85th Annual Report
1966

OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER
Wooster, Ohio Bulletin 995

Research and Development...

Serving Ohio's Largest Industry
July 1, 1966

Mr. Jacob E. Davis
Chairman, Board of Control
Ohio Agricultural Research and Development Center
Dear Mr. Davis:

I have the honor of presenting this Eighty-fifth Annual Report of the Ohio Agricultural Research and Development Center for the year ended June 30, 1966, for transmission to the Governor of Ohio and the citizens of our State.

This report describes how research and development are serving agriculture, Ohio's largest industry, and contributing to our State's economic growth.

Sincerely yours,

Roy M. Kottman
Director

CONTENTS

Serving Ohio's Largest Industry ....................................... 1
Dissemination of Research Results .................................. 2
Improving Efficiency of Production .................................. 3
Protecting Plants Against Pests ..................................... 6
Protecting Animals Against Disease .................................. 8
Developing the Economy of Southern Ohio ........................... 10
Serving Ohio's Greenhouse Industry ................................... 12
The Advance of the Soybean ........................................... 14
Management . . . Key to the Future ..................................... 16
Marketing of Agricultural Products .................................... 18
Processing and Use of Food ............................................. 20
Financial Statement .................................................... 22
Research Projects, 1965-1966 ........................................... 26
Literature Published by Center Faculty Members in 1965-1966 ....... 32
Center Publications ..................................................... 45
Center Administration and Faculty ..................................... 46
Ohio farmers produced 260 million bushels of corn in 1966. This is 150 million bushels more than were produced each year in Ohio only two decades ago. Similarly, 1966 Ohio soybean production was the highest in history—60 million bushels against 23 million bushels produced in 1950. The increase in value of just these two crops over the past 20 years amounts to nearly $300 million of additional new wealth. As each dollar of new wealth gets into the channels of trade, it generates $3 to $5 of off-farm business activity. In other words, Ohio’s economy was more than $1 billion larger in 1966 than it was in 1950 as a result of increased yields of just two field crops.

The growth of Ohio’s agriculture has been dramatic. It has thrived on continual nurturing by agricultural research and extension education. Scientists at the Ohio Agricultural Research and Development Center are continuing their efforts to develop new and improved varieties of corn, soybeans, and wheat. They are bending their efforts toward the discovery of new products and new techniques to control diseases of plants and animals as well as the insects which afflict them.

Center scientists are engaged not only in production research but, equally important, in finding ways to improve the flavor and nutritive value of food products, to reduce the cost of processing and marketing food products, and to provide Ohio’s consumers with increasingly more wholesome food at reasonable cost.

Automation and mechanization are rapidly becoming bywords of Ohio’s agricultural industry. Research Center scientists are increasingly focusing their efforts on the development of varieties and improvement of cultural practices, equipment, and techniques which will meet the needs of a rapidly mechanizing industry. In the unglaciated areas of the State, research is underway to promote the physical, chemical, and biological changes essential to stripmine reclamation and the profitable production of both forage and forest crops on previously unproductive or marginal land.

Despite the dramatic developments of the past, extensive use is being made of Research Center findings by all segments of Ohio’s agricultural industry. There can be no relaxation of effort. On the contrary, the opportunities and challenges to Ohio’s agriculture are greater today than ever before. Our population is increasing here in Ohio, in the United States, and throughout the world. As agricultural production becomes more specialized, it likewise becomes more demanding of research inputs as well as capital and management. Thus, the efforts of the Ohio Agricultural Research and Development Center must be increased and the tempo of our endeavors quickened if Ohio’s agriculture is to meet the challenges of the 1970’s and 1980’s. As new knowledge is developed and new applications of already existing knowledge are made, the importance and the impact of further research will increase dramatically.

A high level of agricultural efficiency is a requisite to the prosperity of any community, state, or nation. In the underdeveloped nations of the world, a substantial majority of the population is required to produce food in order to keep just one step ahead of starvation. We must guard against the complacency to which we may succumb as we compare our United States agriculture to agriculture in those countries which have not yet benefited from agricultural research and extension education.

The production and marketing of food represents our nation’s largest business! It is three times larger than automobile manufacturing, bigger than steel, and bigger than the aerospace industry. Unfortunately, the public seems to be much more impressed by the drama of space travel or the staggering data of automobile numbers being manufactured than by something as commonplace as food. Yet food production is America’s biggest business and in Ohio it is our State’s largest industry! In serving this industry, the Ohio Agricultural Research and Development Center has, during the past year, continued its contribution to the further building of our State’s economy.

As we look ahead, we see almost unlimited opportunity for Ohio’s agricultural industry resulting from the new knowledge which will be derived from a hard-hitting and forward-looking research program at the Ohio Agricultural Research and Development Center.
Dissemination of Research Results
by DR. WILLIAM E. KRAUSS, Associate Director

The Hatch Act of 1887 was passed by the Congress not only to provide for agricultural research in every state and territory, but to encourage dissemination of the results of such research. As defined in the Act, such centers for agricultural research were to be established “in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science.” Later in the Act, the word “diffusing” is explained as meaning publication of bulletins or reports of progress for distribution to newspapers and to such individuals actually engaged in farming as may request them.

We have come a long way since this original charge was made. Subsequent legislation extended markedly the scope of agricultural research, with resulting increased realization that research responsibility was not completely discharged until documentation for publication had been made and usable information was disseminated to the public. As society developed from primarily rural to primarily urban, the problems of agricultural production, distribution, and utilization became correspondingly more complex. Coincident with this was the development of new areas of science which attracted many. The overall effect was a dearth of scientific manpower. Thus, a third responsibility of agricultural research institutions became that of training scientists for the future.

Members of the OARDC scientific staff are aware of their three-way responsibilities, the evidence for which is partially recorded in this Annual Report. In addition, many members of the staff “disseminate” their research findings in the classroom at the graduate and undergraduate levels and in the guidance provided to graduate students in their training and selection of thesis and dissertation problems.

Whereas originally the written or printed word was the primary medium through which new information was transmitted to those who might use it, new communications media, such as radio and television, have speeded up the rate of transmitting new knowledge. Special days and demonstrations likewise have been developed as quick converters of scientific knowledge to new technologies or direct application.

The OARDC uses all available mass media and other devices for disseminating the information resulting from its research program. When this information is summarized, it makes an imposing document.

During the year covered by this Annual Report, staff members produced 32 research publications (bulletins, circulars, summaries), 46 Ohio Report articles, 176 press releases, 136 scientific journal articles, and 101 papers for presentation at scientific meetings. In addition, the staff filled 990 speaking engagements, prepared 244 radio and television scripts, 106 farm papers and trade journal articles, 35 departmental mimes, and contacted directly 101,585 people, including those who attended field days at Wooster and the outlying branches, but not including some 15,000 other visitors!

In this effort to disseminate information, the Public Information staff and the Cooperative Extension Service play important parts. An editorial staff is constantly available to assist in the preparation and editing of manuscripts, in developing formats for most effective presentation, and in preparation and selection of illustrative material. Extension workers not only convert the findings of scientists into the language of laymen but often suggest problems which warrant attention of researchers.

An outstanding example of teamwork in the dissemination of research results involved the maize dwarf mosaic problem. Through the coordinated efforts of agronomists, entomologists, and plant pathologists, clues were found as to the nature of the viruses involved in this and related field crop diseases. Not only were scientific articles prepared for documentation in the literature, but popular articles were published and field demonstrations were initiated to serve as guides in the selection of suitable varieties. Scientists, public information personnel, extension specialists, and county agents were involved in this total effort.

Through processes such as these, the findings of research have made possible the development of technologies and practices which so far have kept the food production and population increase curves from meeting. Future prospects demand intensification of these techniques, for the time lag between discovery and adoption still is too great. At the same time, the resulting contributions to knowledge will make for better understanding and greater appreciation of the wonderful world in which we live.
Improving Efficiency of Production

Agricultural research has played a major role in the great success story of American agriculture. One U. S. farmer today produces enough food and fiber for himself and 37 other persons. But the pressure to produce more food on less land is increasing. Population is growing rapidly in the U. S. and throughout the world. One recent study indicated that food exports to developing countries will at least double—and may triple—by 1980. By the end of this century, markets will exist for 70 to 80 percent more meat than our farmers are now producing.

Research Center scientists are dedicated to the goal of assisting Ohio agriculture in helping meet these challenges. They are improving crop varieties and livestock, testing cultural and feeding practices, investigating environmental effects, evaluating new materials, and developing new research tools and techniques to further extend the boundaries of agricultural knowledge.

Livestock: A significant breakthrough was made in animal nutrition research during the past year with development of a new pelleted feed for dairy cattle. This feed, called Dehy-100, permits feeding higher levels of urea with dehydrated alfalfa meal for a lower cost source of nitrogen for protein. Use of Dehy-100 in dairy rations can amount to a possible market for an additional 25,000 tons of urea and 50,000 tons of dehydrated alfalfa annually in the state.

Dairy products are the largest single source of farm income in Ohio. Dairy cattle research at the Center is aimed at increasing efficiency and boosting production from Ohio herds.

Scientists believe that blood type may be related to milk production. They are studying the possibility of predicting potential production at an early age by blood typing heifer calves.

Animal scientists are attempting to develop a simple and accurate method of predicting percent of lean meat in live animals. An ultrasonic scanner, a delicate electronic device, is being tested for estimating the amount of fat and lean tissue. In studies with swine last year, mass selection based on ultrasonics was superior to any method or combination of methods compared. This technique has promise for purebred breeders in selection for meat-type hogs.

Two paste feeding systems for swine were developed and demonstrated during the year. Studies have shown that paste feed is suitable for automated feeding systems, feed waste is minimized, and performance is equal or superior to that of pigs on dry feed.

Agricultural engineers and animal scientists are studying the effect of controlled environment on swine performance. Results have shown that feed consumption and daily gain are significantly influenced by both dry-bulb and dew-point temperature levels.

New turkey research facilities added at the Center last year will facilitate studies in nutrition, breeding, housing, and management. Poultry scientists are continuing the search for feed formulations to fit the needs of the turkey at each age during the growing period.

Research is underway to determine optimum lighting procedures for turkey egg production. Other
studies are concerned with comparison of artificial insemination methods, development of semen storage methods, management, and egg production, quality, and hatchability.

Research is being conducted with both egg and broiler type chickens to determine the most efficient feeding systems. Geneticists are attempting to develop methods to improve populations which have apparently plateaued from selection.

