RESEARCH AT THE
NORTH CENTRAL BRANCH

Ohio Agricultural Research and Development Center
WOOSTER, OHIO
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FACTS ABOUT THE NORTH CENTRAL BRANCH

History: The North Central Branch, with frontage on the shores of Sandusky Bay, contains 350 acres. Approximately 125 acres can be classed as man-made marshland. This marshland was developed by building dikes to form 10 ponds and drilling large artesian wells to supply the water.

The cropland, marshland, and all buildings were given to the State of Ohio in 1954 by William E. Levis, long associated with the Owens-Illinois Glass Company of Toledo, Ohio. All facilities thus became a part of the Ohio Agricultural Research and Development Center to further research in dairying, crops, and wildlife. Other related areas of research were added to make up the present program.

Dairying: The dairy barn was included in the original gift to the state. It is 220 feet long and 40 feet wide, with a 60-foot wing for maternity and calf feeding research. It was designed to house two herds for housing research, using open-shed and stanchion type facilities. The barn is equipped with a mechanical gutter cleaner, two 12 x 40-foot silos with unloaders, a bale conveyor system, and a natural air hay dryer. The modern milking equipment includes a pipeline milker and an 800-gallon bulk milk storage tank.

Approximately 50 cows are kept in the milking herds at all times, with an equal number of replacements. The cows are all bred artificially, using frozen semen which is stored in a liquid nitrogen unit. Nearly all feed for the dairy cattle is produced on the farm.

Crops: Research projects in crop production at the North Central Branch are conducted by staff members in a number of different departments of the Ohio Agricultural Research and Development Center. The work of the Agronomy Department includes crop variety testing and developing, fertility studies, weed control herbicide evaluation, tillage, crop rotation, and row spacing studies. Most major crops of the area are included in some phase of the work.

The Botany and Plant Pathology Department has work on many phases of crop diseases and their control. The main effort is on soil-borne diseases.

The Department of Agricultural Engineering is cooperating with Agronomy in the development of new tillage techniques for heavy soils and is exploring the possible use of asphalt as a spray mulch to aid emergence and plant growth. The use of surface flow irrigation on this heavy lakebed soil has been another area of study.

Wildlife: The red-winged blackbird continues to cause considerable damage to crops in this area. All facilities, marshland, and cropland are made available for research projects concerning this major problem.
Drainage: The major portion of the soil on this farm is Toledo silty clay which is very heavy and poorly drained. This soil is similar to much of the land in the old lakebed section of northwestern Ohio. Since draining this land is very important for successful crop production, an extensive research layout of controlled surface and subsurface drained areas was built to study how proper drainage can best be accomplished.

Experimental installations of plastic-lined mole drains are being tested to determine their effectiveness on this heavy soil.

Robert Eby is the Branch Manager and is assisted by Charles Wilier, whose primary responsibility is Herdsman. Six other men are employed full-time to help with the milking and other farm operations.

Residents of the area are welcome to visit the Branch to observe the research being conducted. Special tours of the Branch can be arranged with Mr. Eby.
The weather center at the North Central Branch is similar to those at all Branches of the Ohio Agricultural Research and Development Center. Daily observations include air and soil temperatures, precipitation, and description of the general weather conditions. Soil moisture determinations are made weekly. These data are summarized and made available to researchers with experiments at the Branch.

Plant growth, yield, insect and disease infestations frequently are related to climatic conditions. By comparing field observations with weather data, researchers are better able to evaluate their experimental results.

Weather data gathered at this Branch is assisting climatologists in characterizing the climate of Ohio. A knowledge of the climate of the area is essential when new cultural practices are being developed, introduction of new varieties is proposed, or new methods of disease and insect control are being tested.

Climatic Characteristics of North Central Branch and Vicinity

Mean annual temperature: 51°F
Mean annual precipitation: 32 inches
Length of growing season: 187 days
Date after which less than 50% chance of freezing temperature (32°F): Oct. 25
Normal mean growing season temperature: 65°F
Number of days with 90°F and above temperature: 15 days
Normal rainfall for growing season: 17 inches
Mean number of days during July and August with 0.10 inch or more rainfall: 13 days
Average annual inches of snowfall: 35 inches
A special shelter for housing the recording instruments is shown. Robert Eby, the Branch Manager, is recording the daily temperatures.

The evaporation pan and anemometer record daily surface evaporation and wind movement. This information is essential for irrigation research.
The main objective of this experiment is to compare effects of different methods of drainage on crop yields. Some plots are not drained, others are surface drained only, others are tile drained only, and some have a combination of both tile and surface drainage. The soil is Toledo silty clay loam, which has a very slowly permeable subsoil.

Tile flow, surface runoff, water table height, soil temperature, and rainfall measurements are being taken. To accelerate collection of data, the plots are irrigated to simulate natural rainfall. Plots have been irrigated at least once each year and some as many as three times. The depth of water applied during each irrigation normally would occur only once in 10 to 15 years by natural rainfall.

All plots were planted with the same crop each year for 3 years. In 1959, 1960, and 1961, Kentucky fescue grass was the crop but no yields were taken. In the undrained plots, some grass drowned out. Otherwise, no differences in growth were observed.

During 1962, 1963, and 1964, corn was grown with three rates of nitrogen fertilizer in the subplots. These yields are shown in Table 1. The average corn yields were significantly higher for the three drainage treatments than for the undrained treatment. No significant differences in corn yields could be found between the three drained treatments. The application of nitrogen fertilizer was highly effective in increasing corn yields at all drainage levels.

An economic evaluation of the drainage systems with a nitrogen application of 100 pounds per acre for the corn showed that the benefit-cost ratio for surface drains was 10:1, tile drains 6:1, and the combination tile-surface drainage system 4:1 when compared to the undrained plots. The study indicated that the surface drainage system gave the greatest benefit per dollar invested in the drainage system.

Soybean yields obtained in 1965 are also shown in Table 1. The relatively lower soybean yields on the undrained plots compared to the corn yields were partly due to the three irrigations on the soybeans. Corn was sprinkled only twice each season.

From tile flow and surface runoff measurements, the surface drainage system caused a reduction in tile flow. Likewise, the tile system reduced surface runoff. The drainability of the soil was computed from tile flow measurements. These values were then taken to obtain the required tile spacing for a given rate of water table drop. They are given in Table 2. For any desired rate of water table drawdown, tile spacings were greater where good surface drainage was provided. This increase was 50 percent or more compared to the spacings for no surface drainage. These spacings were obtained for this particular experimental site but may be extended to similar soils.
DRAINAGE

MAJOR PROBLEM ON HEAVY CLAY SOILS

Surface run off and tile flow are constantly recorded with instruments like the one shown.

