1968 Research Report: Eastern Ohio Resource Development Center

A Branch of the
OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER
Wooster, Ohio
CONTENTS

* * * *

Facts About the Eastern Ohio Resource Development Center .......... 1
Soils of the Eastern Ohio Resource Development Center,
by Nicholas Holowaychuk and George F. Hall ...................... 3
Landslips in Southeastern Ohio, by Kaye R. Everett,
George F. Hall, and Nicholas Holowaychuk ...................... 4
Beef Cattle Breeding, by Earle W. Klosterman,
C. F. Parker, and V. R. Cahill .................................. 6
Sheep Research, by C. F. Parker ................................ 9
Reproductive Performance of Ewes Mated on Bluegrass,
Alfalfa, and Ladino Pastures and Under Dry Lot
Confinement, by C. F. Parker .................................. 13
Year-Round Pastures for Beef Cows in Southeastern Ohio,
by R. W. Van Keuren ........................................ 15
No-Tillage Corn, by Glover B. Triplett, Jr.,
Samuel W. Bone, and Charles P. Knotts ......................... 20
Ultra Low Volume Malathion for Livestock Fly Control,
by R. E. Treece ............................................ 21
Tree Growth and Yields of 15 Apple Cultivars on Two
Size-Controlling Rootstocks, by Freeman S. Howlett .... 23
Nutritional Investigations with Size-Controlling
Apple Rootstocks, by G. A. Cahoon .......................... 25
Peach Cultivar Evaluation for Southeastern Ohio,
by Robert G. Hill, Jr. ........................................ 26
Grape Investigations in Southern Ohio, by G. A. Cahoon ........ 27
Elderberry Evaluation for Southeastern Ohio,
by Robert G. Hill, Jr. ........................................ 28
Stripmine Reclamation Research, by Paul Sutton .............. 29
FACTS ABOUT THE EASTERN OHIO RESOURCE DEVELOPMENT CENTER

The Eastern Ohio Resource Development Center, authorized by the 106th Ohio General Assembly in House Bill 949, is operated as one of the ten branches of the Ohio Agricultural Research and Development Center at Wooster.

This branch started with the purchase of 728 acres of farm land 1 1/2 miles northeast of Belle Valley in Noble County. The first land purchase was from H. W. and Pearl Morgareidge and was approved by the Center's Board of Control on October 14, 1965. Additional land to make up the 728 acres was purchased from Michael and Thelma Sholtis and Chalmers Wells.

The site was selected because of its central location in the Appalachian Plateau area of Ohio and because of the existence of all major soil types characteristic of eastern and southeastern Ohio. A significant factor in the choice of location was proximity of Interstate 77, which will be reached at Belle Valley. Another important factor in the site selection was its location in an area which will not be subject to stripmine operations. Proximity of the Noble County Airport was an added advantage. The above site is known as Unit 1.

During 1966, the Ohio Agricultural Research and Development Center received gifts of 1,000 acres from the Union Carbide Corporation and 325 acres from the Baker and Noon Coal Company. This area is known as Unit 2 of the Eastern Ohio Resource Development Center. It is located approximately 7 miles southeast of Caldwell, with part of it bordering State Route 564. Unit 2 is being used for maintaining part of the 300 beef cattle herd and for stripmine reclamation research and demonstration.

Soils on both units have been mapped in cooperation with U. S. Soil Conservation Service personnel. The soils are quite representative of the soils in southeastern Ohio.

Two residences, one for the manager and the other for the assistant manager, have been completed at Unit 1. A third residence at Unit 2 was remodeled.

A 2-mile access road through Unit 1 was constructed. At Unit 2, a 2-mile section of Enoch Township road running through the farm was widened and stoned through the courtesy of Mr. Howard Devol and the Union Carbide Corporation.

A farm pond comprising 4.1 surface acres, with a storage capacity of 13.8 million gallons or 42.6 acre feet, has been completed at Unit 1. Water from this pond serves four purposes: domestic water supply, livestock, irrigation, and recreation. Three additional farm ponds have been constructed—one at Unit 1 and two at Unit 2. One of the ponds at Unit 2 was constructed through the courtesy of Mr. Howard Devol and the Union Carbide Corporation. It is located so that the water can be used for spoil bank infiltration studies by Dr. Paul Sutton.
The domestic water system includes a concrete block pump house, 8000-gallon raw storage tank, water treatment building with 4000-gallon domestic water supply, sand filter, and chlorinator.

An information pavilion, parking area, and observation point were constructed through the courtesy of Mr. Lee Crock and the Crock and Schafer Construction Company. A 30 by 40-foot farm shop with public restrooms was completed in the fall of 1966. A new 46 by 160-foot poled sheep shed was completed in 1968. It is used as a sheep feed storage and lambing shed.
A comprehensive program of soils investigations has been undertaken at the EORDC. One objective of this research is to study the influence of the properties of these soils on the establishment, management, and productivity of forage crops and pasture.

The initial phase of this research was a detailed survey of the soils of both units to show their extent and distribution and to evaluate the degree of erosion in each area. A map of the soils of Units 1 and 2 and short descriptions of each soil have been prepared.

Other phases of soils research involve field and laboratory investigations of the physical, chemical, and mineralogic properties of each major soil occurring on the Center. This basic information will contribute to a better understanding of these soils' properties which influence moisture uptake and availability, ease of working, and liming and fertility needs and responses.

The soils of the Center are similar to those occurring over a considerable part of eastern and southeastern Ohio. Thus, research findings at the EORDC should be of considerable value to a large part of the state.

Soils of Southeastern Ohio will produce good pastures with proper management. On land above, brush was removed and lime and fertilizer added.
LANDSLIPS IN SOUTHEASTERN OHIO

Kaye R. Everett, George F. Hall, and Nicholas Holowaychuk
Department of Agronomy

Mass movement of soil on slopes is an economic problem on farms in most counties in southeastern Ohio. These landslips or slides, characterized by uneven and irregular microrelief, cause problems in tillage, fertilization, and other farm operations.

Identification and characterization of landslip areas is the first step in research directed toward development of methods for stabilization of these areas. The second step is to determine the magnitude of the movements both in area and depth and the relative importance of the factors which influence movement such as slope, underlying rock strata, and rainfall characteristics.