Field Crops: Plant breeders are continuing to seek disease- and insect-resistant crop varieties with desirable agronomic characteristics. New inbred and hybrid lines, as well as improved breeding techniques, are the objectives of continuing corn breeding studies. A new line of feed barley is expected to be named and released soon. In addition to high yield potential, it has good resistance to barley leaf rust and powdery mildew. Scientists are also studying high yielding spring barley varieties in the search for a high quality malting barley suitable for production in Ohio.

Oat breeding studies are aimed at development of varieties with greatest resistance to rust, higher yields, and medium-early maturity. Work is also underway to develop a hardier oat variety to meet the demand for a winter oat adapted to southern Ohio.

Various soils respond differently to different tillage systems. In some Ohio soils, for example, timely cultivation of row crops, even when weeds are not present, can boost yields 10 percent or more. Other soils can produce maximum yields with less tillage or even no tillage. Agronomists are seeking the best tillage systems for specific soils.

A sophisticated electronic device, the direct reading emission spectrograph, is speeding up research to measure the nutrient levels in plants. By measuring concentration of essential elements in plant tissue, scientists can determine optimum nutrient levels for various crops. Plant analysis can be correlated with soil tests to help growers apply elements in short supply and avoid application of excessive amounts.

Water and rainfall studies seek the best soil management practices to reduce runoff and soil erosion. Different tillage systems, crop residues, and mulches are under trial. On sandy soils in north central and northwest Ohio, windbreak materials, tillage methods, crop residues, and cover crops are being studied to find the best method of reducing wind erosion.

Agricultural engineers are comparing surface drainage, tile drainage, and combinations of the two to determine costs and benefits to farmers in terms of increased crop production. Other studies are measuring runoff under different types of tillage systems.

Forestry: Forest genetics, a relatively new science, is receiving special emphasis at the Research Center. Breeding work is underway with pines, sug-
ar maple, red oak, and other species. These studies may lead to development of hybrid trees with pest resistance, straight trunks, rapid growth, and other desirable characteristics.

The search is continuing for disease-resistant American chestnut trees. Scions of native American chestnut trees have been grafted on Chinese chestnut root stocks and will be inoculated with fungus to determine their resistance. Growth and form of several varieties of Chinese chestnut are under observation.

Center researchers investigated physiological processes and ecological factors affecting the growth and development of forest trees. In one study, a systematic study was made of nutrient deficiency symptoms in trees under controlled nutritional levels. Correlation of nutritional level with growth and deficiency symptoms, coupled with chemical analyses of the trees, provides a basis for corrective forest fertilization.

Fruits and Vegetables: Research on apples illustrates the wide range of studies to improve efficiency of producing fruits and vegetables. Cultivars and cultural practices are being tested as the basis for recommendations to Ohio growers.

Horticulturists are conducting apple breeding research to develop new varieties yielding solid red fruits of good dessert quality. Earlier maturity dates, firmness, and freedom from physiological disorders also are considered necessary attributes. Growth, yield, and quality of standard and experimental varieties are under continuing study.

Extensive studies are being made of chemical tree thinning. Scientists are analyzing factors affecting variability of thinning results and fruit russetting. Results indicate that gallonage of thinning spray applied and pH of the spray solution are closely associated with thinning results. Tree nutrition also influences fruit russetting.

A study is underway to determine the precise action site and mechanism of chemical thinning agents. Information is being obtained on whether the agent acts on the seed, vascular tissue, or other parts of the developing fruit. The findings will give better understanding of the causes of erratic thinning results and will help reduce or eliminate factors responsible.

Leaf analysis indicates that nutritional levels are closely related to apple yield and quality characteristics. Nitrogen and potassium have been shown to be key elements. Results of this study demonstrate that leaf analysis is an excellent tool for predicting nutrient levels needed for optimum yield and quality.

Horticulturists and agricultural engineers are investigating the effects of irrigation and mulch on apple yield and quality. Nutritional aspects of these practices, as well as water requirements, are under study.

Grape cuttings, rooted in the greenhouse, will be planted in southern Ohio in an effort to re-establish a profitable grape industry in that area.

Pollinating inbred lines of corn in a breeding program seeking to develop new virus-resistant strains.
Protecting Plants Against Pests

Insects, diseases, weeds, and other pests cost Ohio farmers millions of dollars each year. Research Center scientists are vigorously seeking safe, effective, economical methods of reducing these production barriers. They are developing pest-resistant plants, evaluating chemical control materials and methods, and exploring ways to integrate biological, chemical, and other control measures.

Plant Insects: The alfalfa weevil, the most serious insect pest in Ohio, caused more than $7.3 million damage to the state's hay crop in 1966. Detailed studies are being made of the weevil's life history and habits. A new mobile laboratory enables researchers to make biological analyses at the scene of heavy infestations. Findings to date provide the basis for the type and timing of control recommendations and indicate new control approaches. Early spring applications of granular pesticides and aerial applications of low-volume chemical concentrates are being evaluated.

Another menace to Ohio agriculture is the cereal leaf beetle, which was found in 70 counties in 1966. Although damage is not yet economically significant, a rapid buildup would pose a serious threat to the state's 3 million acres of wheat, oats, rye, and barley.

In 1966, studies were made of the impact on oats and wheat of caged populations of the beetles. Estimates of percent leaf destruction by larvae gave an accurate indication of the larval population. This finding will be useful in determining population levels in areas where the beetles become established. Good chemical control methods are available and studies are continuing to determine efficient biological controls. For example, tests are being made of control with disease organisms and radiation. Insect attractants are being explored for their possible use in conjunction with insecticides.

Corn rootworms are another serious insect problem, costing Ohio farmers an estimated $9 million annually. Effective and economical chemical controls are available. However, some rootworm resistance to chlorinated hydrocarbons has shown up in Ohio and other chemicals are being evaluated as possible substitutes. Corn hybrids and inbreds are being screened for resistance or tolerance to rootworm damage.

Applying herbicides to evaluate their effectiveness in weed control in strawberries. Similar studies are being made with other crops.

Wheat streak mosaic has been identified in Ohio small grains and corn. Efforts are now underway to develop resistance in crop varieties.
Aerial applications of ultra low volumes of undiluted insecticide have proved effective for controlling the alfalfa weevil.

Weeds: More effective methods of cultural and chemical weed control in field crops, fruits, vegetables, and home lawns are being developed. New herbicides and combinations of herbicides are tested on different soil types and under various environmental conditions.

Agronomists are studying the growth habits and life cycles of specific weeds and the influence of environmental factors, growth regulators, and herbicides on weeds' physiological processes and growth habits. The effectiveness of cultural methods and herbicides on specific weed-crop situations is being investigated.

Effective methods are available for controlling weeds in small fruit crops and under trees in apple orchards. Tests are being made of post- and pre-emergence herbicides and combinations of these materials to control weeds in other orchard fruits.

Plant Diseases: Breeding for disease resistance is often the only economically feasible means of reducing or avoiding plant disease losses. Sources of disease resistance are determined and combined with other desirable agronomic characteristics.

Maize dwarf mosaic, the corn virus disease first discovered in Ohio in 1962, is a good example. Researchers isolated the virus, determined its wild and commercial host plants, and identified insect vectors. They concluded that development of corn varieties resistant to the MDM virus offered the best solution.

MDM caused an estimated 5 million bushel loss in 1964. From 1964-66, researchers screened several hundred varieties for resistance to the disease. Many Ohio farmers planted resistant hybrids in 1965 and damage dropped to an estimated 2.6 million bushels. Damage by MDM continued to drop in 1966.

Agronomists and plant pathologists are breeding corn for resistance to another virus which first attacked Ohio cornfields in 1964. Temporarily known as the 3A virus, it was identified in 1966 as a strain of wheat streak mosaic virus. Field observations showed damage to corn in 45 counties and to small grains in 23 counties.

Plant breeders often combine resistance to several diseases in field crops. In soybean breeding, for example, root rot resistance is incorporated with resistance to foliar diseases. Multiple-disease resistant strains of corn, oats, wheat, and other crops are being sought.

Agricultural engineers are testing more effective pesticide application equipment. For example, the Research Center and USDA launched a cooperative study in 1966 of a new type of sprayer for applying ultra high concentrate chemicals to orchard crops. Such a spray program, if effective, would save Ohio fruit growers thousands of dollars annually.

Predating Birds: Red-winged blackbirds cause an estimated $15 million damage to Ohio cornfields annually. Fruit and vegetable crops also suffer heavy bird damage. Research is underway in Ohio and several other states to find repelling, eliminating, or sterilizing techniques to manage bird populations and reduce crop damage.

Research Center scientists are studying bird behavior, physiology, flock movements, and flock and roost formations. Experiments are being conducted with "distress cries" to disturb blackbirds on their nests and with scaring devices during heavy damage periods. Agronomists and zoologists are evaluating bird-resistant corn and alternate crops.
Protecting Animals Against Disease

Diseases cause heavy losses in the livestock and poultry industries. Center scientists are studying causes of major animal diseases as well as prevention and control methods.

Research on transmissible gastroenteritis (TGE) in swine has centered on developing better methods of diagnosis, learning more about the TGE virus, and developing an effective vaccine. Cell culture methods were generally satisfactory for isolating the virus from field cases. A test for detecting TGE antibodies in serum also was found reliable. Good results have been obtained in testing immunizing agents.

Veterinary scientists are seeking the most effective protection against baby pig scours. One important discovery is that complete protection may be obtained with a specific antiserum administered orally but only partial protection from parenteral administration. Studies are continuing on immunity and on infection of pigs with *E. coli*, the organism most commonly associated with scours.

A new problem confronted animal and plant scientists in early 1966 when hog farmers in northwest Ohio reported a feeding problem with corn. A similar problem, on a smaller scale, was reported by producers of other livestock and poultry.

The problem involved moldy corn from the 1965 crop, with the main symptom a lack of palatability. Several cases of moldy corn toxicity which may have caused abortion or rectal prolapse were reported by swine producers.

Animal scientists, plant pathologists, and veterinary scientists immediately undertook studies to determine the relationship of molds and red streaking to corn palatability and toxicity, any association of corn viruses with incidence of field ear mold, the type and level of toxicity or lack of palatability in problem lots of corn, and cultural practices affecting the incidence and severity of molds.

Gilts fed one lot of moldy corn farrowed fewer pigs and a greater percentage of mummified pigs than those fed good corn. Two strains of mold produced in the laboratory appeared to affect the vigor of baby pigs as well as the number of pigs farrowed. Corn with one predominant mold type was found to definitely reduce the feed intake and growth rate of growing-finishing pigs. Comparisons of red-streaked and good corn fed to growing-finishing pigs showed no apparent differences in growth rate and feed efficiency.

Center veterinarians have proved that calves can be vaccinated effectively for brucellosis at an earlier age than previously recommended.