The overall layout of the drainage research plots is shown with oats being grown as an indicator crop.
TABLE 1. Effect of Drainage and Nitrogen Treatments on Crop Yields.

<table>
<thead>
<tr>
<th>Nitrogen Treatment lbs/acre</th>
<th>Drainage Treatment</th>
<th>A (Undrained)</th>
<th>B (Surface Drained)</th>
<th>C (Tile Drained)</th>
<th>D (Surface &amp; Tile Drained)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Three-year Average Corn Yields (1962-64) in Bu./Acre</td>
<td>38</td>
<td>55</td>
<td>59</td>
<td>66</td>
</tr>
<tr>
<td>100</td>
<td>Soybean Yields (1965) in Bu./Acre</td>
<td>47</td>
<td>85</td>
<td>98</td>
<td>100</td>
</tr>
<tr>
<td>200</td>
<td></td>
<td>69</td>
<td>103</td>
<td>112</td>
<td>111</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td>51</td>
<td>81</td>
<td>90</td>
<td>92</td>
</tr>
</tbody>
</table>

TABLE 2. Recommended Tile Spacings for Toledo Silty Clay Soil.

<table>
<thead>
<tr>
<th>Desired Rate of Water Table Drawdown in Inches Per Day</th>
<th>*Tile Spacing in Feet</th>
<th>No Surface Drainage-C</th>
<th>With Good Surface Drainage-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>50</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>32</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>24</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>20</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>16</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

*Computed from tile flow measurements. Tile depth is 3.0 feet for all spacings. Spacings apply to the wettest year in 10 for corn and to the wettest year in 40 for grass. The initial water table was nearly at the surface of the soil.
Little if any research has been done on the desired rate of water table drop for different crops. This rate also varies with different varieties of the same crop. The rate should be greater for corn than for grasses. Some researchers report that for field crops the water table should drop about 6 to 12 inches for the first day. These rates give spacings about in the range of present recommendations.

H 61 (ARS cooperating)

PLASTIC TUBE DRAINAGE EXPERIMENT

J. L. Fouss and G. O. Schwab
Department of Agricultural Engineering

This experiment is part of a study for developing new engineering techniques for installation and maintenance of drainage facilities. Particular attention is given to the development of subsurface drainage systems which can be installed at relatively low cost and provide versatility and rapidity in installation.

The present research activities are centered around installing a plastic lining or tube in a "mole drainage" channel. An experimental drainage implement has been adapted to a mole plow to install a completely closed or "zippered" plastic liner in a mole drain channel.

The plastic drain is 3 inches in diameter and is formed from a roll or coil of 10-inch wide sheet vinyl plastic with special interlocking tabs prestamped along both edges. The plastic drain is formed into a circular shape and the interlocking tabs zippered together as the drainage machine is pulled through the ground. The machine installs the mole liner from 2 to 30 inches deep and at speeds of 100 to 125 feet per minute. The total cost of installation (including the plastic material) is estimated at $10 to 12 cents per linear foot. A large crawler tractor, capable of developing up to 30,000 pounds drawbar pull, is required to handle the machine at the 30-inch depth of operation in heavy clay soils.

Three experimental field installations of plastic-lined mole drains have been completed at the North Central Branch. These studies were initiated to determine the problems of installation and maintenance of plastic mole drain liners having various structural cross-sections. Three types of circular drain liners and two types of arch-shaped drain liners are under field study. A total of 12,000 linear feet of plastic-lined mole drains are included in the three installations.

After 5 years of field testing, the results show that the zipper liner has maintained its cross-sectional shape and size better than the other circular types of liners in the experiments. However, it still is not strong enough to maintain an open drain channel over long periods of time. The drains have functioned well, in spite of their partial collapse, and have been equally effective as tile drains in lowering the water table.

The latest approach which is showing much promise is the installation of a corrugated plastic tube in the mole-drain channel by a hollow-blade tool pulled behind the mole plow. The corrugations in the tube wall provide much greater strength and, since fairly thin plastic material is used in the tube wall, the cost is low. Field studies for this new experimental drain tubing are in the planning stage.
If this method of subsurface drainage proves successful, it will have many applications. One important use would be in heavy clay soils. The lower cost of installation would permit closer lateral drain spacings, resulting in better water table control.

H 61 (ARS cooperating)

SURFACE IRRIGATION

R. B. Curry
Department of Agricultural Engineering

The objective of this study is to determine the potential of surface irrigation as part of a combination drainage irrigation system.

The area was graded to provide a uniform 0.2 percent slope 800 feet long with no cross slope. This grade was selected to provide adequate surface drainage as well as nearly optimum slope for surface irrigation. The water is supplied to the head end of the field by gated aluminum pipe. Water is then applied as needed in alternate furrows to plots of both corn and soybeans. Water is applied only during critical periods of crop growth.

Scheduling of irrigation is done with a modified evaporation pan. This indicates irrigation need based on the cumulative daily evaporation multiplied by a factor which corrects for the difference between pan evaporation and crop evapotranspiration.

Since the objective is to study the potential of the system, yields have not been emphasized, although they have been recorded. In general, additional water has benefited both corn and soybeans.

The results indicate that the system will work. Data from 1965 indicated rate of advance of water in the furrows from 6.6 ft./min. to 4.0 ft./min. for a flow of 28 gal./min. Moisture measurement indicates satisfactory lateral movement from the alternate furrows. Soil cracking presents a problem if the soil is allowed to become too dry between irrigations.

The potential use of these results will be in the design of combination irrigation and drainage systems for lakebed soil which will lower the total cost over individual systems and provide a better degree of water management.
FIELD CROP RESEARCH

CORN, SOYBEANS, SUGAR BEETS ARE ALL IMPORTANT TO AREA ECONOMY

Aerial view of agronomic research plots. Photograph was taken while a field day was in progress.

This corn was planted with no tillage. Three lb. of atrazine applied pre-emergence has controlled the weeds.
Within the past 20 years, the standard practice of growing corn in rotation with other crops has been challenged as being unnecessary to maintain high economic yield. The standard tillage method for corn of plowing, diskng (plus harrowing or rolling) also has been questioned. It has been possible to reduce tillage operations and maintain or even increase corn yields. Within the last 5 years, it has become possible to eliminate all tillage operations and kill undesirable vegetation with chemicals while maintaining or increasing corn yields.

The object of this experiment is to compare three widely differing tillage systems on each of three crop rotations. The trials, begun in 1962, will be run at least 8 years. Each treatment will remain on the same plot each year to determine the cumulative effects of tillage and rotation (if any) on soil tilth and corn yield. Similar experiments are being performed on other soil types in the State. At the conclusion of this effort, the potential of each management combination will be evaluated.