Two tracts of cropland with landslip features characteristic of those on the Center have been set aside for intensive study. These tracts are on east-facing slopes on the east and west portions of the Center. Sixteen monuments have been established in each of these tracts. The location of each monument has been determined to within 0.1 inch, based on benchmarks established outside of each active landslip area. Measurements are being made twice each year to determine the amount and type of movement taking place.

Adjacent to each study tract, a trench was dug from the bedrock escarpment to a position on the slope below the active landslip zone. Soil horizons and zones of mixing in these trenches were mapped and samples were taken for physical and chemical analyses.

Morphological characteristics shown in the trenches and the results of the physical and chemical analyses indicate:

1. Soil movement has taken place in both study areas to depths of more than 6 feet.
2. Depth and type of movement have been variable both within a given trench and between the two trenches.
3. Planes where slippage has taken place are characterized by shiny surfaces which occur at various depths and angles and are continuous for many feet.
4. Organic material which accumulated on the surface has been buried to depths up to 6 feet by the soil movement.
5. Soil horizon characteristics present in the stable areas are partly or completely lacking in the adjacent landslip areas because of the mixing action of the movement.

No movement of the monuments has been observed in the year since their establishment.
Uneven microrelief resulting from land slippage at Unit 1.

Severe land slippage along newly constructed highway at Unit 1.
Income from beef ranks as the second largest source of gross farm income in Ohio. Numbers of dairy cattle have been decreasing and numbers of beef cattle have been steadily increasing. Large land areas of eastern and southern Ohio could be improved to further expand beef production.

A large part of the feed for any animal is required merely to maintain the weight of that animal. The beef industry carries a tremendous overhead in the amount of feed needed to meet the maintenance requirements of breeding herds and stocker cattle. It has been estimated that 75 percent of the feed fed to beef cattle is required for this purpose.

There is a direct relationship between rate of gain and efficiency of gain and also between rate of gain and mature size. Selection for rate of gain will likely increase the mature size of individuals in beef breeding herds. Increased use of large breeds in crossbreeding systems will also bring about a general increase in size of beef breeding cattle. A system of beef production is needed in which a small, highly productive cow will produce a calf of desirable slaughter weight and condition at a young age.

Most efficient gains are generally made by the young calf and milk production of the dam is an important factor in the production of maximum weight at weaning age. More information is needed on the effects of crossbreeding various breeds and sizes of cattle and the importance of milk production of the dam upon the total feed required to produce a unit of edible beef.

There are large differences among the numerous beef and dairy cattle breeds in size, growth rate, milk production, muscling, and ability to marble and fatten. These many breeds have been developed for specific types of production and from a wide genetic background. A number of experiments have been conducted to compare the feed lot performance and carcass traits of some of the beef and dairy breeds. However, controlled experiments in which various breeds of beef and dairy cattle of different sizes have been combined in crossbreeding systems have been very limited.

The objectives of this research are:

1. To study the relationship between age of cow and heterosis of fertility and mothering ability in Hereford, Angus, and Hereford-Angus cross cows.

2. To determine the value of large and small breeds of beef and dairy cattle in a crossbreeding system.

3. To study the effect of size of cattle upon total feed cost per unit of beef produced.
4. To compare various breeds and crosses in their total efficiency of beef production.

Hereford, Angus, and Hereford-Angus cross cows of various ages have been bred to Charolais bulls. The average performance of the Hereford and Angus cows will be compared to that of the crossbred cows. This will be done on a within-age-of-cow basis in order to obtain information on the first objective of this experiment.

In addition, representative cows of different sizes and breeds mated to bulls of different sizes will be taken to Wooster for a period of 1 year. During this phase of the study, all cows and their calves will be fed individually to measure the total amount of feed required to produce a unit of edible beef.

Steer calves produced at the Eastern Ohio Resource Development Center will be divided into two equal groups. Half of the calves will be sold at weaning time. The other half will be finished on a high energy ration to be hauled into the feed bunks on the stripmine roads of Unit 2. Cost and returns of these two systems of marketing will be compared. This study will get underway in the fall of 1968.

Hereford, Angus, and Hereford-Angus crossbred cows bred to Charolais bulls are being compared for total efficiency of beef production.

Good corral is needed to efficiently handle beef cattle. A cattle oiler in or near corral helps in fly control.
New sheep feed storage and lambing shed.

Rambouillet, Targhee, Western Blackface, and Dorset crossbred ewes comprise the initial sheep flock at Unit 1.
Sheep research was initiated at the Eastern Ohio Resource Development Center during the fall of 1966 with the introduction of Rambouillet-Targhee, and Western Blackface (Hampshire-Suffolk x Rambouillet) ewe lambs. Horned and polled Dorset ewes were added to the breeding flock prior to the 1968 spring breeding season. One of the primary research objectives at this location is to determine the type of ewe which will be most productive in the area under various management schemes using early, late, and multiple lambing systems.

The initial breeding period was scheduled from May 18 to June 30, 1967. Rambouillet rams were used in all breeding groups. Data relative to the 1967 spring breeding and fall lambing are presented in Tables 1, 2, and 3.

Figure 1 shows the frequency distribution of the lambing dates for those ewes completing a gestation during the fall of 1967. Only two ewes lambed as a result of first estrous breeding. The high lambing peak (23.2% of all ewes lambing) on November 6 and 7 and a subsequent lambing peak 17 days later indicate that a significant portion of the fall lambing ewes were not cycling when rams were first placed with the breeding flock. The introduction of rams into the flock apparently stimulated the anestrus ewes to ovulate without estrus. The initial estrus, ovulation, and conception apparently occurred 17 days later. The average time lag for the ram stimulation effect was 6 days.

A sample of the weaned fall-born lambs with an average age of 106 days and weight of 73.9 lbs. were self-fed a ground ration consisting of:

- 30% Ground alfalfa hay
- 10% Soybean oilmeal
- 60% Ground corn
- .5% Urea
- 1% Trace mineral salt

Plus 1000 I.U. Vitamin A and 15 mg. Auresomycin per lb.

