

PROGRESS REPORT FOR FISCAL YEAR 1974-75
Biological and Agricultural Engineering Extension

Overview

Challenges associated with demands for increased production of food and fiber within rapidly changing constraints have directed activities in Biological and Agricultural Engineering Extension. Cooperative efforts within the department and across the campus in addressing both short term problems and long term goals have resulted in many successful experiences. Departmental programs have explored new frontiers in mechanical harvesting, crop production and processing, environmental control of animal production units, energy conservation, and waste management. Emphasis has been on the field testing of new technology and continued development of procedures for more efficient and economical production and processing of agricultural commodities.

Horticultural Crops

Cucumber mechanization in North Carolina continues to be pursued on two fronts: (1) via commercially available and field proven machines of the destructive once-over type which have become the standard harvesting system in the Midwest; and (2) with the nondestructive, multiple-pick harvester developed at N. C. State. Both types of machines are slow to be accepted due in large part to high capitalization costs and reduced yields which combine to severely limit or eliminate profitability. The capitalization costs, field capacities, and scale of operation associated with the once-over type are considerably greater than for the multiple-pick type. However, the recoverable yield and profit per acre for the multiple-pick type remains marginal in spite of an extensive interdisciplinary producer demonstration being conducted this year because of a multiplicity of operational problems. Acceptance and use of the multiple-pick

system appears to hinge on manufacturing development and refinement of a field-worthy, durable machine which incorporates efficiency, simplicity, and freedom from mechanical failure. So far no suitable commercial developer has been found to fully commercialize the multiple-pick system.

Processing tomato production and harvesting mechanization continues on a small scale in Robeson County, spearheaded by Horticulture Extension with cooperation from Biological and Agricultural Engineering Extension. Reluctance of growers to acquire specialized land preparation, cultivation, and chemical application equipment vital to production of tomatoes for mechanical harvest has proved to be a stumbling block to complete success of this project.

Site preparation equipment and techniques for Frazer fir Christmas tree establishments, worked out by Biological and Agricultural Engineering Extension in cooperation with an equipment manufacturer and grower in 1974, have begun to be adopted in North Carolina. A dealership franchise has been established in western North Carolina and at least two more growers have purchased the equipment and begun to use the techniques.

Chemical Application. Comparative evaluations of three types of sprayers for disease and insect control on tomatoes were continued for a second year in a different location, with results which were consistent with the first year. Information gained from these tests will permit more reliable recommendations on the proper equipment to select and how it should be used for various horticulture crops. North Carolina was selected as a pilot state for training farmers in preparation for the Federal Pesticide Act. A training manual for farmers was prepared which contained the essentials of application equipment and calibration.

Crop Processing

Extension's educational efforts in crop processing have been of immeasurable

value in the "rush to mechanize" North Carolina's number one cash crop. Extension's recommendations on cultural practices, machine management, and curing operations are widely quoted by machinery manufacturers and sales people and are widely accepted by farmers. As a consequence of the cooperation between Extension, manufacturers, and farmers the product of mechanization is well received at the market place. Reflecting this wholesome acceptance of change, equipment sales for '75 have increased dramatically. Sales of bulk barns in North Carolina have increased from 6,000 in '74 to an estimated 10,000 in '75. Mechanical harvesters have enjoyed a similar increase in popularity. Extension has provided engineering specifications and technical advice to three new equipment manufacturers who are selling their wares in '75.

Extension's on-farm testing and applied research have been directly or indirectly responsible for the field testing of a solar barn by one manufacturer in '75, for the introduction of the "least labor cost" bulk curing box by another manufacturer in '75, and for the use of a "least investment cost" bulk box barn by several farmers in '75. On farm tests of energy conserving curing equipment and practices are being expanded in '75.

Bulk tobacco curing barns are being installed at such a rapid rate that many electric lines in the rural areas are extremely overloaded; especially after a power outage when all the barns try to start at once. A method of delayed starting was worked out, and work is now under way with the barn manufacturers and electric suppliers to incorporate this delayed starting on new barns.

Farm Structures

Major emphasis was given to planning, studying, and development of swine and poultry housing systems; waste management; and educational material for use by Extension agents and the consuming public. The expanded plan service continues

to satisfy a national consumer need that could be very difficult to duplicate.

Swine Housing. Housing systems being studied and recommended are well received by swine producers as evidenced by the many construction starts.

Work with precast concrete slat suppliers resulted in the development and availability of gang slats. The units are placed on the foundation by the supplier, and thus, installation labor and costs are eliminated. Building plans and other printed material enable the producer to either build his own unit or contract the construction.

Poultry Housing. Even though new construction has been limited, interest runs high in poultry housing. Emphasis in the industry has been placed on better insulation and ventilation of existing houses.

The Poultry Housing Environmental Seminar seemingly has become an annual affair because of excellent attendance, participation, and industry support. Liaison with research personnel strengthens the educational programs. Studies indicate improved housing will result in more efficient bird performance and fuel savings, factors significant to every poultryman.

Water Management

The major emphasis in water management was directed to design of irrigation systems for land application of wastewater, and for irrigation of horticultural and nursery crops; educational materials for use by Extension agents and the consuming public; research on environmental modification of horticultural crops using sprinkler irrigation; trickle irrigation; and agricultural water requirements.