Dipping fertile turkey eggs in antibiotic solution helps control air-sac disease in poults hatched from the eggs.

Veterinarians, working closely with dairy scientists, are seeking a solution for controlling mastitis in dairy cows.
Several new leads to a solution of mastitis in dairy cattle were uncovered during the past year. Research Center veterinarians, working closely with dairy scientists, found varying degrees of mastitis resistance in cows. Investigations show that forages and grain fed to dairy cows are related to mastitis infections. Studies are now underway to pinpoint this relationship.

Veterinary scientists made a significant finding this year concerning the optimum age for brucellosis vaccination of calves. Calves vaccinated at 2 or 3 months old were as resistant as those vaccinated at the conventional ages of 4 through 8 months. The blood agglutinin titer of calves vaccinated at the younger ages receded to a negative status sooner than for the calves vaccinated at 4-8 months. Progress is being made in the control and eradication of brucellosis. However, early vaccination may be a helpful interim procedure until control is complete.

For several years, scientists have tested various feeding procedures and systems to lower incidence of bloat in dairy cattle. The most recent innovation is to continue feeding corn silage during the summer grazing period. Last year, no bloat problems were encountered with cows grazing alfalfa in rotation when they were fed 25 pounds of corn silage and 10 pounds of ground corn daily.

Dairy scientists are continuing to study factors affecting calcium and phosphorus absorption and the relation of calcium and phosphorus reserves to incidence of milk fever. Studies have shown that cows fed vitamin D can maintain calcium 1½ times longer than cows not receiving vitamin D. This research may provide the key to the basic cause of milk fever and other disorders associated with hypocalcemia.

Progress is being made in disease problems of the turkey industry, too. Scientists have discovered that airsacculitis in turkeys is transmitted through eggs from infected birds. A serologic test to detect infected birds was developed at the Center. With this diagnosis, eggs from non-infected birds can be used to hatch poults which are free from the disease. Emphasis in future studies will be on developing procedures for obtaining and maintaining turkeys free from airsacculitis. An attempt is being made to rear a flock of SPF (specific pathogen free) turkeys.
Developing the Economy of Southern Ohio

Farm income is low in southern Ohio. Cash receipts from farming range as low as $18 per acre in some counties. Many young people are leaving the area to seek employment opportunities. Natural resources of the area are not being developed and used to their full potential.

The Eastern Ohio Resource Development Center, a new Research Center Branch, was established in October 1965 to seek answers to these problems. Extensive research is underway here and at other locations to help southern Ohio citizens develop natural resources of the area. Major efforts are being devoted to ways and means of generating new wealth and thus improving and expanding the economy.

Studies are underway to reclaim and increase the productivity of stripmined land. The potential of expanded fruit production is being explored. Research is being conducted in pasture improvement, economic feasibility of livestock production, and other agricultural enterprises adapted to the area.

Numerous studies are underway to determine effective and economical methods of reclaiming stripmined land in southern Ohio.

The area has an abundance of beautiful scenery and natural attractions. With an excellent road network nearing completion, many opportunities exist for developing tourist and recreation enterprises on agricultural land. Research on the demand and opportunities for outdoor recreation provides useful information for such development.

Stripmine reclamation can increase income and improve the appearance of the southern and southeastern Ohio landscape. Research Center foresters and agronomists are investigating the best methods for reclaiming and increasing the productivity of this land.

Improved, fast-growing tree species are being planted on stripmined land. New and improved forest management techniques are being tested.

Chemical decomposition of spoil bank material is being analyzed to determine how much spoil bank runoff is contributing to water pollution. By sampling and chemical analysis of stream flow, scientists found that stripmining increases the sulfate, magnesium, and acid content.

Research has shown the importance of grading spoil banks to maximize rainfall infiltration. The stripmine industry has adopted improved grading and planting practices based on these findings.

Southern Ohio offers the potential for profitable livestock production. Beef cow and calf breeding herds are being used to test a number of grasses and

With water supplies critical in some southern counties, development of more efficient methods of water retention and utilization are essential.
Grazing systems and various forages and forage mixtures are being evaluated to find the best combination for increasing livestock production in southern Ohio.

Legumes under Ohio River valley conditions. Yields, persistence, and quality of various forage species are being evaluated.

Winter grazing, summer stockpiling, and other systems are being investigated to find the most efficient method of providing an adequate, year-round feed supply for beef herds.

Many opportunities for new and expanded fruit production are being explored. The grape industry is a good example. A century ago, the Ohio River valley had a national reputation as a grape-growing area. By 1890, however, the industry had shifted north to the Lake Erie counties. Diseases were responsible for the virtually complete disappearance of grape production in the Ohio River valley. New technological developments and improved varieties now offer the means to revitalize the grape industry in this area.

Research-demonstration grape plantings have been made in 15 southern Ohio counties. Intensive grape research has been conducted for several years at the Center's Southern Branch and findings from these studies are being applied in the 1-acre plantings. New cultivars, improved cultural practices, fertilization, and more effective pest controls are available. Researchers estimate that grape producers can expect yields of 4 to 6 tons per acre by the fifth year after planting.

Elderberry production is another possible means of bolstering agricultural income in southern Ohio. A new elderberry planting has been established at the Center's Southern Branch and cultural requirements of this fruit are being investigated.

Production of apples for fresh sale through farm and roadside markets is being evaluated at the Eastern Ohio Resource Development Center and the Southern Branch. Dwarfing and semi-dwarfing cultivars are being tested and cultural practices determined. A study is underway at the Southern Branch to learn factors affecting the production of cling peaches for processing.

Recreation enterprises offer potential for generating income and creating employment opportunities. A study was conducted to isolate significant factors affecting the demand for outdoor recreation activities and to develop guidelines for estimating participation in outdoor recreation. Data were obtained on how many people participate in outdoor recreation activities, how much they participate, and how far they travel. This information will be useful in considering recreation as an alternative use of farm land in the area.
Pollinating spring crop greenhouse tomatoes for fruit set studies.

Fruit quality and yields are emphasized in environmental research and breeding studies with greenhouse tomatoes.

Serving Ohio’s Greenhouse Industry

Quality is the major emphasis of research on production and marketing of greenhouse vegetables and floral crops. Center scientists are working closely with growers to produce top quality products for consumers.

_Greenhouse Vegetables:_ Ohio is the greenhouse vegetable capital of the nation. More than 60 percent of all greenhouse vegetable acreage in the U. S. is located in Ohio and nearly 70 percent of total greenhouse vegetable production comes from this state.

Greenhouse tomato varieties have been developed at the Center which are firm, flavorful, high in nutritive value, and resistant to disease. Center scientists are gaining precise knowledge of plant nutritional requirements, light-temperature relationships, and other environmental conditions. They are testing aerial fertilization with carbon dioxide to promote efficiency of photosynthesis.

A new hybrid tomato developed by Research Center scientists has been grown in Ohio greenhouses for 2 years, principally for the fall crop. It is high yielding and resistant to fusarium wilt and leaf mold. Plant pathologists have discovered that resistance to tobacco mosaic virus, one of the most important diseases limiting greenhouse tomato production, is governed by a single dominant gene. TMV-resistant lines are under continuing observation.

Insects interfere with efficient greenhouse vegetable production, too. Control of aphids on lettuce and whiteflies on tomatoes have been major problems recently. The aphid problem has been solved through research leading to extension of the use of Phosdrin on lettuce growing in the greenhouse up to 10 days before harvest. Systemic insecticides are being evaluated for use in controlling whiteflies on tomato plants.

A study is underway to relate the nitrogen and potassium supply in the soil and in greenhouse tomato plants to maximum yield of quality fruits. The effects of excessive amounts of applied nitrogen and potassium and high leaf nitrogen and potassium on yield and fruit quality defects are being measured.

Findings show that total number of defects increases significantly with added increments of nitrogen and high leaf nitrogen. Excess potassium also in-
creased defects but not as significantly as excess nitrogen.

This study shows that amounts of potassium and nitrogen found in leaf analysis are not always correlated with amounts applied to the soil. This illustrates one of the values of leaf analysis for assessing the nutritional status of greenhouse tomato plants. A moderate nitrogen supply must be maintained which is sufficient for high yields without detrimental effects on fruit quality attributes. Further study of the effects of excess potassium is needed.

Carbon dioxide enrichment of greenhouse atmospheres is being explored as a possible method of increasing fruit size and yield and improving fruit quality. Results show that adding CO₂ is beneficial for spring crops of tomatoes but is of doubtful value for fall crops.

With favorable temperature ranges, CO₂ enrichment increased fruit set, fruit size, and total yield in spring crops. However, effects of added CO₂ on fruit quality varied and further research is needed.

In fall crops, major plant growth and fruit set occur when outside temperatures are high. Maximum ventilation is needed to prevent excessively high greenhouse temperatures, making it difficult to maintain satisfactory levels of CO₂ in the greenhouse.

Marketing research is underway to measure consumer preferences for greenhouse and competing types of tomatoes. Consumer reactions to greenhouse tomatoes grown with and without added CO₂ are being studied.

Floral Crops: Horticulturists are studying effects of light, temperature, and growth regulators on the flowering schedule and height of floral crops. These tests have shown that flowering and height of azaleas, poinsettias, and chrysanthemums can be controlled with proper manipulation of environment and use of growth retarding chemicals. Thus greenhouse operators can produce flowering plants of a given size at times when they are not normally available. Efforts are continuing to determine optimum environmental conditions for controlling the height and flowering rate of Easter lilies.

Plant pathologists are evaluating fungicides for control of damping-off and root-rot diseases of floral crops. Studies are being made of application methods, rates, and frequency. Techniques are being developed for assaying soils for residual toxicity of fungicides.

Agricultural economists are testing the market demand for cut flowers at various times of the year. A project which may have far-reaching effects for Ohio's commercial flower producers is aimed at establishment of uniform grades and standards for the nation's flower industry.
More beans per acre is a primary goal of soybean research.

Pre-emergence herbicides are continually screened to evaluate their effectiveness for controlling weeds and grasses in soybeans.

The Advance of the Soybean

Soybeans, often referred to as agriculture’s miracle crop, are on the move in Ohio. New uses for this versatile crop are found almost daily and Ohio farmers are responding to this demand. Research Center scientists are joining researchers in other states in an all-out effort to discover the factors which control soybean yields.

Production of soybeans has grown rapidly. The 1965 crop, for example, was nearly three times the size of that grown just 15 years earlier. And the end is not yet in sight. Economists predict that, even with increased yields, 50 percent more soybean acreage will be needed by 1980.