These lambs were fed to an average weight of 95.4 lbs. and then slaughtered. Carcass data were collected at the Meats Laboratory at the Ohio State University. The feedlot gains and carcass data are reported in Tables 4 and 5.

This report represents the initial performance of the breeding flocks at EORDC. Additional records and data must be collected and analyzed before conclusive information of benefit to the area can be presented. The completion of the new sheep shed will permit sheep research to proceed according to schedule.
Fig. 1.—Frequency distribution for fall lambing ewes (1967). N=69.
TABLE 1. BODY WEIGHTS OF YEARLING EWES DURING SPRING BREEDING - FALL LAMBING (1967)

<table>
<thead>
<tr>
<th>Breed</th>
<th>No.</th>
<th>June 8</th>
<th>October 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackface</td>
<td>53</td>
<td>121 lbs.</td>
<td>131 lbs.</td>
</tr>
<tr>
<td>Rambouillet</td>
<td>45</td>
<td>96 lbs.</td>
<td>108 lbs.</td>
</tr>
<tr>
<td>Targhee</td>
<td>49</td>
<td>113 lbs.</td>
<td>126 lbs.</td>
</tr>
</tbody>
</table>

TABLE 2. FALL LAMBING PERFORMANCE (1967)

<table>
<thead>
<tr>
<th>Breed</th>
<th>Percent ewes lambing</th>
<th>Average lambing date</th>
<th>Lambs born/ewe lambing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackface</td>
<td>29 55.8 November 14</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>Rambouillet</td>
<td>27 60.0 November 13</td>
<td>1.15</td>
<td></td>
</tr>
<tr>
<td>Targhee</td>
<td>13 26.5 November 12</td>
<td>1.08</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 3. LAMB GROWTH DATA FOR RAMBOUILLET Sired LAMBS

<table>
<thead>
<tr>
<th>Breed of ewe</th>
<th>No.</th>
<th>Birth weight</th>
<th>Adjusted 90-day weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackface</td>
<td>23</td>
<td>9.7</td>
<td>79.8</td>
</tr>
<tr>
<td>Rambouillet</td>
<td>23</td>
<td>9.2</td>
<td>71.7</td>
</tr>
<tr>
<td>Targhee</td>
<td>9</td>
<td>9.2</td>
<td>71.8</td>
</tr>
</tbody>
</table>

1 Weights are for lambs born and reared as singles.

2 Weights adjusted for differences in age of lamb at weaning and age of dam.
### TABLE 4. POSTWEANING FEEDLOT GAINS

<table>
<thead>
<tr>
<th>Breeding of lamb</th>
<th>No.</th>
<th>Average daily gain</th>
<th>Feed required/lb. of gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamb. x Blackface</td>
<td>10</td>
<td>.45</td>
<td>7.0</td>
</tr>
<tr>
<td>Bamb. x Rambouillet</td>
<td>6</td>
<td>.47</td>
<td>6.6</td>
</tr>
<tr>
<td>Bamb. x Targhee</td>
<td>10</td>
<td>.45</td>
<td>7.8</td>
</tr>
</tbody>
</table>

### TABLE 5. CARCASS DATA OF RAMBOUILLET GILTED LAMBS

<table>
<thead>
<tr>
<th>Breeding of lamb</th>
<th>Chilled carcass</th>
<th>Carcass grade</th>
<th>Av. fat thickness</th>
<th>Loin eye area</th>
<th>Kidney knob</th>
<th>Untrimmed legs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Total wt.</td>
<td>For day of age</td>
<td></td>
<td>sq. in.</td>
<td>%</td>
</tr>
<tr>
<td>Bamb. x Blackface</td>
<td>10</td>
<td>48.4</td>
<td>.302</td>
<td>11.7</td>
<td>.19</td>
<td>2.04</td>
</tr>
<tr>
<td>Bamb. x Rambouillet</td>
<td>6</td>
<td>45.8</td>
<td>.281</td>
<td>11.3</td>
<td>.11</td>
<td>2.02</td>
</tr>
<tr>
<td>Bamb. x Targhee</td>
<td>10</td>
<td>45.8</td>
<td>.272</td>
<td>11.5</td>
<td>.24</td>
<td>1.85</td>
</tr>
</tbody>
</table>

1 Carcass Grade: Average choice, 11; Choice plus, 12; Prime minus, 13.

2 Average fat is calculated from a medial, central and lateral fat measurement over the loin eye area at the 12th rib.
REPRODUCTIVE PERFORMANCE OF EWES MATED ON BLUEGRASS, ALFALFA, AND LADINO PASTURES AND UNDER DRY LOT CONFINEMENT

C. F. Parker
Department of Animal Science

Workers at this Research Center have previously reported delayed conception accompanied by a prolonged lambing season when ewes are mated on ladino clover pastures. This adverse effect has been associated to an estrogenic-like substance in ladino clover which apparently affects the hormone balance related to the onset of estrus and conception rate of ewes. A less pronounced effect has been observed from grazing ewes on birdsfoot trefoil. Oregon workers have reported delayed conception and a higher degree of barrenness from breeding ewes on red clover vs. grass pasture. Grass pastures have not been reported to have a negative effect on conception rate.

In 1965, Bell and Parker reported that young ewes and mature ewes respond differently when mated on pasture and under dry lot confinement. Yearling ewes conceived approximately 3 weeks earlier when mated on pasture vs. dry lot and with a significantly higher lambing rate. Mature ewes did not exhibit differences in date of conception or lambing rate between the two breeding environments.

During the past three breeding seasons, Columbia and Targhee ewes of mixed ages have been randomly assigned to treatment groups and placed in dry lot or on bluegrass, alfalfa, or ladino clover pastures approximately 2 weeks prior to the start of the breeding season. Ewes in dry lot have been fed 4 lb. of alfalfa hay and 0.5 lb. of concentrate daily. The breeding season has been initiated during mid-September and has lasted approximately 35 days. Rams have been exchanged among the breeding groups at 6-day intervals to minimize the fertility influence a ram might have on a given treatment group.

Data were statistically analyzed and the least squares means are presented in Table 1. Breeding environment effects were significant for lambing rate, with a differential response between breeding environment and age of ewe at breeding.