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plow, disk twice, plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-continuous corn</td>
<td>73</td>
<td>Poor</td>
<td>58</td>
<td>104</td>
<td>81</td>
</tr>
<tr>
<td>-corn, soybeans rotation</td>
<td>87</td>
<td>weed</td>
<td>89</td>
<td>109</td>
<td>99</td>
</tr>
<tr>
<td>-corn, oats, alfalfa rotation</td>
<td>72</td>
<td>control</td>
<td>73</td>
<td>102</td>
<td>88</td>
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<tr>
<td>Plow, plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-continuous corn</td>
<td></td>
<td>very</td>
<td>no-</td>
<td>77</td>
<td>101</td>
</tr>
<tr>
<td>-corn, soybeans rotation</td>
<td></td>
<td>low</td>
<td>tillage</td>
<td>77</td>
<td>102</td>
</tr>
<tr>
<td>-corn, oats, alfalfa rotation</td>
<td></td>
<td>stand</td>
<td>plots</td>
<td>low stand</td>
<td>103</td>
</tr>
<tr>
<td>No tillage, plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-continuous corn</td>
<td>86</td>
<td>--</td>
<td>73</td>
<td>99</td>
<td>86</td>
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<tr>
<td>-corn, soybeans rotation</td>
<td>88</td>
<td>--</td>
<td>weedy</td>
<td>101</td>
<td>--</td>
</tr>
<tr>
<td>-corn, oats, alfalfa rotation</td>
<td>82</td>
<td>--</td>
<td>82</td>
<td>95</td>
<td>88</td>
</tr>
</tbody>
</table>

So far, when weeds were properly controlled and stand was satisfactory, the only outstanding treatment has been plow, disk for corn following soybeans. The study has not run long enough to assess trends or predict which treatment or treatments will be best.
DATE OF PLANTING FOR CORN

J. Benton Jones, Jr.
Department of Agronomy

General recommendations call for planting corn sometime between May 1 and June 1. However, research has clearly pointed to the significant value of planting corn before May 10. Higher yields and lower moisture content at harvest are two distinct advantages for "early planted corn".

A summary of rainfall probabilities indicates that there is less likelihood of rainfall during planting if completed prior to May 10. Since early planted corn tends to tassel and pollinate earlier, initial ear development will occur when the likelihood of rainfall is higher. Early planted corn will not grow as tall as late planted corn and therefore tends to be more resistant to lodging and stalk breakage.

Corn planting can be done too early, however. Corn seed will not germinate unless the soil temperature is 50°F or higher. If the soil temperature is less than 50°F, the seed will lie dormant in the ground. In general, planting prior to April 25 in southern Ohio and May 1 in northern Ohio can result in poor germination and loss in stand.

Current corn planting recommendations call for planting in southern Ohio between April 25 and May 5 and in northern Ohio between April 30 and May 10. To meet this time schedule, soil preparation may need to be speeded up. The use of minimum tillage techniques can be of significant value if corn is to be planted on time.

<table>
<thead>
<tr>
<th>Planting Date</th>
<th>Date 50% Silk</th>
<th>Yield, Bu./A.</th>
<th>Grain Moisture at Harvest, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/16</td>
<td>7/13</td>
<td>96</td>
<td>18</td>
</tr>
<tr>
<td>4/19</td>
<td>7/11</td>
<td>96</td>
<td>24</td>
</tr>
<tr>
<td>4/26</td>
<td>7/15</td>
<td>100</td>
<td>21</td>
</tr>
<tr>
<td>5/3</td>
<td>7/10</td>
<td>96</td>
<td>21</td>
</tr>
<tr>
<td>5/10</td>
<td>7/22</td>
<td>63</td>
<td>25</td>
</tr>
<tr>
<td>5/17</td>
<td>7/26</td>
<td>74</td>
<td>34</td>
</tr>
<tr>
<td>5/24</td>
<td>8/3</td>
<td>62</td>
<td>30</td>
</tr>
</tbody>
</table>

Effect of Planting Date on Date of Silk Initiation, Yield, and Grain Moisture.
NITROGEN FOR CONTINUOUS CORN

H. J. Mederski
Department of Agronomy

Nitrogen at rates ranging from 0 to 200 lb. is being applied to a continuous corn cropping system at the North Central Branch. The data in the table show corn yields from 1960 through 1965. The 1960 yields are third year corn but the first year of the experiment.

<table>
<thead>
<tr>
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<td>0</td>
<td>43</td>
<td>24</td>
<td>62</td>
<td>28</td>
<td>37</td>
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<td>50</td>
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<td>100</td>
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<tr>
<td>150</td>
<td>81</td>
<td>88</td>
<td>108</td>
<td>60</td>
<td>58</td>
<td>75</td>
</tr>
<tr>
<td>200</td>
<td>87</td>
<td>93</td>
<td>106</td>
<td>63</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>100*</td>
<td></td>
<td></td>
<td></td>
<td>52</td>
<td></td>
<td>78</td>
</tr>
</tbody>
</table>

*Corn in rotation with alfalfa + 100 lb. N.

The data show very large increases in corn yield for all rates of nitrogen. The most profitable rate of nitrogen was 150 lb. over 6 years. The 200 lb. rate produced slightly more corn than 150 lb. but was less profitable. This experiment includes plots with 200 lb. of N but stalks are removed annually after harvest. The removal of stalks has not affected yields.

In general, yield increases from nitrogen are largest in those years with ample rainfall and high yields. In low yielding years, nitrogen is still profitable although somewhat less so than in the good years.
Herbicides for controlling weeds in corn may be applied pre-emergence or post-emergence.

Pre-emergence refers to application after the corn is planted but before the corn and weeds are through the soil. The pre-emergence materials may be applied overall (broadcast) or in bands over the rows, leaving the middles to be cultivated. Better control of weeds is usually obtained by all pre-emergence herbicides if some rainfall occurs within the first few days after application. If no rainfall occurs within a week to 10 days after application, incorporation with a rotary hoe will likely improve results.

Post-emergence refers to application after the corn and weeds are through the soil. These herbicides may be applied as overall sprays or with drop nozzles. A new application technique used with certain herbicides is a precise directing of the spray to the foliage of the weeds, with little or no spray on the corn foliage. Equipment is available for this type of application.

For information on weed control in other crops, refer to Ohio Cooperative Extension Service Bulletin 172.

**Atrazine and Simazine**

Atrazine and Simazine have consistently resulted in good to excellent control of annual broadleaf and grass weeds when applied pre-emergence. Atrazine can also be used soon after emergence of the corn and weeds. The weeds must be less than 2 inches tall to be killed. These materials will not injure corn, even at rates much greater than recommended.

For most Ohio soils, 2 lb. active will result in adequate control of weeds. On light sandy soils, good weed control has been gained from 1 to 1.5 lb./A. On very heavy clays, soils high in organic matter, and where there is a known serious weed problem, rates of 2.5 to 3 lb./A. should be used.