Ohio farmers produce $120 million worth of soybeans each year. This is more than 10 percent of total cash income from farming in the state. Although corn has greater farm value, soybeans are Ohio’s leading cash crop and rank right behind dairy products, beef cattle, and hogs as sources of income. In terms of cash income, they are the top farm commodity in 12 Ohio counties.

Soybeans, rich in protein, are used in manufacturing margarine, salad dressing, cooking oil, baby foods, special foods for people with diet problems, synthetic products, and livestock feeds. They are one of our most important exports—for livestock feed and to help relieve the protein shortage in countries where people cannot afford protein derived from animals and animal products.

Center agronomists are conducting breeding and screening studies to develop new, improved soybean varieties. High yielding varieties with disease resistance and high protein content are being emphasized.

A study is being conducted to determine the role of various nutrient elements in amino acid synthesis in the soybean plant. From this, scientists hope to find out how soybean quality can be improved through soil fertility practices.

Another test is underway to relate yields to the nutrient element status of Ohio soils. Several years’ research have shown that soybean yields are consistently higher on soils with high fertility level. Soybean leaf samples analyzed in the Center’s Plant Analysis Laboratory have been found deficient in manganese, phosphorus, and potassium. Many samples tested in 1966 also were low in nitrogen.
Soybeans in a growth chamber are part of a study of internal water stress on plant behavior with a goal of developing drought-resistant varieties.

Manganese may also cause toxicity problems, particularly in eastern Ohio. It has long been known that manganese availability in soil increases as the soil pH declines. Scientists point out that a highly significant relationship exists between yield and manganese level in the plant, with yields declining sharply when manganese in the upper leaves is above or below a suitable level.

A continuing search is being made to find the best combination of cultural practices and herbicides for weed control in soybeans. Herbicides are evaluated to check their performance on different soil types and under varying weather conditions.

Research has shown that water is the most critical factor affecting soybean yields. In one 10-year study, rainfall accounted for a difference in yield of 23 bushels per acre between the best and poorest years.

A new research tool developed at the Center enables scientists to determine the severity and duration of water stress or water shortage within the soybean plant. When this instrument, called a beta gauge, is clamped to a plant leaf, it continuously records the amount of water in a growing plant. These studies have shown that even in summers with average rainfall, the soybean plant is frequently subjected to water stress during the growing season. It is known that water stress affects the vigor of plant growth. Plant scientists are investigating other effects and ways to reduce or eliminate these water shortages.

Several methods of controlling plant water loss are under study. Significant advances have been made in tillage and use of mulch residues for control of soil moisture evaporation. Use of chemicals or film coatings on plant leaves to restrict water loss are also being investigated. Attempts are being made to develop drought-resistant varieties with larger root systems and greater water-absorbing and water-conserving capacity.

Agricultural engineers are studying ways to reduce soybean harvesting losses. Fundamentals of drying are being investigated to obtain information needed for the design of an efficient drying system. Engineers have developed a mathematical model to describe drying rate and have designed laboratory equipment to test different drying methods.

The impact on Ohio markets of changing international trade in soybeans and other grains is being evaluated by agricultural economists. They are analyzing volume and flow of grains into the export market and establishing a basis for determining effects of changing exports on the structure of Ohio markets.
Management . . . Key to the Future

Managerial skill—the ability to make optimum use of resources to achieve a desired goal—is becoming increasingly important on the farm, in the home, and in all areas of agriculture. Studies are being conducted to identify and measure managerial capabilities of farmers, develop a framework for home management studies, evaluate changes occurring in managerial roles, and measure management performance.

Using a factor analysis technique, researchers are quantifying attributes of managerial skill and relating these to performance. A study is underway to determine relationships between human factors involved in managerial activity. The basic objectives are to develop scales which discriminate between good and poor farmers and to analyze relationships between subjective human factors involved.

An innovation scale tested last year discriminated between “good” and “poor” farmers but an occupational interest scale failed to discriminate. The two groups of farmers did not differ when family, farm, and community goal scales were used and they did not differ for specific goal orientation. Good farmers differed from poor farmers in perception of goal progress, however.

Some types of farming are more speculative and require different kinds of managerial ability than others. The managerial skills needed to control the resource base needed for efficient volume today are different than those required in the past. Criteria for measuring manual, mental, and business skills can be used by farmers in determining if they should expand or move into different or higher risk types of operation.

Increased capital requirements continue to intensify farm financial management problems. The number of farm units with an average investment of $100,000 to $300,000 is growing rapidly. This is an expected development as land value per acre continues to rise and purchased assets make up a larger proportion of total assets used in production.

With the continued growth of commercial farms, financial management problems are becoming more apparent in three major areas. These are capital acquisition, with particular emphasis on credit and leasing; management of larger investments; and inter-generation transfer of capital. Studies are in process to measure the probability of repayment of credit in relation to income and to study changes in methods by

The trend to larger farms and more expensive inputs requires additional management skills. Research is aimed at development of methods to evaluate managerial ability and provide management tools for farmers.
which farm real estate is transferred and farm ownership is financed in Ohio.

Several continuing studies of management performance are in progress. Response from different inputs is being measured in all major types of farm operation. Results of these studies indicate the optimum size operation as well as the most efficient production techniques and environmental conditions.

Home economists are examining and adapting existing theories to a proposed framework for management research. Using the systems approach, demands and resources are proposed as input and resource use as output. Different aspects of planning and controlling are being compared on the basis of residence and employment status. The framework will be modified in accordance with findings from this study.

In another study, home economists compared relationship of cash receipts, expenditures for consumption, and savings of 26 families over a 2-year period. Monthly financial records of each family were processed. The families were interviewed to obtain their evaluations of financial experiences during the record keeping period and to relate their expectations, performance, and awareness of financial directions.

A study is underway to identify the changing roles of store managers and supervisory management personnel in the wholesale and retail food industry. The results are expected to be useful in developing a profile of their future roles which will aid industry management in planning for the future. Such a profile can imply needed changes in organization and in selection, evaluation, and promotion procedures.

Findings indicate that the complexity of future wholesale and retail food distribution operations will make it necessary for store management (both independent and chain) to depend more on headquarters personnel and supervisory specialists. Thus many of the management functions traditionally performed at store level will move up in the organizational structure.

A second phase of the study is concerned with developing procedures to meet these changes in personnel and management needs. Specific objectives are to discover individual and organizational “predictors” of effective management and to explore training and management development methods which will enhance management behavioral changes.

Twelve years of financial records of 100 grain and feed firms have been analyzed to determine if the financial statement can be improved as an aid for guiding management. The objective is to establish guidelines in financial statements which provide management with the keys to operational efficiency and give indicators of success or failure. As a result of the study, changes have been made in presentation of data to make the financial statement more useful.
Marketing of Agricultural Products

More than 370,000 Ohioans are employed in processing, wholesaling, and retailing of agricultural products. Research to improve efficiency in this dynamic marketing system reduces costs and expands markets, thus benefiting producers, marketing firms, and consumers.

In milk marketing, for example, wholesale and retail distribution costs account for about 50 percent of total operating costs of dairy processors. Research to reduce these costs will strengthen markets, improve the position of producers and processors, and give consumers the advantage of lower prices.

A study was initiated recently on efficiency in fluid milk distribution. To determine the potential of home delivery, an analysis was made of consumer buying habits and preferences for store-purchased or home-delivered milk. Detailed cost analyses of wholesale or retail milk routes will be made and an optimum home delivery system will be simulated.

More accurate forecasts of prices and a more equitable pricing system are major goals in livestock marketing studies. Researchers are developing and testing forecasting models consisting of optimum combinations of variables affecting wholesale beef prices for different time periods.

Economists are helping meat packers evaluate the ability of their buyers to estimate carcass performance of live animals. Actual performance is being compared with packer buyer estimates in terms of price, dressing percentage, grade, cutability, rail cost, and wholesale dressed beef selling price. The long range goal of this and related studies is to pro-

Top: Improved storage methods and facilities are among the research goals related to marketing.

Left: Studies are underway to help improve marketing at the retail level.
vide an equitable basis for integration contracts between meat packers and cattle feeders.

A study is underway on the effects of changing market conditions and facilities on Ohio grain and feed marketing firms. Information has been collected on storage facilities, annual volume handled, annual sales, grain drying capacity, and value of buildings and equipment. Thus, basic information on all grain and feed firms serving Ohio has been identified and classified. These data will be compared with findings of an earlier survey to determine structural changes which have occurred in the industry. Using transportation and economic models, an attempt will be made to determine the optimum size and location of grain and feed firms for the state.

To help develop new markets, a study is being initiated of the potential of irrigated fruit and vegetable production in central and western Ohio. If economically feasible, this could lead to expansion of agricultural industry in the state.

An analysis of roadside marketing in 11 northeastern Ohio counties was completed during the past year. Results showed variations in sales from a low of $7,500 to a high of $108,000. Net returns varied from a loss of $1,900 to a profit of $13,500. The high profit markets had higher sales volume per dollar invested, higher proportion of total sales from apples and peaches, higher retail margins, and lower proportion of total sales from vegetables than the low profit markets.

Most consumers like sweet corn with high sugar content or corn which is “fresh,” according to results of a consumer preference study. The 120 families surveyed showed a marked preference for corn kept under refrigeration, which helps maintain its sugar content. Nearly three-fourths of the group were dissatisfied with non-refrigerated corn. More than 90 percent of the families said they preferred to purchase corn at a farm or roadside market.

Consumers’ motivations in selecting a retail food store were revealed in another study. Findings showed that “a pleasant shopping experience” was an important consideration in attracting customers to a particular store. Such an experience includes friendly personnel, well-stocked shelves, clean store, wide selection, and fast check-out service. Other motivational factors are prices, social influences, nearness to other services, meat quality and selection, advertising, conveniences such as pre-packaged meats and produce, and location.
Processing and Use of Food

Research to develop new and improved foods expands markets for Ohio-grown products. It enables consumers to buy foods of finest flavor, color, texture, wholesomeness, and nutritive value at relatively low cost.

Scientists are seeking new uses for agricultural products, modifying foods by processing and combining with other foods, and exploring ways to retain quality and extend the shelf life of dairy products, fresh fruits and vegetables, and meat. Home economists are investigating metabolic uses of various kinds and amounts of dietary fats and special nutritional requirements of consumer groups.

A new line of blended meat products is being developed by Research Center poultry and animal scientists. Chicken bologna, the first of these new products, is now under test. Various percentages of chicken and red meat are being checked for taste, texture, color, and storage characteristics to find those most acceptable to consumers. The researchers envision such other new products as chicken hot dogs, chicken-hamburger blends, and chicken patties. Studies are also being made of factors affecting chicken meat flavor.