Ewes mated in dry lot conditions have consistently produced fewer lambs per ewe lambing than ewes bred on either bluegrass or alfalfa. There appears to be a dynamic effect of alfalfa on lambing rate independent of body weight changes prior to and during breeding.

During the 1966 breeding season, the average weight changes for ewes in dry lot, on bluegrass, and on alfalfa were 15.8 lb., 15.0 lb., and 16.0 lb., respectively. Mature ewes were least affected by the environment at breeding but generally responded most favorably when mated on bluegrass. Yearling ewes were highly stimulated when bred on alfalfa pasture as indicated by the marked increase in lambing rate. Breeding yearling ewes under dry lot conditions was the least desirable as determined by the lambing rate and average lambing date.

Moving ewes from an alfalfa pasture to a bluegrass pasture at the start of the 1966 breeding season appeared to have an adverse effect on
lambing rate, especially among the young ewes. The ladino clover pasture used in 1966 was not a pure stand and did not delay the date of conception as previously reported.

The environment prior to and during the mating period has been found to have an important effect on the reproductive performance of the ewe. Young ewes bred on alfalfa pastures have a significantly higher lambing rate than those bred on bluegrass or under dry lot conditions. Mature ewes were not largely affected by the environment at breeding but were observed to respond most favorably when mated on bluegrass. Causes of the reduced reproductive performance of young ewes mated in dry lot merit further investigation.

TABLE 1.--Reproductive Performance of Ewes Mated under Different Environments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dry Lot</th>
<th>Bluegrass</th>
<th>Alfalfa</th>
<th>Alfalfa to Bluegrass</th>
<th>Ladino Clover</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1965</td>
<td>1.49</td>
<td>1.57</td>
<td>1.68</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1966</td>
<td>1.54</td>
<td>1.87</td>
<td>1.85</td>
<td>1.33</td>
<td>1.55</td>
</tr>
<tr>
<td>1967</td>
<td>1.34</td>
<td>1.52</td>
<td>1.51</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>1.45</td>
<td>1.65</td>
<td>1.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age of ewe</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yearling</td>
<td>1.25</td>
<td>1.39</td>
<td>1.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mature</td>
<td>1.65</td>
<td>1.77</td>
<td>1.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Day of Lambing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1966</td>
<td>74.0</td>
<td>62.7</td>
<td>59.4</td>
<td>62.3</td>
<td>61.4</td>
</tr>
<tr>
<td>1967</td>
<td>69.6</td>
<td>68.0</td>
<td>71.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>71.8</td>
<td>65.3</td>
<td>65.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Lamba born per ewe lambing.

2 January 1 equals day 1.
Research at the Eastern Ohio Resource Development Center is aimed at developing a year-round pasture program for beef cows. Such a program includes stockpiling hay and standing forage in the field for the late summer pasture slump and for winter feed.

In addition to giving good yields, the forages in such a program must retain adequate quality and nutritional value under this kind of storage to meet the needs of the beef cow and calf.

Although the soils in this region are initially acid and low in fertility, they respond well to fertilization. With lime and fertilizer, good forage yields can be expected.

The basic year-round pasture program includes a winter pasture field where the first hay crop is harvested as round bales and the bales are left in the field. The bales and the regrowth are saved for the winter period beginning in November-December. If sufficient feed has been stockpiled, pregnant beef cows can remain on this winter pasture until spring pastures are ready to graze. Tall fescue has been found to be the best grass for this use. Bluegrass and orchardgrass have been used with satisfactory results.

Other pastures are used for spring, summer, and fall grazing. Some acreage should be planned as hay for the first crop, storing it as emergency feed and to carry the herd through drought years. The aftermath supplements the other summer pasture. Orchardgrass is a good choice for this use. Tall fescue, orchardgrass, and bluegrass are good choices for early spring and fall grazing.
Fertilization Needed

Wherever legumes are not dependable, grasses plus nitrogen must be used. Such a year-round program requires 60-100 lb. of available nitrogen per acre annually (200-300 lb. ammonium nitrate). All pastures should receive 60-100 lb. available nitrogen in early spring. If moisture is good and the additional pasture can be used, another application may be made later in the year. The winter pasture may need an additional August application to provide more feed.

Phosphorus, potassium, and lime are needed periodically to maintain good forage production. Applying 400 lb. of 15-15-15 or equivalent analysis fertilizer every several years in place of ammonium nitrate is necessary to maintain the phosphorus and potassium levels.

Winter Pasture

Five beef cow herds with 25-30 cows in each herd have been wintered satisfactorily for the past two winters at three branch locations in southern and southeastern Ohio. These cows came through the winter in good condition on winter pasture. Only salt, minerals, and water were supplied in addition to pasture. Their late winter and early spring calves had birth weights similar to herds wintered in the barn. Herd health in all groups remained good.

The beef cow herd at the Eastern Ohio Resource Development Center is made up largely of Angus-Hereford crosses. The 30 cows averaged 955 lb. on November 20, 1967, when going on the winter pasture and 894 lb. on April 8, 1968, at the end of the winter pasture season. The condition of the cows remained good. More than half of the calves were dropped by the end of March, with the remainder dropped in April and May. They averaged 77 lb. at birth. The cows had been bred to a Charolais bull.

The winter pasture at the EORDC was an old hay meadow, largely orchardgrass and Kentucky bluegrass. It was limed on April 20, 1967, at the rate of 3 tons per acre. Fertilizer at the rate of 200 lb. of ammonium nitrate and 100 lb. of triple superphosphate per acre was applied on April 27, 1967, with a spinner spreader.

The first crop was baled June 21, 1967, when the grasses were fully headed, and the round bales were left in the field. There were 1.5 tons of round bales per acre in the winter pasture and 1.1 tons of standing regrowth, a total of 2.6 tons per acre. This compares with a 2-year average of 5.1 tons per acre from new seeding tall fescue winter pasture at the Southern Branch. All yields are given on a hay basis at 12% moisture.

The baled hay had 7.8% crude protein when baled in late June, 7.8% in November, and 9.6% in February. The higher percent in February probably is only a sampling difference. The standing forage was 9.0% crude protein in November and 7.7% in February. This level of crude protein is adequate for wintering pregnant beef cows. The crude protein values are on a dry matter basis.
Cows reached hay bales with no difficulty despite snow up to 18 inches in depth.