Atrazine and Simazine are available in an 80% wettable powder. For a 2 lb. active ingredient rate, 2.5 lb. of the 80% wettable powder are required.

These herbicides are relatively non-volatile, non-soluble materials and remain in soils longer than most other herbicides. However, in Ohio research studies, no injury has occurred to field crops grown after corn which was treated with atrazine or Simazine at 2 lb./A. or less when the wettable powder formulation was used. Vegetable crops, tobacco, or sugar beets should not be planted the year following an application of these herbicides.
**CDAA-T (Randox-T)**

Randox-T will control most annual broadleaf and grass weeds when applied pre-emergence. It performs best on soils relatively high in organic matter. This material should be applied to a fairly dry soil but needs slight to moderate rains following application for best results. Do not use on sandy soils. Randox-T is available in liquid and granular formulations. The rate of application should be 3 to 3.5 lb. of active CDAA per acre (1 to 1.5 quarts of the liquid or 30 lb. of the 11.7% CDAA granules). There have been isolated cases of Randox-T injuring soybeans and tomatoes the year following application.

**2,4-D**

2,4-D may be applied to corn pre- or post-emergence. Applied pre-emergence, 2,4-D has been quite erratic. Unless rainfall occurs within a few days after application, poor weed control can be expected. The low-volatile ester of 2,4-D should be used pre-emergence and is most effective if applied 1 to 3 days before the corn emerges. It may be applied as a liquid spray in 10 or more gallons of water per acre or as granules. Rates of application should be 1 lb. active/A. on light soils and up to 2 lb./A. on heavy clay or high organic matter soils. 2,4-D should not be applied pre-emergence to sandy soils.

After corn has emerged, 2,4-D may be applied to kill broadleaf weeds. The rate of application should be ½ lb./A. of the ester formulations or ½ lb./A. of the amines. After the corn is 12 inches high, drop nozzles should be used to prevent spraying the whorl of the corn.

In river bottoms where wild cucumber is a problem, a mixture of 2,4-D and 2,4,5-T should be applied at lay-by or up to the time corn begins to silk or tassel. Drop nozzles may be used at lay-by but hand or high clearance sprays are required after lay-by. The rate of application should be 3/4 of a pint per acre of a 1 to 1 or 2 to 1 mixture of 2,4-D and 2,4,5-T ester (½ lb./gallon concentration).

**Linuron (Lorox)**

Linuron may be applied pre-emergence or directed post-emergence. Applied pre-emergence, it controls most annual broadleaf and grass weeds. It is available as a 50% wettable powder. The rate of application should vary considerably as to soil type. It should not be used on sandy soil. On lighter soils low in organic matter, the rate should be 1 lb. active/A. (2 lb. 50% material). On most Ohio soils, the rate should be 1½ to 2 lb./A. (3 to 4 lb. 50% material). On heavy clay or high organic matter soils, the rate should be from 2 to 2½ lb./A. (4 to 5 lb. 50% material). Plant corn at least 1 3/4 to 2 inches deep to avoid injury.

Linuron will also control broadleaf and grass weeds when applied as a directed post-emergence spray. A surfactant (wetting agent) should be used when applied in this manner. The rate of application should be 2 lb./A. (1 lb. 50% material). For this treatment to be effective, the corn must be at least 16 to 18 inches high and the weeds must not exceed 8 inches in height.

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Other Materials

Ramrod is a new material which is approved for pre-emergence use on corn. It has resulted in excellent grass control and good broadleaf weed control. Roundup is a combination of Ramrod and 2,4-D and may be somewhat more effective on broadleaf weeds than Ramrod alone. These materials are available as wettable powders and granules.

Kornweede is a combination of EPTC and 2,4-D. Results have been variable with this product which is available as a liquid and granules.

Dicamba (Banuel-D) has approval for use on corn as a pre- and post-emergence application. Studies indicate that the best use of this product may be with a mixture of 2,4-D. It is available as a liquid and granules.

Dalapon (Dowpon) plus 2,4-D has performed quite well, especially on giant foxtail, when applied as a directed post-emergence spray when the corn is 12 to 18 inches high and the weeds are not more than 6 inches high.

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EFFECT OF CULTURAL FACTORS ON STALK ROT OF CORN

L. E. Williams and J. B. Jones, Jr.
Departments of Botany and Plant Pathology and Agronomy

Experiments at the North Central Branch have demonstrated that a preceding crop of soybeans decreased root and stalk rot and increased yields in a subsequent crop of corn. The root and stalk rot of corn is primarily caused by the soil-borne fungus (mold) Fusarium roseum.

The present experiment deals with the effect of soybean cropping on corn root and stalk rot as it might be affected by nitrogen fertilization or methods of plowing. The beneficial effect of soybeans was apparent, even though as high as 200 lb. of nitrogen per acre were used in the corn-corn and soybean-corn sequences. Different methods of plowing appear to affect the amount of corn root and stalk rot. It has not been established whether plowing affects the disease-causing fungus by differences in aeration, moisture, or build-up of beneficial microorganisms.
Information is needed on the adaptation and performance of available spring oat varieties in north central Ohio. So a program of oat variety testing was initiated in 1966 at the North Central Branch of the Ohio Agricultural Research and Development Center.

Ten varieties were seeded in four replications with a farm drill. Each drilled strip will be harvested with a combine. Data will be collected on grain yield per acre, weight of grain per bushel, dates of heading and combine ripe, percentage of lodged straw at combining, height of plants at maturity, and relative infection with oat diseases. Averages of the data for successive years of testing will serve for comparative evaluation of the varieties in making recommendation for the north central Ohio area.

Spring oat varieties included in the 1966 performance test at the North Central Branch are:

Recommended varieties:

Brave, Clintland 60, Dodge, Garland, Goodfield (for grain)

Rodney (for silage or green-chop)

New variety releases:

Clintland 64, Clintford, Orbit, Tyler
D. L. Katterheinrich, superintendent of outlying branches for the Ohio Agricultural Research and Development Center, left, and Robert L. Eby, the North Central branch manager, inspect winter wheat varieties on test.
New and potential varieties of wheat are tested under the different soil and climate conditions which occur in the state. This test at the North Central Branch helps determine how wheats perform in this general area compared to the recommended varieties. There are 12 entries, each sown 2 times. Of the recommended varieties, Fulton, Redcoat and Reed are included. TN1L55 is a new strain from the cross Vermillion X Lucas. It may be named and released if its performance measures up to its past record at other locations. Performances of some varieties and advanced lines in this test in past years are shown in the following table:

