Award for having the greatest lifetime production of any cow in Nebraska in 1953. She produced 161,544 pounds of milk with 5,672 pounds of butterfat, in nine lactations on twice-a-day milking.

Dairy Steers Grown for Beef

Four years' work has been completed in growing and feeding Holstein steers for beef. Feed lot performance and carcass value of Holstein and Brown Swiss steers is now being studied. Aureomycin is being used in an attempt to control digestive disorders in young animals.

Four years' work has been completed in using irrigated bromegrass-alfalfa pasture with dairy cows. Irrigated temporary pasture crops are now being studied.

In 1948, the entire herd was placed on a long-time dairy cattle breeding project together with the herd at the Scotts Bluff Experiment Station and a part of the Holstein herd at the College of Agriculture in Lincoln. This project will probably be conducted for 15 years.

Dairymen at the Station have been A. R. Sharrah, 1914-47, and Myron G. A. Rumery, 1947 to the present.

Serving as dairy herdsmen have been Harry Stanton, Paul Brown, Homer Discoe, L. A. Thomlinson, Gene Block, William Schnackenberg, and Charley Marlin.

Poultry

Many individuals, schools, and extension groups have used the poultry plant to study production practices.

MYRON G. A. RUMERY

THE POULTRY DEPARTMENT was established during the fall and winter of 1919 for the purpose of demonstrating good practices in farm poultry production. Many individuals, schools, and extension groups have used the plant to study production practices.

Improved breeding stock, chicks, and hatching eggs were furnished to surrounding areas during the early years of the plant's operation.

Marvel L. Baker supervised poultry research during the years 1934-1941. He used stocks of White Leghorns and White Plymouth Rocks for this work.

The Experiment Station has been cooperating with the Poultry Husbandry Department of the College of Agriculture in testing experimental crosses. Also, during the year 1952-1953 a test was conducted to study the effect on egg production, hatchability, and mortality of adding a vitamin concentrate to a standard laying ration.

Breeding and selection of the White Leghorn flock is being continued.

The following men have served as poultrymen: Robert Jandebeur, 1919-1922; T. A. Bouwens, 1922-1923; D. L. Robertson, 1923-1925; Leroy Parks, 1925-1933; M. L. Baker, 1934-1941; E. A. Wolfe, 1942-1951; J. C. Adams, 1951-1952; and Myron G. A. Rumery, 1952 to the present.

Poultry assistants have been Bernard Leavitt, 1934-1948; Leo Neilsen, 1948-1951; and Ely Miller, 1951 to the present.

The Next Fifty Years

Agricultural research is not static. It will be even more vital in the future than in the past.

W. V. LAMBERT

THE GREAT strides that have been made in farming in the fifty years since the establishment of the North Platte Station have been truly impressive. Most of the farming practices that have transformed this area from an almost virgin prairie to the highly productive country it is today were unknown a half century ago.

Irrigation has been developed, new and better adapted varieties of crops have been created, and summer fallow, strip cropping, mulch tillage and better rotations have been discovered and put into wide use. Mechanical power has replaced horsepower. Better strains of animals, improved feeding practices and better disease control methods for livestock have been developed. In short, the transformations in agriculture since 1904 constitute changes the like of which the world has never before seen.

As we celebrate this anniversary today and look in retrospect at the accomplishments of the last fifty years, I think we should ask ourselves about the next fifty. Will they bring such startling changes and will research play a greater or lesser part in the agriculture of the next half century?

If we may judge from the accelerated pace of science in farming in the last decade I would predict that the role of the North Platte Station in service to agriculture will be even greater in the last half of the century. Farming is becoming more complicated each day. The farmer of tomorrow will have to be better trained and have a ready source of good information if he is to produce efficiently and overcome the many problems that will confront him. My prediction is that farmers will lean more heavily on the North Platte Station than they have in the first fifty years.

What direction will the research take in the next fifty years? Certainly it will be concerned with the development of better plants and animals, with methods for better conservation and use of water, the control of pests and diseases of livestock and plants, control of weeds, better management of pastures, maintaining soil fertility, conservation of land resources, and improving the efficiency and economy of farm structures. Many other phases of agriculture will be studied and more of the research will probably be on fundamental problems.

We must remember that agricultural research is not a static thing. The problems of farm production are so intimately bound together that when one factor is changed the whole system may be changed. The

limiting factors under one system of farming may be overcome but other limiting factors will develop as the result of a new discovery. The rapid changes occurring in economic conditions, wear and tear on the soil from continued cropping, the multiplicity of conditions under which plants and animals are grown, plus the biological changes which occur in plants and animals and their parasites, make research a never ending task.

These many factors are certain to make research more vital to the agriculture of this region in the next fifty years than it has been in the past. I predict that this Station will become more essential with each passing year. If we continue to support such institutions as this, I am convinced that Nebraska's farmers can look forward to great progress.

3½ M