Winter Pasture Carrying Capacity

The cow herd at the EORDC was on winter pasture from November 20 until April 29, when they were moved to spring pasture. The winter pastures supplied 2.3 tons of feed (hay basis) per cow for this period. In addition, they received a half ton of grass hay per cow to supplement the winter pasture in February, March, and April.

The winter pasture carrying capacity was .9 acre per cow. This compares with about two-thirds acre per cow from tall fescue at the other branch locations in 1966-67 and 1967-68. Including the hay fed at EORDC, about an acre and a third per cow were needed. However, this is an old hay meadow which needs to be renovated at the earliest opportunity.

The 27 acres of winter pasture were divided into five areas with electric cross-fences. The cows were required to clean up one area before being moved to the next. This practice increased the carrying capacity of the winter pasture. The cows on winter pasture consume more feed than they need and some control of intake is needed.

Cows going on winter pasture in good condition can lose some body weight with no adverse effect. In fact, fat on the animals is one method of carrying feed into the winter.

A field has been seeded to Kentucky 31 tall fescue for winter pasture at the EORDC and is being grazed in 1968.

Snow Cover

Snow during December, January, and February covered the winter pastures for part of this period. However, the cows were able to reach the bales with no difficulty, despite snow up to 18 inches in depth.

The cattle cleaned up all of the forage satisfactorily with a minimum of waste, except for scattered patches of reed canarygrass. The standing reed canarygrass appeared to be largely unacceptable to the cows.
Summer Pasture

Tall fescue, bluegrass, and orchardgrass provide early spring pasture following the winter pasture. This should be fertilized with nitrogen in late March or early April to increase early growth.

The summer pasture should be largely orchardgrass and/or bluegrass because of better acceptability than tall fescue during this period. A total program based on tall fescue is not best for livestock until more information is obtained on "fescue-foot" problems reported from other states. Another question is the effect of the species of grass used for summer pasture on calf weaning weight and quality. When pasture quality is low, as in dry years, creep feeding is advised if the calves are to be sold at weaning. Because of excellent moisture in 1966, the pasture quality remained good and no creep feeding was done at the EORDC beef pasture unit.

From the data to date, it appears that an acre of fertilized improved grass should carry a beef cow and calf for the 7 months of summer pasture (April 15 to November 15). A reserve supply of hay from years of surplus production should be on hand to feed during drought years.

Deferred Pastures

With the peak of forage production coming in May and June, extra feed is available during this period but frequently there is a feed shortage in late summer. The early surplus can be carried over as standing forage or as round bales, just as with winter pastures. The aftermath from fields cut for stored hay will also provide late summer grazing.

All of these methods are being studied at the three branches to provide late summer pasture for the beef cow herds. Although there is some waste in deferred grazing of orchardgrass, timothy, smooth bromegrass, and Kentucky bluegrass, the cattle clean up this mature material satisfactorily and no labor or equipment costs are involved. Round baling the early surplus harvests the forage at the desired stage of growth but adds some labor and equipment costs. It has the advantage that hay not needed can be removed from the field and stored or sold. Additional information is needed on the deferred use of pastures and the effects on yield and nutritional value.

Summary

A year-round pasture program for beef cows is feasible for southeastern Ohio. The generally open winters make it possible to keep a beef cow herd with a minimum of housing and feed storage.

Winter feed can be supplied as round bales and standing regrowth accumulated in the field. This feed is of sufficient quality to adequately maintain pregnant beef cows. For the periods of brief snow cover, the cows can generally reach the bales, even if the standing forage is covered.
With fertilization, the soils in the area will produce good forage yields. Orchardgrass, tall fescue, and Kentucky bluegrass are the best species for developing a year-round forage program. The program should include stockpiling and deferred grazing to supplement pastures during the late summer pasture slump, as well as some hay storage for emergency needs and to carry over for dry years.

Beef cow numbers should be adjusted to the average feed supply. Over-stocking can sharply reduce pasture production. Such over-grazing will largely cancel out the improvements expected from seeding better grasses and using lime and fertilizer.

Taking advantage of the soil and climatic resources of southeastern Ohio, beef cow and calf producers in the area should be able to compete successfully with other regions of the United States.
NO-TILLAGE CORN

Glover B. Triplett, Jr., Samuel W. Bone, and Charles P. Knotts
Department of Agronomy

Although the climate and many soils in southeastern Ohio can support excellent corn yields, few acres of corn are planted because of the erosion hazard involved with conventional tillage practices. Excellent corn yields are possible where herbicides are substituted for tillage in controlling weeds. In tests at the U. S. Hydrologic Station at Coshocton, erosion was negligible and yields were good from a field of corn grown without tillage on a 10 percent slope (Table 1).

Good crop management practices were followed in establishing corn for this demonstration. The soil was tested and 200 lb. per acre each of nitrogen, phosphorus, and potassium fertilizer were applied prior to planting. At planting time, 200 lb. per acre of a 12-12-12 analysis fertilizer were applied with the planter. The orchardgrass-fescue sod was killed with a mixture of 3 lb. of atrazine per acre, 1 lb. of simazine per acre, plus 1 gal. of oil per acre applied April 24. Diazinon was applied April 29 at 2 lb. active per acre to control insects living in the sod.

DeKalb's XL 45 corn was planted May 7 in 40-inch rows with a seed drop of 26,000 per acre. Emergence was excellent and the mature population was 25,000 plants per acre. A special planter designed to cut through the killed sod and cover seeds was used for planting. The field required little additional attention prior to harvest.

Several thousand acres of corn were planted in untilled soil in Ohio during 1968. This technique promises to increase the potential for grain production in southeastern Ohio.

TABLE 1.--Comparison of Conventional Tillage and No-Tillage Corn, Coshocton, Ohio, 1964-67.