Wheat Variety Test, North Central Branch.
Adjusted Average Yields and Bushel Weights.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Years Tested</th>
<th>Yield Bu./A.</th>
<th>Bu. Wt. lb.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fulton</td>
<td>6</td>
<td>35.6</td>
<td>58.4</td>
<td>Mid-season maturity. Medium tall.</td>
</tr>
<tr>
<td>Monon</td>
<td>5</td>
<td>36.0</td>
<td>59.3</td>
<td>Very early. Short.</td>
</tr>
<tr>
<td>Reed</td>
<td>2</td>
<td>36.5</td>
<td>58.9</td>
<td>Mid-season maturity. Stiff straw.</td>
</tr>
<tr>
<td>Redcoat</td>
<td>3</td>
<td>35.1</td>
<td>59.1</td>
<td>Good disease resistance. Sometimes shatters.</td>
</tr>
<tr>
<td>Vermillion</td>
<td>6</td>
<td>35.0</td>
<td>59.3</td>
<td>Medium early. Medium short.</td>
</tr>
<tr>
<td>TNLh31</td>
<td>1</td>
<td>33.5</td>
<td>58.9</td>
<td>New line. Dropped in 1965.</td>
</tr>
<tr>
<td>TNLh03</td>
<td>1</td>
<td>31.2</td>
<td>58.6</td>
<td>Promising new line. Stiff straw.</td>
</tr>
<tr>
<td>TNLh36</td>
<td>1</td>
<td>35.9</td>
<td>59.0</td>
<td>Promising new line.</td>
</tr>
</tbody>
</table>

*Currently recommended varieties.
STRAINS AND VARIETIES OF SOYBEANS

P. E. Smith
Department of Agronomy

These tests make it possible to determine the field performance of new experimental strains in comparison with the standard recommended varieties. A practical use of results from these tests is illustrated by three new soybean varieties recently released in Ohio (Chippewa 61, Lindarin 63, and Harosoy 63). The superiority of these varieties was established from the results of these and many similar tests.

Annual and 5-year Average Yields of Eight Soybean Varieties when Grown in Large Field Plots and Harvested with a Field Combine, North Central Branch.

<table>
<thead>
<tr>
<th>Variety</th>
<th>5-year Av. 1961-65</th>
<th>Annual Yields - Bushels per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chippewa</td>
<td>31.2</td>
<td>35.5</td>
</tr>
<tr>
<td>Chippewa 61</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lindarin</td>
<td>-</td>
<td>41.3</td>
</tr>
<tr>
<td>Lindarin 63</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Harosoy</td>
<td>-</td>
<td>43.6</td>
</tr>
<tr>
<td>Harosoy 63</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Shelby</td>
<td>41.3</td>
<td>43.8</td>
</tr>
<tr>
<td>Ross</td>
<td>39.3</td>
<td>46.4</td>
</tr>
<tr>
<td>Yearly average</td>
<td>42.1</td>
<td>35.3</td>
</tr>
</tbody>
</table>

*Missing data indicate that the particular variety was not included in the test for a specific year.
Several herbicides have resulted in good to excellent control of annual broadleaf and grass weeds in soybeans. Most of these are recommended to be applied pre-emergence immediately after the beans are planted and up to the time they start breaking through the soil. Three weeds which usually are quite difficult to control with pre-emergence materials are jimsonweed, velvetleaf, and cocklebur.

The pre-emergence materials may be applied overall (broadcast) or in bands over the rows, leaving the middles to be cultivated. Better control of weeds is usually obtained by all pre-emergence herbicides if some rainfall occurs within the first few days after application. If no rainfall occurs within a week to 10 days after application, incorporation with a rotary hoe will likely improve results.

**Amiben**

Amiben applied pre-emergence to soybeans controls most annual broadleaf and grass weeds. For several years in Ohio studies, this has been the most consistent herbicide for weed control in soybeans. Rate of application should be 2½ to 3 lb./A. (5 to 6 quarts/A. of 2 lb./gal. concentrate or 25 to 30 lb./A. of 10% granule). Use the higher rate on heavy clay and/or high organic matter soils.

**NPA (Alanap) plus CIPC**

This combination of materials has been widely used for pre-emergence weed control in soybeans in Ohio. NPA controls ragweed but not smartweed, while the reverse is true of CIPC. Both materials are fairly effective on annual grasses. Soybeans should be planted at least 1½ inches deep to prevent injury.

The recommended rate of application is 2 lb. active/A. of each material on most Ohio soils. On high organic matter soils, the rate should be increased to 3 lb./A. of each. Ready-mixed liquids and granules are available in a 3 to 2 ratio of NPA to CIPC. So a rate of 3 lb. NPA and 2 lb. CIPC should be applied per acre if these are used.

**Linuron (Lorox)**

In Ohio, linuron has resulted in good control of annual broadleaf and grass weeds when applied pre-emergence. Control of weeds has extended throughout the growing season.

The recommended rate of application varies from 3/4 to 2 lb. active/A. (1½ to 4 lb./A. 50% wettable powder) according to soil type. It should not be applied to sandy soils. The lower rate should be used on very light soils and the higher rate should be used on heavy clay and high organic matter soils. For most Ohio soils, the recommended rate is from 1 to 1½ lb./A. Soybeans should be planted at least 1½ inches deep because shallow covered beans will likely be injured.
DNBP (Dinitro) (Premerge, Sinco PE)

DNBP applied pre-emergence has resulted in inconsistent weed control in Ohio. The approved rate is $\frac{3}{2}$ lb./A. (2.5 gallons). Do not use on sandy soils. Preferred time of application is just prior to emergence of the soybeans.

DNBP applied soon after emergence of soybeans (cotyledon to two-leaf state) and weeds has resulted in good control of the broadleaf and grass weeds. Recommended rate is $2\frac{1}{2}$ to 3 lb./A. (3 to 4 quarts/A.). Do not apply when temperature is 85°F or above. Some burning of soybeans may occur but usually they will grow out of this condition.

CDAA (Randox)

Randox will only effectively control annual grass and in Ohio is not too consistent in this respect. It must be applied pre-emergence and the soil should be fairly dry at time of application. Better results are usually obtained on high organic matter soils. Do not use on sandy soils. Rate of application is 1 to 5 lb./A. with the higher rate on heavy soils.

2,4-DB (Butoxone, Butyrac)

2,4-DB will effectively control cocklebur and reduce the competitive effect of jimsonweed and some other broadleaf weeds. It must be applied from a week to 10 days before the soybeans bloom up to early-bloom. Rate of application should be 0.2 lb./A. in 10 to 20 gallons of solution per acre.

Treflan (trifluralin) and Vernam are two herbicides which must be incorporated into the soil for maximum effectiveness. Both materials are more effective on grasses than broadleaf weeds.