To develop potential new markets for fruit products, horticulturists made a study of 300 apple-fruit juice blends. Juice of five apple varieties was combined with different percentages of strawberry, grape, cherry, peach, blueberry, and black raspberry juice. The blends were adjusted with sugar and acid to provide a series of 10 sugar-acid ratios. Evaluation by a taste panel indicated preferred blends and the optimum sugar-acid ratio.

Dairy technologists studied two Yugoslavian cheese varieties to adapt them to American conditions. The major concern in adaptation was the use of various processed fruits are analyzed for organic acids which are important in product quality.
of cow's milk instead of sheep's milk as in Yugoslavia. Katchkaval, a member of the pasta filata cheese family, proved readily adaptable to cow's milk. The studies also produced a highly acceptable, semi-soft, low fat variety of White cheese.

Other dairy technology research is aimed at increasing the shelf life of fluid milk, improving uniformity of quality in buttermilk and other cultured products, and helping manufacturers produce a uniform, high quality Swiss cheese.

A study of the chemistry of heat-induced flavor changes in milk indicates that all milk proteins contribute to the volatile sulfur components and thus to the flavor. The rate and extent of acid development during manufacturing and processing of the curd appear to be major keys to Swiss cheese quality. Studies are continuing to determine the optimum rate of acid formation for high quality cheese and to introduce modern methods of acidity control and measurement to the manufacturing plants.

A significant advance in food processing research has been development of a tank for transporting mechanically harvested tomatoes from the field to the cannery. With this system, tomatoes are washed, protected against damage, and delivered to the processor in clean, mold-free condition.

Horticulture researchers are investigating the influence of different levels of nitrogen on the composition of tomato fruit before and after canning. The effects of nitrate accumulation on can corrosion are being analyzed.

Additional studies deal with processing, quality, and mechanical harvesting and handling characteristics of new tomato varieties; relation of processing techniques and chemical composition to potato chip quality; and the influence of processing techniques on grape products. Evaluations are being made of the color, flavor, and texture of frozen strawberries, black raspberries, and blackberries and canned apple slices and sauce. A study was completed last year of the effect of cultivar and raw product storage duration on the quality of frozen apple pies.

Animal scientists are using a sterile tissue technique to extract germ-free portions of meat from a carcass. This laboratory method, which enables them to keep fresh, unprocessed meat stored at room temperature for extended periods, may lead to a practical means of preserving meat flavor and extending its storage life. Methods have been perfected for inoculating single strains of microorganisms into the germ-free samples, enabling the scientists to determine which ones affect meat flavor and quality.

Home economists conducted two studies last year to investigate the effects of type and quantity of dietary fat on lipid and protein metabolism. Two groups of college women participated in the studies, which were divided into five experimental periods of six days each. A normal or control diet was used for three periods and semi-purified food diets for the other two. The latter consisted of two levels of essential amino acid nitrogen.

Preliminary results show that cholesterol values were not materially affected by dietary treatment. All subjects stored relatively large amounts of nitrogen when transferred from the semi-purified to the control food diets. It appears that body reserves or amino acid pools were depleted and replenished in an attempt to produce nitrogen equilibrium on the semi-purified diets.

A study is being made of food purchases and use by families with pre-school children. Home economists surveyed dietary and purchasing practices, evaluated medical and nutritional status of the children, and identified problems for further research in child nutrition.
Financial Statement

Statement of Income and Expenditures for Fiscal Year Ending June 30, 1966

<table>
<thead>
<tr>
<th>FEDERAL GRANTS</th>
<th>SPECIAL CONTRACTS AND AGREEMENTS</th>
<th>STATE OPERATING APPROPRIATION</th>
<th>CAPITAL IMPROVEMENT APPROPRIATION</th>
<th>ALL FUNDS TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance July 1, 1965</td>
<td>$1,097.32</td>
<td>$156,144.12</td>
<td>$255,437.78</td>
<td>$2,108,862.29</td>
</tr>
<tr>
<td>Income</td>
<td>1,484,916.00</td>
<td>457,858.99</td>
<td>3,701,089.62</td>
<td>3,459,600.00</td>
</tr>
<tr>
<td>Total Balance and Income</td>
<td>$1,486,013.32</td>
<td>$614,003.11</td>
<td>$3,956,527.40</td>
<td>$5,568,462.29</td>
</tr>
</tbody>
</table>

Expenditures

| Personal Service | $1,242,039.18 | $195,644.32 | $1,969,783.32 | $2,002,121.69 | $3,407,466.82 |
| Travel | 30,045.15 | 24,646.54 | 28,772.84 | 83,162.53 |
| Equipment | 46,472.94 | 92,666.42 | 163,578.62 | 292,717.98 |
| Supplies and Materials | 39,407.46 | 39,828.85 | 562,070.50 | 641,306.81 |
| Other Expenses | 12,299.79 | 48,752.13 | 306,353.11 | 368,405.03 |
| Land and Structures | 13,299.79 | 249,090.00 | 2,002,121.69 | 2,251,211.69 |
| Personnel Benefits | 55,183.21 | 154,792.50 | 2,211,810.77 | 2,211,810.77 |

Total Expenditures | $1,476,447.73 | $403,071.32 | $3,434,440.89 | $2,002,121.69 | $7,266,081.63 |

Balance* | $59,565.59 | 210,931.79 | 522,086.51 | 3,566,340.60 | 4,358,924.49 |

Less State Funds Restricted | 59,565.59 | 210,931.79 | 522,086.51 | 3,566,340.60 |

Balance June 30, 1966 | $59,565.59 | $210,931.79 | $518,089.65 | $3,556,166.97 | 4,344,754.00 |

*Includes encumbered funds.

Source of Operating Funds

- State Appropriation: 55.1%
- Federal Grants: 28.4%
- Sale of Salvage: 9.5%
- Research Products: 8.5%
- Contracts and Agreements: 5%

How Operating Funds Were Spent

- Personal Services: 72.4%
- Supplies, Materials, Travel: 21.8%
- Equipment: 5.8%
### Inventory June 30, 1966

<table>
<thead>
<tr>
<th>Supplies</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage</td>
<td>$48,300.00</td>
</tr>
<tr>
<td>Office</td>
<td>$1,058.00</td>
</tr>
<tr>
<td>Laboratory and Research</td>
<td>$1,428.00</td>
</tr>
<tr>
<td>Agricultural</td>
<td>$2,500.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building</td>
<td>$5,569.00</td>
</tr>
<tr>
<td>Other</td>
<td>$512.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>$351,876.00</td>
</tr>
<tr>
<td>Laboratory and Research</td>
<td>$1,411,782.00</td>
</tr>
<tr>
<td>Livestock</td>
<td>$213,768.00</td>
</tr>
<tr>
<td>Agricultural, including Tractors</td>
<td>$616,242.00</td>
</tr>
<tr>
<td>Motor Vehicles</td>
<td>$169,283.00</td>
</tr>
<tr>
<td>Tools and Machinery</td>
<td>$37,978.00</td>
</tr>
<tr>
<td>Other</td>
<td>$39,582.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lands</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$1,080,827.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Structures</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$14,439,500.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Inventory</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$18,420,207.00</td>
</tr>
</tbody>
</table>

### Gifts

#### Cash Receipts

**July 1, 1965 through June 30, 1966**

<table>
<thead>
<tr>
<th>Provider</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agway</td>
<td>$15.00</td>
</tr>
<tr>
<td>American Cyanamid Company</td>
<td>$3,500.00</td>
</tr>
<tr>
<td>Asgrow Seed Company</td>
<td>$30.00</td>
</tr>
<tr>
<td>California Packing Corp</td>
<td>$30.00</td>
</tr>
<tr>
<td>Chemagro Corp</td>
<td>$200.00</td>
</tr>
<tr>
<td>Chevron Chemical Company</td>
<td>$500.00</td>
</tr>
<tr>
<td>Crookham Company</td>
<td>$30.00</td>
</tr>
<tr>
<td>Dow Chemical Company</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Joseph Harris Co., Inc.</td>
<td>$2,800.00</td>
</tr>
<tr>
<td>Hess &amp; Clark</td>
<td>$4,000.00</td>
</tr>
<tr>
<td>International Minerals &amp; Chemical Corp</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>New Idea Farm Equipment</td>
<td>$2,324.70</td>
</tr>
<tr>
<td>Ohio Florists Association</td>
<td>$11,450.00</td>
</tr>
<tr>
<td>Ohio Greenhouse Cooperative Assoc</td>
<td>$23,210.00</td>
</tr>
<tr>
<td>Ohio Seed Improvement Association</td>
<td>$400.00</td>
</tr>
<tr>
<td>W. D. Pounden</td>
<td>$18.00</td>
</tr>
<tr>
<td>Robson Seed Farms Corp</td>
<td>$30.00</td>
</tr>
<tr>
<td>Rogers Bros. Company</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>Stouffer Chemical Co</td>
<td>$15.00</td>
</tr>
<tr>
<td>Stockley-Van Camp, Inc.</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>Union Carbide Corp</td>
<td>$55,582.70</td>
</tr>
</tbody>
</table>

### Grants and Contracts

#### Cash Receipts

**July 1, 1965 through June 30, 1966**

<table>
<thead>
<tr>
<th>Provider</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Dehydrators Association</td>
<td>$3,300.00</td>
</tr>
<tr>
<td>The Alfalfa Processors Association, Inc.</td>
<td></td>
</tr>
<tr>
<td>American Society of Heating, Refrigerating and</td>
<td></td>
</tr>
<tr>
<td>Air-Conditioning Engineers, Inc.</td>
<td></td>
</tr>
<tr>
<td>Clinton Corn Processing</td>
<td>$2,222.00</td>
</tr>
<tr>
<td>Franklin County Regional Planning Commission</td>
<td>$2,640.00</td>
</tr>
<tr>
<td>Hess &amp; Clark</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Massey-Ferguson, Inc.</td>
<td>$3,125.00</td>
</tr>
<tr>
<td>National Commissions Association</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>National Institute of Health</td>
<td>$13,499.57</td>
</tr>
<tr>
<td>National Science Foundation</td>
<td>$64,871.13</td>
</tr>
<tr>
<td>Northern Ohio Sugar Company</td>
<td>$4,000.00</td>
</tr>
<tr>
<td>Ohio Greenhouse Cooperative Association</td>
<td>$5,775.00</td>
</tr>
<tr>
<td>Shell Oil Company</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>Standard Oil Company [Ohio]</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>The Ohio State University Water Resources Center</td>
<td>$8,450.00</td>
</tr>
<tr>
<td>Tri-County Regional Planning Commission</td>
<td>$1,400.00</td>
</tr>
<tr>
<td>U. S. Atomic Energy Commission</td>
<td>$87,694.55</td>
</tr>
<tr>
<td>U. S. Dept. of Agriculture, Animal Disease and Parasite Research Division, Agricultural Research Service</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>U. S. Dept. of Agriculture, Crops Research Division, Agricultural Research Service</td>
<td>$18,750.00</td>
</tr>
<tr>
<td>U. S. Dept. of Agriculture, Entomology Research Division, Agricultural Research Service</td>
<td>$53,827.00</td>
</tr>
<tr>
<td>U. S. Dept. of Agriculture, Forest Service</td>
<td>$11,750.00</td>
</tr>
<tr>
<td>Velisical Chemical Corp</td>
<td>$10,690.00</td>
</tr>
<tr>
<td>Total</td>
<td>$314,684.25</td>
</tr>
</tbody>
</table>