<table>
<thead>
<tr>
<th></th>
<th>Conventional Tillage</th>
<th>No-Tillage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runoff, Inches</td>
<td>1.73</td>
<td>0.24</td>
</tr>
<tr>
<td>Erosion, Lb. Soil per Acre</td>
<td>7760</td>
<td>120</td>
</tr>
<tr>
<td>Corn Yield, Bu. per Acre</td>
<td>104</td>
<td>117</td>
</tr>
</tbody>
</table>
ULTRA LOW VOLUME MALATHION FOR LIVESTOCK FLY CONTROL

R. E. Treece
Department of Zoology and Entomology

Good horn fly control has been reported by the use of ultra low volume (ULV) aerial applications of malathion in South Dakota. Investigations were initiated in August 1968 to determine the feasibility of such sprays for control of flies on pastures in southeastern Ohio.

Three pastures were selected for treatment at the Eastern Ohio Resource Development Center. The pastures selected were extremely hilly. One pasture was located on land reclaimed after stripmining operations had been completed. The cattle consisted of Herefords, Charolais-Hereford, and Angus-Hereford crosses.

Pasture 1, designated as the winter forage area, contained about 50 acres of open land surrounded by woods into which the cattle could forage. Thirty cows and 26 calves ranged in this pasture.

Pasture 2, the west pasture, contained about 150 acres of clear land with additional wooded areas available to the 65 cows and 40 calves.

Pasture 3, the north pasture, was located about 12 miles distant. It contained 140 acres of cleared land with several small clumps of trees. Thirty cows and 28 calves were located in this pasture.

The pastures and cattle were sprayed with ULV malathion (95%) on August 19 between 4:30 and 5:00 p.m. A Piper Pawnee with two 8005 nozzles mounted on each wing was used. Calibrated delivery rate was 4 liquid oz. per acre. However, because of variable altitude due to the difficult terrain, dosage is not known. Approximately 50 acres were sprayed in each pasture. The animals were herded into the center of the pasture before spraying and at least two passes were made directly over the cattle. Altitude of the plane over the cattle was approximately 30 feet. The cattle were not unduly disturbed by the spraying operation.

Air temperature at the time of treatment was approximately 80° F. At 10:30 a.m. the next day, air temperature was 83° F. A heavy rain shower occurred between 6 and 7 p.m., shortly after treatment.

Results and Conclusions

Fly counts were made on two herds before spraying and on all herds between 10-11 a.m. the following day. Observations are presented in Table 1. Complete control of the horn fly was observed 17 hours after treatment. Face fly populations were reduced slightly but not sufficiently to give the animals worthwhile protection.

By 4 days after treatment, there was some recovery of the horn fly populations, although control was still excellent. Because of the larvae and pupae in cattle droppings, several applications would be necessary to provide prolonged control.

-21-
TABLE 1.—Fly Control with ULV Malathion.

<table>
<thead>
<tr>
<th>Pasture</th>
<th>Face Fly\textsuperscript{a}</th>
<th>17 Hours Post-Treatment</th>
<th>4 Days Post-Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Face</td>
<td>Back</td>
<td>Horn Fly\textsuperscript{b}</td>
</tr>
<tr>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>Few</td>
<td>56</td>
</tr>
<tr>
<td>3</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Control</td>
<td>40</td>
<td>Few</td>
<td>--</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Face fly populations in pastures 1 and 3 were similar to that in pasture 2.

\textsuperscript{b} Horn flies were on the belly and could not be readily counted. The observations in pasture 2 were conservative.

\textsuperscript{c} Horn flies were on the back.
The adaptation of cultivars, tree size, and density per acre are major factors in establishing profitable apple enterprises in southeastern Ohio.

An experimental orchard was planted in the spring of 1966 at the Eastern Ohio Resource Development Center. Fifteen cultivars representing a wide range of harvest period and two size-controlling rootstocks were utilized. Size and yield of trees, as well as certain fruit quality attributes, will be ascertained as this planting continues. A few fruits were produced in 1967. In 1968, sufficient fruit developed on some trees of several cultivars to require a light fruit thinning.

The two size-controlling stocks are Malling 26 and Malling-Merton 106. This is the first experimental planting by the Research Center of trees on these two rootstocks. Malling 26 was introduced by the East Malling Research Station, East Malling, England, in 1958. Trees of several English cultivars propagated on this rootstock are reported to be roughly 50 percent larger than those propagated on Malling IX, the most dwarfing of all rootstocks available at this time. Malling-Merton 106, resulting from the crossing of Northern Spy with Malling I, was introduced by the East Malling Research Station some years ago. Trees on this rootstock are reported to grow at approximately the same rate as those on Malling VII. Malling VII at Wooster has produced trees at least two-thirds the size of those on non-dwarfing apple seedlings. Few orchards of trees propagated on Malling-Merton 106 in this country have yet reached 10 years of age.

The site selected for this planting is undoubtedly, from the point of view of frost injury, one of the best in southeastern Ohio. All trees have been planted on the contour, with the rows 18 feet apart. Trees on Malling 26 are 12 feet apart in the row and those on Malling-Merton 106 are 18 feet apart.

The trees were planted in large holes in a backfurrow. A fertilizer containing nitrogen, phosphorus, and potassium was mixed with surface soil and placed in the bottom of each hole. The orchard is growing in sod largely made up of Kentucky bluegrass. The grass is cut several times annually and weed control chemicals are used around each tree.

The cultivars utilized are: Franklin, Holiday, Melrose, Ruby, Starking, Chelan Red, Gallia Beauty, Golden Delicious, Jonathan, Red Prince, Close, McIntosh, Idared, Melba, and Sundale Sturdy Spur.

These cultivars ripen over a very wide range of harvest season. Their adaptability for farm or roadside markets is a major objective of the work.
NUTRITIONAL INVESTIGATIONS WITH SIZE-CONTROLLING APPLE ROOTSTOCKS

G. A. Cañoon
Department of Horticulture

In the spring of 1968, an apple nutrition experiment involving approximately 8 acres of land was established at Unit 2 of the Eastern Ohio Resource Development Center. This site was chosen because of its position above the surrounding terrain which will afford warm growing season temperatures, maximum exposure to sunlight, and excellent air drainage to prevent spring frost injury. Six hundred and fifty trees each of Golden Delicious and Red Delicious were planted on rootstocks of Malling VII, IX, and 26 and Malling-Marton 106 and 111. With increased commercial acreage being developed on these rootstock-scion combinations in Ohio, more information is needed on their nutritional requirements.