Dacthal, Tanoran, Planavin, and Ramrod have approval for use on soybeans but further studies will be conducted before a general recommendation is made. Ramrod can be used only on soybeans which are to be harvested for seed purposes.
This experiment started as a study of control of Phytophthora root rot of Harosoy soybeans with row applications of fungicides mixed with 0-20-20 fertilizer. Root rot was found to be most severe in all treatments in which fertilizer was added, regardless of the presence of fungicides. Applications of fungicides without fertilizer have no effect on the severity of root rot. The effect of row fertilizer applications on Phytophthora root rot of Harosoy soybeans over a 2-year period is summarized in the following table.

<table>
<thead>
<tr>
<th>Row Application</th>
<th>Percent Disease</th>
<th>Yield (bu./acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 lb. 0-20-20</td>
<td>13.3</td>
<td>20.6</td>
</tr>
<tr>
<td>Attaclay control</td>
<td>16.5</td>
<td>27.4</td>
</tr>
</tbody>
</table>

This work is being expanded to determine which components of 0-20-20 fertilizer are responsible for the increased severity of Phytophthora root rot in susceptible varieties.
FORAGE PRODUCTION

QUALITY FORAGE IS IMPORTANT FOR OPTIMUM MILK PRODUCTION

Bandseeding with press wheels is recommended method for seeding legumes.

Combination mower-conditioner is used to make quality hay.

Summer feeding with green chop forages has proven very satisfactory. Considerable losses sustained with direct pasturing method are avoided.
ALFALFA VARIETY TEST
G. R. Gist
Department of Agronomy

The alfalfa variety test, seeded in 1965, includes 22 varieties in four replications. A number of commercial and private alfalfa varieties are in the test, along with varieties developed by various state agricultural experiment stations. This test will be harvested on a four-cutting schedule, with the first cutting about May 25. Yield data from this test will be considered with data from similar tests at other locations in Ohio in determining the relative yield of alfalfa varieties. For current yield ratings, see Cooperative Extension Service Bulletin 172, The 1966 Ohio Agronomy Guide.

Varieties in the test are:

<table>
<thead>
<tr>
<th>Cayuga</th>
<th>Arnim</th>
<th>DuPuits</th>
<th>Orchies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culver</td>
<td>522</td>
<td>Glacier</td>
<td>Progress</td>
</tr>
<tr>
<td>Saranac</td>
<td>525</td>
<td>Haymor</td>
<td>WL-202</td>
</tr>
<tr>
<td>Vernal</td>
<td>I-583 Brand</td>
<td>Warrior</td>
<td>WL-302</td>
</tr>
<tr>
<td>Alfa</td>
<td>Mustang</td>
<td>Europa</td>
<td>WL-303</td>
</tr>
<tr>
<td></td>
<td>Cardinal</td>
<td>FD-100</td>
<td></td>
</tr>
</tbody>
</table>

Factors which should be considered in the selection of an alfalfa variety include: intended use, relative yield, resistance to bacterial wilt, winter hardiness, earliness, and rate of regrowth. Characteristics of many important alfalfa varieties are listed in Table 55 of Bulletin 172.

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ALFALFA MANAGEMENT STUDIES
J. L. Parsons and R. W. Van Keuren
Department of Agronomy

Stands of three alfalfa varieties, Vernal, Ranger and DuPuits, were established in 1960. The plots were harvested uniformly in 1961 and the experimental treatments started in 1962. Half of the plots received 500 lb. per acre of 0-20-0 in April 1962. All plots received 200 lb. per acre of 0-0-60.

Cutting treatments are designed to simulate schedules followed by alfalfa dehydrators and to determine whether the adverse effects of early harvest can be overcome by long growth intervals or high fertility. The various cutting treatments were applied in 1962 and 1963. In 1961, a uniform harvest was made of all plots to measure the effect of previous treatments.

Dry weather during the experiment reduced the alfalfa yields, as well as the effects of the treatments. Despite this, preliminary information from the study shows some conclusions of interest.
The phosphorus did not have a large effect on yield compared with no phosphorus. There was a trend toward increasing yield slightly with the addition of phosphorus. However, after a good level of soil phosphorus is reached, additional amounts apparently do not markedly improve yields.

The highest yields came from the four cuts, which started May 25 and ended September 7. The lowest yields were from treatments cut five times, starting May 11 and ending September 7. The conventional four-cut treatment yielded 64% more than the five-cut treatment.

Extending the recovery periods following an early first harvest improved yields slightly, particularly if the recovery period following the first harvest was extended from 28 days to 62 days.

Although DuPuits alfalfa yielded as well as Vernal the first treatment year, it declined more sharply in yield due to the treatments. Both Vernal and Ranger were much less affected by the cutting treatments than DuPuits.

Effect of Cultural Factors on Alfalfa Root Rot

A. F. Schmitthenner
Department of Botany and Plant Pathology

Seedling root rot of alfalfa is often severe enough in Ohio to result in seeding failures. The damage generally occurs during the months of May, June, and July of the seeding year. Four fungi are involved in the disease in this area: Aphanomyces, Phytophthora, Pythium, and Rhizoctonia. Damage is generally least in alfalfa seeded after corn and most in alfalfa following alfalfa. The experiment has been designed to study the interrelation of soil pH and compaction, row fertilization, and rotation as they affect alfalfa seedling root rot and stand establishment.
A survey of cultural practices used and sugar beet yields produced by 1,000 growers over a 5-year period show that date of planting is usually too late and stands not thick enough for maximum yields. The average planting date for all growers was April 26. However, growers who were able to plant earlier gained about 1 ton of beets for each 10-day advance in planting date. The average stand for all growers was 78 percent. The grower who was able to increase his stand to 88 percent also added about 1 ton to his yield.

In view of the importance of early planting, experiments involve a system in which the soil is fall plowed and leveled with a harrow. In the following spring, beets are planted as soon as the surface 2 inches of soil is dry enough for proper planter functioning. No tillage is done prior to planting, which means that the producer does not have to wait until the entire plow layer is dry enough to disk or harrow. Seedings of this kind were made successfully on March 25, 1962. An extreme, prolonged drought resulted in poor stands and no yield determinations were made.

This work has been repeated each year from 1963-1966, along with experiments to determine how much, if any, post-emergence cultivation beets require. Yield comparisons are being made between weed-free beets which receive normal cultivation and no cultivation.

HERBICIDES FOR SUGAR BEETS

Edward W. Stroube
Department of Agronomy

With the general usage of monogerm seed, chemical weed control in sugar beets is a production practice of utmost importance. The labor requirement could be drastically reduced by the use of monogerm seed and an effective herbicide.

The most effective herbicides approved for use on sugar beets are a combination of endothal and TCA and a combination of pyrazon (Pyramin) and TCA. These treatments should be applied pre-emergence. The pyrazon-TCA combination is more effective against lambsquarters than the endothal-TCA mixture.