### Capital Improvements

**July 1, 1965 through June 30, 1966**

- Completed Agronomy and Forestry Greenhouses and Headhouse
- Completed Animal, Dairy, and Poultry Science Building
- Completed Research Operations Service Building
- Completed Two Turkey Research Buildings
- Completed installation of new gas boilers in Central Heating Plant
- Established Eastern Ohio Resource Development Center
- Funds for the above facilities were provided by the 105th and 106th General Assemblies

### Major Equipment Acquisitions

**July 1, 1965 through June 30, 1966**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goniometer Assembly for Spectrograph and</td>
<td>$4,654.00</td>
</tr>
<tr>
<td>Scintillation Counter</td>
<td>$7,065.00</td>
</tr>
<tr>
<td>Channel Analyzer</td>
<td>$9,991.00</td>
</tr>
<tr>
<td>Tri-Carb Spectrometer</td>
<td>$8,040.00</td>
</tr>
</tbody>
</table>
RESEARCH IN ACTION
Serving Agriculture, Ohio’s Largest Industry

1. Electron microscope magnifies many thousands of times for studying minute particles.
2. Seeking new ways to preserve flavor and lengthen storage life of meat.
3. Grazing studies improve animal gains and extend pasture life and production.
4. Flowering crabapples in the Secrest Arboretum.
5. Beta ray gauge method, developed by Center scientists, measures plant water balance.
6. Human nutrition is studied by home economists.
7. New mobile unit provides on-the-spot laboratory for alfalfa weevil research.
8. Research efforts are seeking to expand the state’s grape production—particularly in southern Ohio.
CONSERVATION, DEVELOPMENT, AND USE OF NATURAL RESOURCES

Agricultural Economics and Rural Sociology
- Economic appraisal of opportunities for alternative land use in southeastern Ohio
- Multiple use forest-recreation enterprises in Ohio
- Use and planning of land resources in Ohio
- Economic and legal factors in providing, using, and managing water resources in agriculture

Agricultural Engineering
- Tillage practice in relation to soil tilth and crop response
- Hydrologic aspects of drain depth and spacing as related to soil properties, climate, crop response, and crop rotations
- Effectiveness of surface and subsurface drainage for slowly permeable soils
- Flow of colloidal suspensions in porous media
- Fundamentals of soil erosion by water and their application to the design of control measures
- Hydrologic characterization of small watersheds
- Electrokinetic removal of colloidal materials from suspension

Agronomy
- Effects of soil physical conditions on plant growth
- Integrated effects of soil structure on plant growth
- Factors affecting release of exchangeable and non-exchangeable potassium from soils
- Soil characteristics which affect subsurface drainage
- Chemical and physical properties of soil organic matter
- Development of cropping systems for soils in which chronic plasticity imposes restrictions on production
- Relating crop yields with the nutrient element status of Ohio soils
- Effects of soil management treatments on erodibility and infiltration characteristics of Ohio soils
- Analysis of soil survey data
- Physical and chemical characteristics of important Ohio soils
- Conservation and improvement of muck soils
- Establishment of forage species on strip mine spoil banks
- Accumulation of climatological data
- Mineralogy of Ohio soils
- Detailed characterization of soil and vegetation on selected sites to serve as basis for future evaluations of effects of radioactive contamination
- Mapping and characterization of soils of the Chariot project area, Alaska
- Soil moisture movement in unsaturated soils
- Fission product-soil organic matter complexes

Botany and Plant Pathology
- Bioclimatic and soils investigations in forest environments

Forestry
- Management of experimental forests
- Physical and chemical changes in weathering coal spoils
- Organic matter relationships in coal spoil banks
- Accumulation of fixed nitrogen on spoil banks
- Strip mining and water quality

PROTECTION OF MAN, PLANTS, AND ANIMALS

Agricultural Biochemistry
- Mode of action of antibiotics on microorganisms and immunity

Agronomy
- Chemical and cultural control of weeds in field crops
- Weed control in turf
- Winter injury to crop plants from the indirect effects of low temperature
- Basic physiological and morphological responses of weed crop species to herbicides
- Effect of traffic on turfgrass and soil physical condition as influenced by types of tires, load, species of grass, and environmental factors
- Drought injury and resistance in plants
- Development of tillage-replacing herbicide systems

New greenhouses and headhouse for the Departments of Agronomy and Forestry were dedicated in May 1966.
Animal Science
Infant mortality among lambs
Control of intestinal parasites of swine
Antibacterial agents in rations for growing-finishing swine
Acceptance of moldy and red-striped corn by hogs

Botany and Plant Pathology
Control of fungus and bacterial diseases of fruit plants
Comparison of new fungicidal, chemotherapeutic, and nutritional formulations for control of vegetable diseases
Pathogenic variability and inheritance of disease resistance in tomatoes
Effect of crop rotation on incidence of diseases caused by soil-borne pathogens and associated changes in soil fungus populations
Nature and control of stalk rot of corn
Introduction, multiplication, and preservation of disease-resistant and other genes in the tomato
Biology of the tomato early-blight organism with reference to the existence of races and resistance
Forage crop and soybean diseases
Deciduous tree fruit diseases
Tobacco mosaic and other viruses of greenhouse tomatoes
Oak wilt disease
Control of soil-inhabiting nematodes, fungi, bacteria, and insects affecting vegetable crops
Control of plant parasitic nematodes
Biological control of diseases on the aerial parts of plants
Factors which affect the formation and germination of sclerotia of certain important plant pathogenic fungi
Nature and control of diseases of woody ornamental plants
Damping-off and root-rot diseases of greenhouse floral crops
Diseases of outdoor plants grown for decorative uses, with special emphasis on rose and gladiolus
Mechanism of survival of root-infecting fungi in soil
Dwarfing virus diseases of corn

Dairy Science
Production in the bovine mammary gland of immunity to cattle diseases

Horticulture
Chemical and cultural weed control studies with horticultural crops
Factors associated with tree decline in Ohio apple orchards
Trace levels of pesticides in agricultural commodities in marketing channels
Effect of selected herbicides on composition and quality of food crops

Veterinary Science
Factors responsible for variation in resistance to mastitis of cattle
Chemistry and physiology of bloat
Shipping fever complex in cattle
Role of mycoplasma, ornithosis, Newcastle disease, and other agents in airsacculitis
Enteric diseases of baby pigs
Calfhood brucellosis vaccination: retention of blood agglutination titer and duration of resistance
Disease conditions in Ohio lambs at time of slaughter
Control of parasites in livestock and poultry
Sporadic toxicological, environmental, infectious, and non-specific problems in chickens and turkeys
Transmission of bovine leukemia

Gerlough Hall, dedicated in July 1966, houses the Departments of Animal, Dairy, and Poultry Science.

Zoology and Entomology
Evaluating insect resistance in onion varieties, strains, and hybrids
Biological control and insect pests of stone fruits
Evaluating insect resistance in varieties and strains of potatoes
Biological control of insects attacking greenhouse vegetables
Biological control of insects affecting corn
Effect of time of planting, weather, and character of plant growth on corn borer populations
Ecological study of the red-winged blackbird as related to crop damage
Mechanism of physiological action of insecticides
Chemical factors influencing choice of host plants by insects
Biological control of vegetable crop insects
Biological, ecology, and control of insects attacking livestock, with special emphasis on face fly
Biological, ecology, and control of insects attacking apples and pears
Disease resistance and genetics of honey bees
Biological, ecology, and control of insects attacking cereal crops, with special emphasis on cereal leaf beetle
Water balance and nutrition in mites
Bionomics of cereal leaf beetle
Integrated control of insect and mite pests of pine trees
Role of microorganisms in the biological control of insect pests
Spatial patterns of orchard mites
Control of yellow jackets in recreational areas
Insects affecting alfalfa
Identification and control of arthroped vectors of virus diseases of corn
Maintenance and development of collections of the Institute of Acarology
Methods for the rearing of specific virus-infected codling moth and salt-marsh caterpillar larvae
Microbiology and pathology of the cereal leaf beetle
Pathogenesis and diagnosis of Nosema disease in the honeybee
Heptachlor and heptachlor epoxide residues on fall-treated alfalfa hay and in milk
EFFICIENT PRODUCTION AND QUALITY IMPROVEMENT

**Agricultural Biochemistry**
Nutrition of and amino acid biosynthesis in cultured plant cells
Control of enzyme synthesis in plant cells

**Agricultural Economics and Rural Sociology**
Analysis of new dairy production systems and development of improved farm organizations for Ohio dairy farms
An economic study of the commercial beef enterprise in Ohio
Measurement and evaluation of farm managerial resources
Economic returns from individual forestry operations in Ohio
Aerial application of pesticides as a competitive production technique
Contractual agreements used by tenants on pork-producing farms
Evaluation of quality in fresh market sweet corn
Analysis of investment alternatives with emphasis upon repayment

**Agricultural Engineering**
Improved methods and equipment for subsurface drainage
Adaptations in grain harvesting equipment
Mechanical methods of handling high-moisture complete rations for swine
Development of materials handling systems
Irrigation requirements and potentials of field and horticultural crops
Effect of controlled thermal environment upon reproductive performance of swine
Effect of controlled thermal environment on performance of dairy cattle
Studies of thin-layer, shallow, and deep-bed drying of cereal grains

**Agronomy**
Breeding field corn for Ohio
Oat breeding and variety evaluation
Effect of length of harvest period and rest period on yield and survival of forage plants
Establishment, maintenance, and harvesting of high-quality forages
Development and evaluation of improved varieties of soybeans for farm and industrial utilization
Relation of soil temperature to growth and mineral absorption by plants
Comparison of upright and prostrate broadleaf birdsfoot trefoil under grazing
Ionic interactions in soils and in systems of plant roots in relation to nutrient uptake
Nitrogen fertilization and green manuring studies with continuous corn
Two methods of soiling and a stored feed program for summer feeding of dairy cows
Fundamental research in corn breeding methods leading to isolation of superior germ plasm
Wheat breeding and variety evaluation
Influence of variable nutritional environment on the organic composition of soybeans
Adaptation, management, and utilization of forages in southern Ohio
Winter barley breeding and evaluation
Cultural practices for sugar beets
Turf culture and pest control