Treatments consisting of various levels of nitrogen, phosphorus, and potassium will be imposed on these trees in the spring of 1969. With the experimental design to be used, it will be possible to determine if the cultivars of Red and Golden Delicious have different nutritional requirements when grown on these various rootstocks. To date, no such extensive experiment has been conducted in Ohio or the surrounding states with these size-controlling rootstocks.

Contour apple orchard was planted at Unit 2 in spring of 1968.
A peach cultivar orchard has been established at Unit 2 of the EORDC to investigate the potential of superior cultivars when grown under local environmental conditions. The main test consists of 16 cultivars in replicated plots. This group includes 10 clingstone cultivars considered to be of particular interest to the manufacturers of baby foods. The rest of the plots are planted to freestone types known to be well suited to the fresh fruit trade. In addition, the orchard contains 11 other newer cultivars which were planted for preliminary observational purposes. This group includes several nectarines or fuzzless peaches. All cultivars were set in plots of three trees each.

The orchard is being maintained in sod according to recommended horticultural practices. Conventional disease and insect control programs are being followed. Some difficulties have been encountered in establishing the trees and the precise cause of these difficulties has not yet been determined. In spite of these problems, there is ample evidence that peaches can be grown successfully in the area.

As the orchard matures, data will be obtained on the growth and yield response of these cultivars to local soil and weather conditions. This data will prove most valuable as the basis for recommendations to growers interested in developing a peach industry in southeastern Ohio.
Climatic surveys indicate that there is an area along the Ohio River with favorable grape growing qualifications, such as a frost-free growing period of 175 days or more. On this basis, an experimental vineyard was established at the Southern Branch, Ripley, in 1960. Results of this study show several cultivars which look quite favorable and could have commercial value.

Because it was difficult to know how well this one site might represent climatic and soil conditions in this southern Ohio area, a series of 15 research-demonstration plantings were established in as many counties during 1965-66. With establishment of the Eastern Ohio Resource Development Center in 1966, it appeared fitting that the evaluation of this area and of cultivars should be continued and that other types of grape research should be undertaken.

In the spring of 1966, a 1/4-acre planting of the cultivar Buffalo was made. It is anticipated that nutritional investigations with nitrogen and potassium will be initiated here in the spring of 1969. In addition, eight cultivars of both French and American hybrids were established. They are: Seyve Villard 12375, Vaseport, Catawba, Alden, Himrod, Steuben, Bokay, and Couderc 7120.

In the spring of 1967, an additional 1-acre planting was made. This planting will incorporate an irrigation-training-trelling experiment. The cultivars planted here consist of Concord, the standard blue grape of Ohio, and Seibel 5279, a white French hybrid considered excellent for its wine-making qualities. For the guard rows of the experiment, an American hybrid from Missouri named Blue Eye has been established.

The vines have all grown exceptionally well. All of the cultivars came through the 1967-68 winter but were severely damaged by a late spring frost on May 6. Very few vines were killed by the frost but many of the buds which produce the fruit were damaged. As a result, the vineyard has very little fruit this year.

Variety evaluation (left) is part of research program to help re-establish grape industry in southern Ohio.
A small planting of elderberries was made at Unit 2 of the EORDC in April 1967. The objectives were to ascertain the feasibility of producing elderberries as a commercial crop in southeastern Ohio and to determine their cultural requirements in this area. The planting consists of 10 replicated plots of three plants each of six different cultivars. These are: Adams No. 1, Adams No. 2, Johns, New York 21, Scotia, and York. These cultivars all are commercially propagated and are reported to have desirable growth, yield, and berry characteristics. One-year old plants were used in making the planting.

All of the cultivars made reasonable growth during the 1967 season. The planting over-wintered well. Growth during 1968 was very good. Many plants reached heights of 4 to 5 feet. York was most vigorous. Some yields were produced during 1968 but full production cannot be expected until 1969. At that time, data will be collected relative to berry size and quality characteristics of the different cultivars.

Since the planting was established, it has been maintained under a close-clipped sod. The plants have been fertilized annually with ammonium nitrate at the rate of 1/4 lb. per plant per year. No important disease and insect problems have been encountered.
Reclamation of coal stripmine spoil banks by establishing vegetation has had limited success in some areas of Ohio. The toxic spoils result from acid and highly soluble salts which in turn are brought about by the oxidization of iron pyrites. Low pH values and highly soluble salts are characteristic of a large part of the spoil banks located on Unit 2 of the EORDC.

One major problem is to determine methods for establishing vegetation on toxic spoil banks. Some of the methods under investigation are removal of acid and salts by leaching, applying lime to neutralize the acidity, covering toxic areas with soil, and treating small areas for individual tree plantings.

Large quantities of salts and acid were removed from toxic spoil material by leaching with water in the laboratory. By successive leachings, the salt content and total acidity were greatly reduced. The concentration of salts and the pH of the leachate are shown in Table 1. The salt concentration was greatly reduced but only a small increase in the pH occurred.

Table 2 shows the results of applying limestone to the spoil before and after leaching. This indicates that when the salt concentration is reduced to a relatively low level, the amount of limestone required to neutralize the acidity is significantly reduced.

To effectively leach spoil material, the water must penetrate and move through the material. Different surface preparations to increase water infiltration of spoil banks are being investigated. These preparations consist of different tillage operations to loosen the spoil and to leave the surface rough in order to retain water on the spoil bank and thereby reduce runoff.

The establishment of vegetation by applying limestone is being investigated. In laboratory studies, plants have been grown on toxic spoils when enough limestone has been applied to neutralize most of the acidity. Lime curves for the spoil bank selected for the study indicate that approximately 16 tons per acre of limestone would be required to neutralize most acid areas. The initial values of the acid areas were well below 3.0. The effect of neutralizing the surface acidity of the spoil bank on the water quality of an adjacent water impoundment is also of interest. Previous pH measurements of the water indicated that surface drainage has significantly increased the acidity.