Dalapon (Dowpon) or endothal can be applied post-emergence but generally are not as effective as pre-emergence treatments. Dalapon is effective only on grasses.
Joseph Halusky, research assistant, works a decoy trap. This has been an effective method of catching blackbirds.

Typical blackbird damage to an ear of corn.
Bird depredations to agricultural crops have been a problem since man first cultivated crops. Since 1950, damage to corn in Ohio by the red-winged blackbird has been increasing and in 1965 it was rated as the most serious threat to an agricultural crop.

Recent surveys in Ohio and Illinois indicate that the nesting population of the red-winged blackbird has increased more than 200 times since the turn of the century. This increase is due to the introduction and development of alfalfa and clover in the Midwest and to the red-winged blackbird's adaptation to a better habitat than its native marshes, many of which were drained for agriculture.

Following nesting, the redwing spends a few days to a week in vegetation near its nesting site. Then it migrates along natural or manmade bodies of water on flyways similar to those used for centuries. On these migratory flyways, it passes some of the best corn fields and may be decoyed into a field and destroy an entire crop in a matter of minutes.

**EXTENT OF BIRD DEPREDATIONS**

In Ohio, red-winged blackbirds fly over 50 counties, although the corn in only 30 percent of the areas of these counties received damage in 1965. The cash value of the corn damaged in these areas is more than $30 million annually. In addition, damage to corn used as feed amounts to many additional millions.

In the past 25 years, the impoundment of water in Ohio for flood control, wildlife reserves, and water supplies has provided the red-winged blackbird with a new roosting habitat on its migratory flyway. It has also provided the farmer additional fields to grow superior corn in the vicinity of the water impoundments.

Many millions of dollars are spent by farmers in a partially successful attempt to prevent the destruction of their crop. A recent survey in Ohio indicates that an average of more than $5 per acre is spent in the counties subjected to constant, persistent depredations by these birds.

In addition to the direct damage to the grain while it is soft or milky, the bird is responsible for additional damage to the grain such as molding, rotting, sprouting on the cob, and a general failure for the ear to mature when direct damage reaches a critical degree.
RESEARCH ON BIRD DEPREDAIONS

Cooperative research has been conducted by several agencies in the U. S. Department of Interior and the U. S. Department of Agriculture. In 1963, a formal inter-regional project was approved by the Cooperative State Research Service in which various representatives of Agricultural Experiment Stations and the Bureau of Sport Fisheries and Wildlife collaborated to Devise Ways and Improve Methods to Protect Corn and Other Grain Crops from Damage by the Red-Winged Blackbird and Associated Species.

Research has been in the following areas:

- Resistance in varieties of sweet and field corn
- Physiographic factors
- Plant, stalk, or ear characteristics
- Stalk or ear density
- Various planting dates
- Weedy corn fields compared to “clean fields”
- Visual and auditory scaring devices
- Chemical repellents
- Habitat manipulation, including soil and moisture
- Diversion plantings
- Removing birds from the area
- Cropping systems and harvesting methods
- Methods of attracting and deterring birds

In addition, research has been carried on to Devise Means of Crop Protection through Fundamental Studies of Bird Behavior, Biology and Physiology. Research has been done on bird behavior, biology and physiology as follows:

- Various ages, sexes, and longevity of the redwing
- Flight patterns used in finding food and roosts during migration
- Reaction of redwings to various nesting and fledging habitats
- Extent of the migration and flyways used throughout the year
- Nesting behavior and range of the species
- Physiology of birds, especially the senses
- Effect of habitation and imprinting on behavior
- Effect of learning
- Feeding behavior
- Effect of chemicals on reproduction, food supply, and associated animals
- Reaction of birds to various visual and auditory stimuli
- Social behavior of redwings
- Parasites and diseases of blackbirds

The North Central Branch is ideally located for research on the problem of depredations of corn by blackbirds. It is situated on a major flyway in North America and contains 110 acres of cattail marshes. It is separated from Sandusky Bay by 350 acres of cattail marshes and the “School Lands” where the blackbirds often roost in the millions.

In 1957, the marshes were added to the farmland deeded to the Ohio Agricultural Research and Development Center by the late W. E. Levis. At this time it was evident that blackbirds, especially the red-winged blackbird, could not be controlled in soft field corn or sweet corn when the maturation of the corn coincided with large roosts of birds in the cattail marshes.
An ecological study begun here determined the nature and extent of the damage to corn in Ohio by blackbirds and discovered that this exploding population was due to the nesting success of red-winged blackbirds in alfalfa fields. Additional data justifies the conclusion that the damage done by the redwing is by birds on their annual migrations, which carry them across Lake Erie into Kent County, Ontario and Upper Michigan and as far south as the Gulf of Mexico and the South Atlantic States.

Ohio research on the numbers of redwings nesting in alfalfa and studies on migrations with banded birds indicates that the number of birds is still increasing.

At the time corn is damaged, many millions of birds are changing from field to field, county to county, state to state, and country to country. To eliminate them in only one place would not relieve the problem in any one field, county, state, or country.

Research indicates that the only practices or treatments effective in reducing damage are constant scaring devices operated in the field at 2-minute intervals during all daylight hours while the corn is susceptible to damage.

It was learned in 1963 that blackbirds prefer field corn to sweet corn and that migrants rather than resident birds cause the damage.

Control research is being done at the North Central Branch and other branches, as well as at Federal and State Refuges, to find a way to control blackbirds and to find clues to control which will manage the great population of birds and not endanger other forms of life. For example, experiments will be conducted at the North Central Branch to determine the value of chemicals in preventing damage to corn. Decoy traps will be operated in an attempt to improve methods of trapping, devise better ways to control blackbirds, furnish data for the study of population changes, and determine whether sufficient numbers can be caught if the method is projected throughout North America.

Until redwings can be managed, corn growers in this area must protect their crop or suffer great losses. One program at the North Central Branch in 1966 is to show how well a field of corn can be protected with exploders operated during all daylight hours that the corn is soft.
CALF NUTRITION STUDIES

J. W. Hibbs and H. R. Conrad
Department of Dairy Science

Since the herd was established in 1955, more than 150 calves have been used in calf feeding experiments at the North Central Branch. In general, the calf research carried out at the Branch has paralleled the work conducted at Wooster. It provides added Holstein numbers and gives the added advantage of observations in two locations with different environmental conditions.

The overall aim of the experiments conducted from 1955-1965 has been to improve and study the limitations of the Ohio High Roughage System. This system has been designed to raise low cost dairy herd replacements and dairy beef feeders, with maximum dependence upon good roughage and the early development of normal rumen function.

