MECHANICAL AIDS AND EQUIPMENT FOR HARVESTING

VEGETABLES IN FLORIDA

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There are no mechanical harvesters of vegetables in Florida except for Irish potatoes and radishes. Numerous mechanical units are being used, however, which reduce harvest labor, make the labor more efficient, make handling easier, speed up the operation, or help with any combination of these factors. Records of costs of production of Florida's multi-million dollar vegetable enterprises show that harvesting is a big item of total labor costs.

With most vegetable harvest operations, a large labor force is needed for a short time, usually, a few weeks. Local labor forces normally cannot handle this peak demand, and growers must use migratory labor. In recent years, agricultural research has resulted in considerable success in obtaining better yields, improved fertilization, better varieties, improved insect and disease control, and improved pre-harvest equipment. This has not been true with harvesting equipment. Many vegetables are hand harvested in a manner virtually unchanged in the last fifty years. An investigation of the problem suggests four primary causes for this slow advancement:

1. Vegetables must be handled much more carefully than other crop products to prevent damage to the product.
2. Vegetable crops generally do not mature uniformly nor at one time.
3. The potential number of mechanical harvesting machines needed has not been large enough to interest many manufacturers.
4. Designs of successful vegetable harvesters have not been developed.

Primary objectives in improving a harvest operation are usually one or more of the following:

1. To reduce the labor required
2. To reduce the unit cost of production
3. To substitute dependence on labor by the use of machines
4. To reduce the time required for harvesting
5. To maintain or improve the quality of the product.

All of these aims are elements of one major objective—that of producing more packages of vegetables at no increase in cost per package, or the same number of units at a reduced cost, or more units at a reduced cost, while at the same time maintaining or improving quality.

PRESENT STATUS OF VEGETABLE HARVESTING EQUIPMENT IN FLORIDA

Workers in the Agricultural Engineering and Vegetable Crops Departments of the Florida Agricultural Experiment Station undertook a project to study mechanizing the harvest of some of Florida's vegetable crops. Home-built or semi-commercial vegetable harvesters found operating on Florida farms consisted of the following:

1. Large tomato harvesters in south Florida are essentially conveyor belts moved through the fields by a central power unit. Tomatoes are hand picked into buckets and emptied on to the conveyor belts. Workers culling undesirable tomatoes and filling field boxes are located on a platform at the central power unit. Field boxes are placed on trucks and hauled to a packinghouse.
2. A cucumber harvester in south Florida is basically a product conveyor and picker-transfer machine. Pickers work on a canvas bed in a horizontal position with their arms free to reach the rows and place the cucumbers on the conveyor. The cucumbers move along the conveyor to a central sacking platform. A track type tractor pulls the unit through the field. Some observations indicate that workers do not like such a unit because they have to work lying in a horizontal position.
3. A corn and celery harvester in the Everglades is essentially a mobile packinghouse. Hand-cut celery or corn is moved into the packinghouse by conveyor belts. A number of similar units in the Everglades
differ only in that their packing facilities are
designed to handle such produce as escarole,
endive, and Chinese cabbage.

4. A bib lettuce harvester used in the Ever-
glades may be described as a merry-go-round
type of conveyor and mobile packinghouse. A
number of similar units are used in Cali-
fornia on many of the leafy type vegetables.

5. A pepper-cucumber harvester in south
Florida is a mobile unit with grading and wax-
ing facilities. The product is hand picked and
placed on a conveyor which moves the product
to the grader. Results of a study of this ma-
chine will be given later.

6. A small conveyor and platform unit in
central Florida is being used in harvesting
cucumbers. Hand pickers place the cucumbers
on a conveyor, and workers on the platform
sack them for moving to a packinghouse.

None of the units described can be called
mechanical harvesters since vegetables still
must be removed by hand. They are harvester
aids made to simplify, reduce, or eliminate
parts of the total harvesting operation.