Culture, fertilization, irrigation, and variety evaluation of barley tobacco
Evaluation of new and standard strains of forage crops
Factors affecting storage of seed corn
Plant and animal response to companion grazing and stocking rate
Improvement of forage and turf grasses and the development of more efficient grass-breeding procedures
Response of Ohio soils to fertilizer applications

**Animal Science**
Factors affecting the utilization of feeds by ruminants
Influence of ladino clover and birdsfoot trefoil pasture on reproductive efficiency in sheep
Hormone-influenced performance of growing-finishing swine
Adaptability and productive value of Columbia and Targhee sheep for farm flock use in the North Central Region
Development and use of the in vitro rumen fermentation and the effective nutritive value index in evaluating Ohio forages
Influence of levels of nutrition at various stages during growth and fattening upon carcass composition of beef cattle
Differences in beef carcasses and relation of these characteristics to live animals
Rate and extent of forage and forage constituent digestibility by pure cultures of rumen bacteria
Feed lot management and performance of fattening cattle under varying housing conditions
Reproductive performance in swine
Creep feeding systems and rations for production of market lambs from three-breed-cross ewes
Feeding protein and mineral supplements to growing hogs on pasture and in dry lot
Analysis of data from Swine Evaluation Station and Research Center projects
Use of feed additives and adjuvants in production of market lambs and their effects on efficiency and physiology of reproduction of ewe lambs
Comparison of Hereford and Charolais breeds and their reciprocal crosses under two management systems
Feeding and management of gilts, sows, and growing-finishing swine
Utilization and intermediate metabolism of non-protein nitrogen materials by rumen microorganisms
Development of technique to gain access to cecum and adjacent regions of digestive tract of swine
Genetic variation in the maintenance requirements of beef cattle
Swine reproduction
Feeding and management of pigs to 8 weeks of age
Steel, slotted floors for growing, fattening cattle
Genetics in relation to efficiency of production in swine

**Botany and Plant Pathology**
Development of new methods for applying fungicidal formulations to vegetables, with particular reference to the use of low-gallonage sprays
Cytogenetics and embryology in development of the domestic tomato
Factors affecting sucrose translocation in plants

**Dairy Science**
Use of blood serum protein-bound iodine and cholesterol to indicate milk-producing ability
Reciprocal crossing of dairy cattle lines to fix desirable traits
Evaluation of several traits among various relatives for selecting heifers with high production potential
Processing and utilization of meadow crops for pasture, hay, and silage
Factors affecting forage utilization in young calves
Absorption of nitrogen and organic acids directly from the rumen of dairy cattle
Amino acid synthesis in cows fed urea and amino acid supplement rations
Criteria for breeding, selecting, and culling dairy animals
Blood cell antigens and serum protein in cattle
Use of chromosome number, size, and arrangement to detect fertility
Frequency and inheritance of abnormalities in cattle
Gene identification and their response in hair colors and patterns
Ovulation and artificial insemination in cattle
Importance of calcium, phosphorus, and vitamin D in preventing milk fever
Essential amino acids in bovine metabolism
Improving cellulose digestibility for ruminants
Production, utilization, and management of pastures for a dairy enterprise
Physical form of forages and the performance of dairy cattle
Dehydrated alfalfa as an extender of urea
Endocrine aspects of male infertility

Dairy Technology
Factors affecting the marketability of Swiss cheese

Forestry
Forest tree improvement through selection and breeding
Selection and breeding of forest trees
Forest plantation management
Development of wood structure in Eastern white pine
Forest tree physiology
Christmas tree production
Embry development in white pine after self-, cross-, and inter-specific pollination
Effects of fertilizers on soils and tree growth in the sugar maple and tulip poplar in northeastern Ohio
Physical properties of woody cells grown in vitro
Evaluation of growth, form, and blight resistance of Asiatic and American chestnuts

Home Economics
Factors in textile fabric stress

Horticulture
Causes of abscission of flowers and young fruits following application of synthetic hormones
Influence of variety, fertilizers, and date of planting on quality of potatoes manufactured into potato chips
Evaluation of fruit and vegetable varieties for processing (canning and freezing)
Response of the black raspberry to different training systems and severities of pruning as indicated by growth, yield, and fruit quality
Interactions between light intensity, day and night temperature, and carbon dioxide supply on development, yield, and quality of greenhouse tomatoes
Influence of processing techniques on the quality of processed grape products as related to varieties and cultural practices
Use of synthetic growth regulators for control of fruit set and pre-harvest drop of apples and pears
Influence of pesticide chemicals on the physiology and metabolism of the foliage and fruit of the apple
Effect of water application to sod and mulch upon yield and quality attributes of apple fruits and upon certain physiological processes and chemical constituents of leaves, stems, and fruits

Pellet mill in the new Grain Storage and Feed Processing Building enabled dairy scientists to develop a new pelleted high urea feed for dairy cattle.

Environmental analysis of the factors influencing the yield-quality complex of potatoes and tomatoes
Propagation of ornamental plants
Apple breeding for the purpose of producing late-blooming, late-keeping varieties possessing qualities desirable for commercial use
Evaluation of new and uncommon pear varieties, with particular reference to the character, yield, and dessert quality of the fruit
Growth, yield, and quality of apple varieties as affected by size-controlling rootstocks and hardy interstocks of domestic and foreign origin
Chemical sprays as a means of inducing flower and fruit abscission in the apple and peach
Breeding greenhouse tomatoes
Evaluation of promising selections and varieties of certain stone and small fruits for Ohio
Soil and cultural treatments for blueberries
Soil fertility levels for various vegetable crops
Hardness, adaptability, and identification of species, varieties, and clones of some woody ornamental plants
Evaluation of new and improved varieties of vegetables
Yield and quality attributes of Persian (English) walnut, black walnut, and Chinese chestnut selections and seedlings
Development of improved varieties and strains of tomatoes for fresh market processing
Analysis of climatic and edaphic factors contributing to yield and quality differences of tomatoes grown in the processing areas of Ohio
Factors affecting date of flowering and flower bud count of several types of lily clones
More than a half-million dollar inventory of farm machinery and equipment is maintained in the new Research Operations Service Building.

Relationship between cultural practices for greenhouse tomatoes and some physical and biological characteristics of the soil
Apple variety trials, including evaluation of red strains of standard varieties
Causes of tree decline in varieties of European plum
Content and fractions of mineral elements in aerial and root portions of several woody ornamental plants
Effect of short exposures to various temperatures during the small plant stage on the subsequent growth and flowering of snapdragons
Effect of applications of boron, manganese, and molybdenum upon the yield, quality, and foliar content of essential nutrients in early cauliflower
Mineral element content of aerial and root portions of floral crops
Methodology of harvesting and handling of tomatoes for processing
Determination of potential value of new potato lines and varieties
Flower bud initiation and development of several floral crops, with special emphasis on the effects of light, temperature, and growth regulators
Effect of applying certain essential elements on progressive changes in leaf composition, yield, and quality of vegetables grown on organic and upland soils
Mineral nutrition of deciduous tree fruits
Physiological factors relating to viability of dormant nursery stock
Influence of growth-regulating chemicals and environment on pyracantha
Modified atmosphere storage of fruits and vegetables
Relation of leaf nitrogen and potassium in greenhouse tomato to yield, fruit composition, and quality
Stock-scion relationships in horticultural plants
Methods for predicting harvest maturity dates of apples
Characteristics and adaptations of species and varieties of shade and ornamental trees
Effect of nitrogen on the composition of tomato fruit before and after canning and on can corrosion

Poultry Science
Amino acid requirements of the laying hen related to amino acid composition of and availability in dietary protein
Cholesterol metabolism in the fowl
Unidentified reproductive and progeny growth factors in turkey nutrition
Effect of physical and chemical treatment of feedstuffs on growth and nutrient utilization by the chick
Genetics of endocrine function in the fowl
Selection and mating methods for poultry
Physiology of reproduction in the male turkey
Physiology of stress in turkeys and chickens
Unidentified growth factors, organic growth promotants and antibiotic growth response in turkeys
Factors affecting growth and body composition and their effect on reproductive performance of the turkey
Comparison of feeding systems for growing turkeys
Energy metabolism in growing turkeys
Fertility problems in turkeys
Genetics of growth and reproduction in the turkey

Zoology and Entomology
Development and reproduction of the bluegill in farm ponds
Equilibrium humidities of arthropods of agricultural importance

PRODUCT DEVELOPMENT
AND PROCESSING

Agricultural Economics and Rural Sociology
Use of native woods in the manufacture of furniture

Agronomy
Evaluating the quality of new, improved, disease-resistant and insect-resistant soft wheat varieties for cakes, cookies, and other finished products

Dairy Science
Influence of inheritance on composition of milk

Dairy Technology
Chemical and bacteriological factors affecting the market quality of cultured dairy products

Home Economics
Changes in the volatile flavor components of vegetables resulting from processing and storage

Horticulture
Development of methods for evaluating quality of fresh and processed fruits and vegetables
Relation of processing technique and chemical composition to the quality of potato chips
Development of apple-fruit juice blends to further increase utilization
Development and evaluation of frozen fruit pies from Ohio fruits
Development of new products from sauerkraut
Post-harvest chemical and physiological properties of fruits harvested from certain F₁ hybrids and varieties of tomatoes

Poultry Science
Improving acceptability, stability, and utilization of poultry products

Zoology and Entomology
Pesticide residues on animal feeds and human foods
EFFICIENT MARKETING

Agricultural Biochemistry

Biochemical and physiological basis for meat quality and biochemical and bacteriological studies fundamental to processing of fresh meat