To date, experiments involving calves at the Branch have included the following:

2. High roughage pellets and hay vs. dry starter pellets and hay.
3. Effect of hay to grain ratio on calf performance.
4. A comparison of high roughage pellets vs. high roughage pellets and hay fed free choice to 16 weeks of age.
5. Effect of fresh cud inoculations given at the end of the 16-week pellet feeding period on subsequent growth and performance.
6. Use of different sources of roughage in complete high roughage pellets.
7. Performance of calves fed extra milk the first 2 weeks, with loose hay and grain in a 2:1 ratio to 6 months of age.
8. Effect of supplemental vitamin D on performance of calves fed rations of different phosphorus content.

In general, the high roughage system involves limited milk feeding (whole milk or a good milk replacer) to 7 weeks of age, feeding either good loose hay and a simple grain mixture in a 2:1 ratio or high roughage pellets (3/4 inch diameter) containing a 2:1 hay to grain ratio to 16 weeks of age, and loose hay and grain in a 2:1 ratio with a 4 lb./day grain limit (3 lb. for Jerseys) from 16 to 26 weeks of age.

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1/ A full discussion of this system is available in Dairy Science Department Series, 5 (11): November 1961.
Calf Feeding Research

Charles Willer, assistant branch manager and dairy herdsman, takes 8-week weight, withers, height and chest circumference measurements on calf at right.

Below. Two calves are shown on individual feeding trial.
The table shows typical average growth, feed consumption, and cost of raising Holstein calves to 6 months of age on variations of the high roughage system using extra milk for the first 2 weeks with good loose hay and grain fed separately in a 2:10 ratio or high roughage (2:1) pellets fed free choice with or without free choice hay to 4 months of age. Loose hay and grain were fed after 4 months at a 2:1 hay to grain ratio with a 10 lb./day grain limit. It is suggested that, in practice, loose hay of high quality be fed free choice in addition to the pellets.

A total of 113 heifers have completed 6 months on the various experiments at the Branch and have averaged 388 pounds body weight. Fifteen bull calves similarly fed averaged 313 pounds at 6 months of age.

Holstein Calf Performance to 6 Months Fed on Variations of High Roughage System, North Central Branch.

<table>
<thead>
<tr>
<th></th>
<th>Loose Hay &amp; Grain</th>
<th>2:1 H.R. Pellets</th>
<th>2:1 H. R. Pellets + Hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>No calves</td>
<td>22</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Whole milk, 7 wk. (lb.)</td>
<td>439*</td>
<td>466*</td>
<td>462*</td>
</tr>
<tr>
<td>High roughage pellets, 2:1 Hay to grain (lb.) 16 wk.</td>
<td>455</td>
<td>312</td>
<td></td>
</tr>
<tr>
<td>Alfalfa hay (lb.) 17-26 wk.</td>
<td>726</td>
<td>592</td>
<td>673</td>
</tr>
<tr>
<td>Grain (lb.) 17-26 wk.</td>
<td>367</td>
<td>264</td>
<td>249</td>
</tr>
<tr>
<td>Cost to 6 mo.**</td>
<td>$40.74</td>
<td>$50.76</td>
<td>$47.10</td>
</tr>
<tr>
<td>Gain (lb.) 6 mo.</td>
<td>264</td>
<td>313</td>
<td>300</td>
</tr>
<tr>
<td>Cost/lb. gain, 6 mo.**</td>
<td>$0.143</td>
<td>$0.162</td>
<td>$0.157</td>
</tr>
<tr>
<td>Birth weight (lb.)</td>
<td>86</td>
<td>96</td>
<td>82</td>
</tr>
<tr>
<td>Final weight, 6 mo. (lb.)</td>
<td>370</td>
<td>409</td>
<td>382</td>
</tr>
</tbody>
</table>

*Extra milk first 2 weeks.

**Feed costs used were: milk, $4.50/100 lb.; high roughage pellets, $3.00/100 lb.; hay, $30/ton; grain, $2.75/100 lb. Approximately 60 percent of the total feed cost to six months was for the whole milk. The use of a good milk replacer will reduce the total feed costs to 6 months by approximately 20 percent.
A summary of the records on the first 121 cows which have milked four consecutive lactations shows several conclusions which will interest dairymen seeking to understand how cows make milk.

With the well-known increase in production as the cow advances from the first through successive lactations to maturity, there is a compensating decrease in the amount of fat and non-fat solids produced. The non-fat solids include both protein and sugar.

For the cows in the North Central Branch herd, the protein percentage did not change from lactation to lactation, thus leaving the non-fat solids decrease to be accounted for by a decrease in sugar. The protein content found during one lactation, therefore, can be used as an index of the cow's inherited individuality throughout her lifetime. If the non-protein nitrogen is subtracted from the total nitrogen usually included as "protein", the significance of the portion influenced by inheritance is even greater. With relatively high heritability found for the casein portion of the milk protein, selection for that trait should result in cows which produce milk with a higher than average protein (casein) content.

The protein percent of a cow's milk is increased with the advance in pregnancy beyond 3 months. For this reason, the stage of gestation should be considered in the interpretation of protein content among individual cows.

The cows which calved during the autumn and winter produced milk significantly higher in fat content but lower in non-fat solids during pregnancy than those calving during the spring and summer, even though the total milk produced was not different. The seasonal variations in fat percent is attributed to the increased ratio of propionic to acetic acid produced by the bacteria in the rumen with the eating of grass.

The fact that there was no difference between the groups calving during the fall and winter as compared to those calving during the spring and summer suggests that the feeding was equally adequate during the two periods each year that the study was in effect.

The average ages of the cows at the respective calvings were 28, 40, 53, and 67 months.
Loose housed cattle have generally been healthier. The production of the two groups has been similar.

Stanchion housed cattle require much less bedding.
The State Is the Campus for Agricultural Research and Development

Ohio's major soil types and climatic conditions are represented at the Research Center's 11 locations. Thus, Center scientists can make field tests under conditions similar to those encountered by Ohio farmers.

Research is conducted by 14 departments on more than 5900 acres at Center headquarters in Wooster, nine branches, and The Ohio State University, Center Headquarters, Wooster, Wayne County; 2017 acres
Eastern Ohio Resource Development Center, Caldwell, Noble County: 2039 acres
Mahoning County Experiment Farm, Canfield: 275 acres

Muck Crops Branch, Willard, Huron County: 15 acres
North Central Branch, Vickery, Erie County: 335 acres
Northwestern Branch, Hoytville, Wood County: 247 acres
Southeastern Branch, Carpenter, Meigs County: 330 acres
Southern Branch, Ripley, Brown County: 275 acres
Vegetable Crops Branch, Marietta, Washington County: 20 acres
Western Branch, South Charleston, Clark County: 428 acres