Most swine, poultry, and dairy farmers who are practicing terminal land application of wastewaters are using sprinkler irrigation. Considerable time has been devoted to design of least cost, environmentally sound sprinkler irrigation systems for this purpose. Designs have been prepared for a variety of different types of systems, with the ultimate goal being the preparation of

educational materials to cover most of the wastewater situations that will be encountered in North Carolina.

A number of growers and North Carolina State University research personnel have been assisted in the design of irrigation systems for horticultural and nursery crops. This includes design of sprinkler irrigation systems for frost and freeze protection and crop cooling. Research continued on the use of sprinkler irrigation for frost and freeze protection of apples, and trickle irrigation studies were continued on greenhouse grown crops.

The North Carolina Irrigation Conference has become an annual event due to industry and Extension Service attendance and participation. The Sprinkler Irrigation Association's Annual Technical Conference was held in Atlanta, Georgia, in February and was chaired by the water management specialist. North Carolina was well represented with four speakers.

A study which was begun in 1971 to determine agricultural water requirements and maximum practical use of agricultural water was continued and will be completed in late 1975. This study is funded by the Office of Water Resources Research through the North Carolina Water Resources Research Institute and is cochaired by a research staff member in the Department of Biological and Agricultural Engineering. The study was expanded to include some 35 counties in the Tar-Neuse River Basins. Results from this study will be used by a variety of state and federal agencies, plus private consultants.

The main thrust in drainage has been to prepare land-forming design for a number of producers. A computer program developed several years ago has been used for this activity.

The educational activities in water management have been expanded through the North Carolina Irrigation Society and the North Carolina Land Improvement Association. The water management specialist served as technical advisor to both of these organizations.

Agricultural Waste Management

Six papers on agricultural waste management coauthored by Extension specialists were delivered at the Third International Symposium on Livestock Waste held at the University of Illinois during 1975. This represented the largest input from any contributing organization and indicated the magnitude of this University-wide effort and quality of the engineering based program.

Extensive statewide activities have been conducted to help producers upgrade existing systems or secure permit approval for new treatment systems. As a result of interest aroused during the Waste Management Workshop conducted in Alleghany County last August, several dairymen from the western part of the state have requested and received assistance for rainfall runoff controls and land application systems. In conjunction with SCS personnel, a recent survey of selected dairymen across the state has been made regarding waste management alternatives, paying particular attention to the economics of complying with proposed environmental legislation. An attitude of compliance or control has resulted from an effort to educate not only producers but other state and federal agencies. Of significance is the fact that the Farmers Home Administration now requires a statement to the effect that an acceptable waste management system is integrated into a livestock or poultry enterprise before the loan can be approved.

The demonstration waste treatment systems, recently developed at a swine production facility and chick hatchery, have been monitored to evaluate overall system effectiveness and impact on receiving environment so that actual performance data can be used to determine the validity of these land based systems for waste recycling and elimination of point source discharges. Considerable interaction continues with regulatory agencies to clarify procedures required for the design, construction, and operation of land-based treatment systems so that more routine implementation and permitting of such systems will be possible in the future.

Results from our work with lagoon systems for the treatment of animal or agricultural processing waste have gained national attention because of system simplicity and extremely high potential for economical nitrogen removal. About 85% total nitrogen removal has been recorded as a result of surface agitation in the primary lagoon by floating aerators, and wastewater is commonly recycled for cleaning. Producers have come from various parts of the country to examine research and demonstration sites to verify the feasibility of these systems for reducing both the quantity and pollution potential of wastewater that must be ultimately applied to the land.

Work on the second year portion of a three year study entitled, "Pollution From Rural Land Runoff," is continuing to assess the feasibility of evaluating non-point discharges on a watershed basis. Experiences gained from establishing sampling sites and development of instrumented and grab collection techniques have been shared with state and regional agencies initiating non-point source monitoring programs. These studies will accumulate data on non-point source discharges from various land uses and in particular from agricultural lands and areas used for terminal waste application.

The actual impact of rainfall runoff from animal production units on receiving streams in typical geoclimatic regions of the state is being evaluated to verify the feasibility of the EPA regulation that all runoff from a 24-hour, 25-year storm that comes in contact with animal waste must be retained. The impact of runoff from dairies in the mountains and swine drylots in the Coastal Plains on surface and groundwaters are being monitored to determine the applicability of this national criteria for areas in North Carolina which apparently have a very high assimilatory capability.

4-H

Small Engines. When the small engines project was started in 1973, there

were eleven demonstrations at the district level. The most encouraging aspect of this year's program, which included fifteen demonstrations, was the improved quality of the demonstrations at the state level as compared to the district. The improvement is attributed to the request for and assistance given in the form of literature following the district competition.

Electric. The 28th Annual 4-H Electric Congress was conducted at Wilmington with approximately 175 boys and girls and 75 adults in attendance. The 4-H electric demonstration was conducted in each seven extension districts and at the state level. A new 4-H Electric III Manual was prepared on electric motors, and the Electric Project I and II were revised to include energy conservation.

Safety. Three new safety project manuals covering specific categories of hazards were prepared and published as the first of a series of such publications to constitute new safety project literature.