Agricultural Economics and Rural Sociology

Economic problems in adjustment to changing prices on typical farms in west-central Ohio
Adjustments in production of hogs and beef to economic and technological changes
Demand and price structure of corn
Selling strategy and selling costs in Ohio fluid milk marketing
Impact of changing conditions on grain marketing institutions and structure of grain markets
Marketing greenhouse vegetables in Ohio
Trends in production, prices, and methods of marketing Ohio fruits and vegetables
Evaluation of direct sale to consumers as means of marketing fruits and vegetables in Ohio
Economic input-output analysis of productive factors in country elevators in Ohio
Significant trends in the milk industry and their effect on milk markets
Adjustments in livestock marketing in the North Central States to changing patterns of production and consumption
Economic importance of procurement on livestock marketing agencies
Economics of management practices in marketing meat products
Analysis of management development problems in marketing agricultural products
Implications of the European Common Market for midwestern agriculture
Economics of producing tomatoes for processing
Alternative methods for marketing agricultural production rights
Competition between food distribution firms in Ohio
Forecasting prices for feeder cattle, fat cattle, and wholesome beef
Effect of changing market conditions and facilities on grain and feed marketing firms in Ohio
Adjustments in livestock market organization
Adjustments in dairy market organization
The cooperative movement in Ohio agriculture
Market grades and standards for cut flowers and potted plants
Computer programming of management decisions in retailing produce and meat

Agronomy

Market quality in wheat

Dairy Technology

Flavor of market milk in relation to variations in micro-organic constituents

Horticulture

Radio-chemical determinations of pesticides and food additives before, during, and after processing

Poultry Science

Maintaining and improving the functional properties of market eggs
Methods of coordinating egg production and marketing in Ohio
Cost reducing structural adjustments in turkey marketing

HUMAN NUTRITION AND CONSUMER SATISFACTION

Home Economics

Effect of level of dietary fat on selected blood lipid components
Practices of Ohio families in procurement, storage, and use of frozen foods in the home
Factors relating to diets of preschool children

DEVELOPMENT OF HUMAN RESOURCES

Agricultural Economics and Rural Sociology

The communication process and its relationship to adoption of farm and home practices
Problems and opportunities which programs of rural development and rural industrialization bring to agricultural counties in Ohio
Effects of technological and institutional changes on farm income, resource use, and production response
Adjustments in financing and management in the agricultural industry
Changes in Ohio farm land values, their causes, and the use of mortgage credit
Use and management of credit by Ohio farmers
Income of Ohio farmers by counties
Economic and social impacts of alternative agricultural policies
Processes involved in decision-making in small communities
Factors involved in decision making by Ohio farmers

Home Economics

Impact of urbanization on home and family life of young families in Franklin County, Ohio
Use of family income
Energy requirements for performing household tasks
Managerial role of rural and urban homemakers

Two new turkey research buildings are used for studies in genetics, nutrition, physiology, and management.
Machine depth of this mole plow is regulated with a laser light beam to control gradient of the drain tube being installed.

AGRONOMY


Circular feeder for distribution of paste feed for swine is being tested by agricultural engineers and animal scientists.

---


---


---


--- Performance Trials of Spring Oat Varieties in Ohio, including 1965 Results. OARDC, Agron. Dept. Series 184, Jan 1966.


See Davidson, R. H., Dept. of Zoology and Entomology.


--- See Johnson, R. R., Dept. of Animal Science.


--- See Johnson, R. R., Dept. of Animal Science.

Rainfall simulator enables agronomists to apply artificial rainfall to determine infiltration rates of soil.
Using a microtome to section developing pine seeds for investigation of factors affecting success or failure of hybrid seed formation.
DAIRY SCIENCE


Fechheimer, N. S. See Jaffe, W. P., Dept. of Poultry Science (3 citations).


Your Stored Feeding Program. OARDC, Res. Summary 5, Dairy Science, August 1965.


See Van Kruen, R. W., Dept. of Agronomy.


DAIRY TECHNOLOGY


---


---


---


---


---


---


---


---


---


---

Fade-o-meter enables home economics researchers to test cloth samples for colorfastness.
Auto analyzer enables dairy scientists to make faster, more accurate analyses of minerals, nutrients, and compounds.
Physiology laboratory is used in studies of low temperature preservation of turkey semen.


--- Variations in Maturity Rate of Ohio W-R 7 Tomatoes in the 1965 Spring Crop at Columbus, Ohio. OARD, Res. Summary B, Greenhouse Vegetable Research—1966, April 1966.

POULTRY SCIENCE


VETERINARY SCIENCE


ZOLOGY AND ENTOMOLOGY


See Williams, L. E., Dept. of Botany and Plant Pathology (3 citations).


Biological Notes on the Periodical Cicada, Brood V. Ohio Acad. Sci., Columbus, Ohio, April 22, 1966.


We Can’t Do Without Pesticides. Ohio Farmer, April 16, 1966.

See Triplett, G. B., Jr., Dept. of Agronomy.


Honey Bees and Genetics of Behavior. Defiance College, Defiance, Ohio, March 22, 1966.


Analyzing gas from packages of cottage cheese with the gas chromatograph reveals changes occurring in cheese during storage and distribution.
Center Publications . . .

Research Bulletins
977 Tyrophagus neiswanderi, A New Acarid Mite of Agricultural Importance. Donald E. Johnston and William A. Bruce. 20 pp. 3,000 copies.
981 Suggested Location of Ohio Livestock Markets to Reduce Total Marketing Costs. Edgar A. Miller and George F. Henning. 28 pp. 2,500 copies.
982 Meat Department Labor Requirements: A Tool for Improved Retail Management. Bruce W. Marian, Leland E. Ott, and Francis E. Walker. 44 pp. 5,000 copies.
983 Insect and Mite Pests of Trees and Shrubs. R. B. Neiswander. 56 pp. 10,000 copies.
984 Retail Margins on Tomatoes. J. D. Brown and M. E. Cravens. 24 pp. 2,500 copies.
985 Variation in Certain Wood Properties of Eastern White Pine. A. N. Foulger. 28 pp. 2,000 copies.
986 Research and Development for Economic Growth. 84th Annual Report. 56 pp. 10,000 copies.
140 Effectiveness of Insecticides for the Control of White Grubs in Turf. J. B. Polivka. 8 pp. 2,500 copies.
142 Ohio Farmers' Views on Farm Policy Issues. Lonnie L. Jones and John S. Bottom. 14 pp. 5,000 copies.
143 Control of the Cornfield Ant, Lasius alienus (Forster). J. B. Polivka. 8 pp. 2,500 copies.
144 Effectiveness of Insecticides Applied to Turf to Destroy Japanese Beetle Larvae. J. B. Polivka. 12 pp. 2,500 copies.

Research Summaries
4 Sheep Research and Development—1965. Departments of Animal Science, Agronomy, and Veterinary Science. 42 pp. 4,000 copies.
5 Dairy Science. Departments of Dairy Science, Agricultural Economics and Rural Sociology, and Agronomy. 26 pp. 4,000 copies.
6 Lawn and Ornamentals Research. Departments of Agronomy, Botany and Plant Pathology, Forestry, Horticulture, and Zoology and Entomology. 62 pp. 3,100 copies.
7 Beef Cattle Research—1965. Departments of Animal Science and Agricultural Engineering. 30 pp. 4,000 copies.

Public Information Series
Leaves of Absence

The following staff members were granted leaves of absence during the year for professional improvement and to serve in international programs of research and education:

Dr. H. J. Barre, Professor, Agricultural Engineering, Jan. 1 to March 31, 1966, to serve in India under OSU-USAID-Ford Foundation program. J. H. Foster, Instructor, Outlying Branches, Sept. 27, 1965 to March 18, 1966, for graduate study. Dr. R. E. Franklin, Assistant Professor, Agronomy, May 1, 1966 to April 30, 1967, to supervise installation of International Atomic Energy Commission laboratory in Peru. Dr. R. R. Johnson, Professor, Animal Science, Sept. 15, 1965 to Sept. 15, 1966, to conduct postdoctoral research at the University of California.

Dr. W. H. Johnson, Professor and Associate Chairman, Agricultural Engineering, Oct. 15 to Dec. 15, 1965, to serve in India under OSU-USAID-Ford Foundation program. Dr. A. L. Maxon, Professor and Associate Chairman, Animal Science, May 1 to Oct. 31, 1966, to serve in Brazil under OSU-USAID contract. Dr. D. I. Padberg, Assistant Professor, Agricultural Economics and Rural Sociology, July 1, 1965 to June 30, 1966, to serve as staff economist on U.S. Commission on Food Marketing. Dr. J. L. Parsons, Professor, Agronomy, May 1, 1966 to April 30, 1967, to serve in Brazil under OSU-USAID contract.


Promotions

The following faculty members were promoted during the year:

July 1, 1965: Ruth E. Deacon to Professor, Home Economics; N. S. Fecherheimer to Professor, Dairy Science; G. E. Hall to Assistant Professor, Agricultural Engineering; A. H. Hamdy to Associate Professor, Veterinary Science; D. J. Hoff to Assistant to Chairman, Home Economics; R. R. Johnson to Professor, Animal Science; D. E. Johnston to Assistant Professor, Zoology and Entomology; Francilie Maloch to Associate Professor, Home Economics; D. I. Padberg to Associate Professor, Agricultural Economics and Rural Sociology; S. P. Touchburn to Associate Professor, Poultry Science; A. L. Trapp to Associate Professor, Veterinary Science; D. M. Van Doren to Associate Professor, Veterinary Science; R. A. Wilson, Assistant to Chairman, Home Economics; K. L. Bader to Assistant Professor, Agronomy; K. L. Brown to Professor and Associate Chairman, Poultry Science; H. B. Kriebel to Acting Chairman, Forestry.


Resignations, Retirements, Deaths

The following faculty members resigned during the year: B. S. Meyer, Professor and Chairman, Botany and Plant Pathology, July 1, 1965; E. F. Paddock, Associate Professor, Botany and Plant Pathology, July 1, 1965; G. W. Marlowe, Associate Professor, Horticulture, July 9, 1965; J. R. Mills, Instructor, Public Information, August 15, 1965; Christine H. Hillman, Professor, Home Economics, Sept. 30, 1965; A. N. Foulger, Assistant Professor, Forestry, Nov. 2, 1965; R. A. Rutter, Instructor, Outlying Branches, Dec. 31, 1965.


The following faculty members retired: G. F. Henning, Professor, Agricultural Economics and Rural Sociology, Jan. 31, 1966; C. A. Lamb, Professor, Agronomy, Jan. 31, 1966; D. S. Bell, Professor, Animal Science, June 30, 1966; A. D. Pratt, Associate Professor, Dairy Science, June 30, 1966; T. S. Sutton, Assistant Director, June 30, 1966; and J. D. Wilson, Professor, Botany and Plant Pathology, June 30, 1966.

Dr. John Hacskaylo, Professor of Forestry, died Sept. 11, 1965. Dr. C. R. Cutright, Professor Emeritus of Zoology and Entomology, died April 10, 1966.
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 6000 acres at Center headquarters in Wooster, nine branches, and The Ohio State University.

Center Headquarters, Wooster, Wayne County: 1918 acres

Eastern Ohio Resource Development Center, Caldwell, Noble County: 2053 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