Another investigation is underway to determine the depth of soil which has to be placed over toxic spoil to establish plants. The spoil materials selected for this study have a pH of approximately 2.0 at the surface. Soil was placed on the spoil at depths of 2, 4, 6, 8, and 10 inches. These areas were seeded with Kentucky 31 fescue. There is very little fescue in any of the areas. However, there are weeds.
TABLE 1.—The Effects of 20 Successive Leachings of Toxic Spoil Materials in Columns on Soluble Salts and pH of Leachate.

<table>
<thead>
<tr>
<th>Inches of Leachate</th>
<th>Salts (ppm)</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.74</td>
<td>43,750</td>
<td>2.6</td>
</tr>
<tr>
<td>2.04</td>
<td>33,350</td>
<td>2.6</td>
</tr>
<tr>
<td>1.87</td>
<td>23,200</td>
<td>2.6</td>
</tr>
<tr>
<td>1.89</td>
<td>11,875</td>
<td>2.6</td>
</tr>
<tr>
<td>1.90</td>
<td>4,875</td>
<td>2.8</td>
</tr>
<tr>
<td>1.90</td>
<td>3,470</td>
<td>2.8</td>
</tr>
<tr>
<td>1.76</td>
<td>3,200</td>
<td>2.8</td>
</tr>
<tr>
<td>1.93</td>
<td>2,315</td>
<td>2.8</td>
</tr>
<tr>
<td>1.90</td>
<td>2,092</td>
<td>2.9</td>
</tr>
<tr>
<td>1.62</td>
<td>2,130</td>
<td>3.0</td>
</tr>
<tr>
<td>1.62</td>
<td>2,985</td>
<td>2.8</td>
</tr>
<tr>
<td>2.08</td>
<td>2,578</td>
<td>2.8</td>
</tr>
<tr>
<td>2.08</td>
<td>2,108</td>
<td>2.8</td>
</tr>
<tr>
<td>1.79</td>
<td>1,542</td>
<td>3.0</td>
</tr>
<tr>
<td>1.97</td>
<td>717</td>
<td>3.1</td>
</tr>
<tr>
<td>2.01</td>
<td>474</td>
<td>3.1</td>
</tr>
<tr>
<td>1.90</td>
<td>404</td>
<td>3.2</td>
</tr>
<tr>
<td>1.72</td>
<td>460</td>
<td>3.2</td>
</tr>
<tr>
<td>1.86</td>
<td>385</td>
<td>3.2</td>
</tr>
<tr>
<td>2.02</td>
<td>394</td>
<td>3.1</td>
</tr>
</tbody>
</table>

TABLE 2.—Effects of Limestone on the pH of Leached and Unleached Toxic Spoil.

<table>
<thead>
<tr>
<th>Tons per Acre of Limestone</th>
<th>0</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unleached</td>
<td>2.4</td>
<td>2.6</td>
<td>2.4</td>
<td>2.4</td>
<td>2.6</td>
<td>2.8</td>
</tr>
<tr>
<td>Leached*</td>
<td>2.6</td>
<td>2.8</td>
<td>3.0</td>
<td>3.7</td>
<td>5.5</td>
<td>5.7</td>
</tr>
</tbody>
</table>

*29 inches of leachate were collected in 15 successive leachings.
Construction of .47 acre lake for stripmine leaching studies and domestic water source

Areas for studying the effect of different soil depths for establishing vegetation on toxic spoil

Reclamation grading of spoil banks

Spreading lime on spoil bank
TABLE 3.—Effects of Different Preparations on the Survival of Black Locust and Alder Trees Transplanted in Toxic Spoil.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Locust*</th>
<th>Alder*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 lb. of limestone</td>
<td>15.0</td>
<td>6.0</td>
</tr>
<tr>
<td>4 lb. of limestone</td>
<td>17.5</td>
<td>12.5</td>
</tr>
<tr>
<td>2 lb. of lime rock</td>
<td>3.5</td>
<td>5.0</td>
</tr>
<tr>
<td>4 lb. of lime rock</td>
<td>11.0</td>
<td>11.0</td>
</tr>
<tr>
<td>.5 soil</td>
<td>12.5</td>
<td>9.5</td>
</tr>
<tr>
<td>1 soil</td>
<td>17.0</td>
<td>13.5</td>
</tr>
<tr>
<td>2 soil</td>
<td>18.5</td>
<td>9.0</td>
</tr>
<tr>
<td>2 lb. of limestone</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>2 lb. of lime rock</td>
<td>4</td>
<td>3.0</td>
</tr>
<tr>
<td>Check</td>
<td>1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

*Total number of trees transplanted equals 20 locusts and 20 alders in each plot.

and other vegetation in the areas containing the 4, 6, 8, and 10 inches of soil. These areas will be reseeded.

In an area where the spoil material slipped down the hill, various preparations were made before black locust and alder were transplanted. The treatments and the number of surviving trees for each treatment are listed in Table 3. Each value represents the average of two replications. For each treatment, 20 locust and 20 alder trees were transplanted in the spring of 1968. The data in Table 3 were obtained July 31, 1968.

For the first seven treatments, a post hole digger was used to dig holes in the spoil approximately 10 inches deep. The diameter of each hole was approximately 7 inches except for the seventh treatment, when the hole was twice the diameter of the other holes. The limestone and lime rock were mixed with the spoil and the hole filled. The soil was used to fill the holes. In the case of the .5 soil treatment, the lower half of the hole was filled with soil. The last three treatments listed in Table 3 consisted of regular transplanting with the lime materials placed around the base of the tree on the surface of the spoil.

The most plant growth is being obtained with the 2 soil treatment. However, it is not known how the trees will react when the root systems become more in contact with the toxic spoil.
Ohio's major soil types and climatic conditions are represented at the Research Center's 12 locations. Thus, Center scientists can make field tests under conditions similar to those encountered by Ohio farmers.

Research is conducted by 13 departments on more than 6,200 acres at Center headquarters in Wooster, ten branches, and The Ohio State University.

Center Headquarters, Wooster, Wayne County: 1,953 acres
Eastern Ohio Resource Development Center, Caldwell, Noble County: 2,053 acres
Jackson Branch, Jackson, Jackson County: 344 acres

Mahoning County Farm, Canfield: 275 acres
Muck Crops Branch, Willard, Huron County: 15 acres
North Central Branch, Vickery, Erie County: 335 acres
Northwestern Branch, Haynsville, 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