Current Research

Time, motion, and damage data was gather-
ed on the pepper-cucumber harvester described
as item 5 while harvesting and packaging
cucumbers. Comparisons were then made with
a normal hand picking operation and handling
through a central packinghouse. This study
revealed that the harvester produced one-third
more units with the same total input of man-
hours on labor.

Similar observations were made of the cu-
cumber harvester described as item 6. This
unit reduced total harvesting labor by one-
third. Cucumbers from this unit and similar
 cucumbers hand picked were checked for dam-
age after being packaged in a central pack-
inghouse. The machine-handled cucumbers show-
ed considerably more damage than those har-
vested by hand.

A harvester aid machine was built by the
Agricultural Engineering Department (Fig.
1) to study labor-saving possibilities in harvest-
ing a variety of crops. It is a two-wheeled unit
designed to be tractor drawn. The two wheels
were adjustable in both height and width for
various row spacings and plant heights. The
conveyors were made to span 18 feet and the
working platform was 11'-6" wide and 10'-6"
long. An inclined, cleated conveyor delivers
the produce to the center front of the platform.

This design allows versatility for finished pack-
aging, bulk handling, or sacking, depending on
the kind of vegetable and how it is to be
marketed.

Since cabbage is a $12,000,000 Florida en-
terprise and harvesting is an all-labor opera-
tion, this crop was considered first. Field tests
using the harvester aid in the Hastings and
Sanford areas indicated that this unit would
double the output of a crew when compared
to use of field carts and a central packing shed
operation.

Trials with cucumbers showed that the ma-
chine gave an increase in crew output of about
30 per cent as compared to hand handling. In
this study, cucumbers were assembled in field
sacks and then transported to a central pack-
inghouse.

When the machine was used with mature
green tomatoes, it gave an average saving in
labor of about 50 per cent over hand handling.
The tomatoes were assembled in field boxes
and then transported to a central packinghouse.
In very low yielding tomatoes where much
vine searching was required, there was no
saving in labor as compared to hand handling.

Limited trials of the machine were made on
cauliflower and eggplant. These trials indi-
cated that the unit could be used to harvest
these products. However, sufficient observa-
tions were not made of the use of the machine
on these crops to determine its capacity.

The harvester aid is an experimental unit
and if commercially built, could be simplified
and designed more ruggedly for the crop to be harvested.

Current work on this project also involves the use of a mechanical cutter for bulk handling of a new variety of southern peas (Fig. 2). This variety grows with its pods above the vine. The machine cuts the pods off and elevates them into bulk boxes. Preliminary field trials of this unit indicate that it has merit and warrants further study.

![Fig. 2. Experimental pea harvester operating in a field of southern peas.](image)

The harvester aid is just what the name implies and might be fitted into present production patterns to advantage as a means to reduce the labor requirements and costs of production of certain vegetables.

More complete mechanization of the production and harvest of these crops seems possible, however. In furthering this study of the production of vegetables, a systematic analysis is being made of the various production operations, particularly harvesting, for the purpose of determining the functional specifications of machines which can perform these operations mechanically.

**Summary**

Mechanizing the harvest of Florida’s vegetables is a complex problem requiring careful consideration of the many operations involved. It will require the best planning and thinking of researchers, growers, marketing groups, and the commercial machinery manufacturers.

Designs for successful vegetable harvesters for Florida conditions have not yet been developed except for potatoes and radishes. Work is underway for making a systematic analysis of the harvesting operations of some of Florida’s more important vegetable crops. Work on machines to meet the functional specifications needed to harvest the specific crop will be undertaken as time and facilities permit.

To alleviate immediate labor problems, studies will be continued on harvester aids.

**LITERATURE CITED**


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**VERTICILLIUM WILT OF TOMATO IN DADE COUNTY, FLORIDA**

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Verticillium wilt (Verticillium albo-atrum Reinke & Berth.) has been recognized recently as one of the principal causes of decline in vigor and productivity of tomatoes grown on “old” rockland soils of Dade County. The disease appears to be widespread, and its importance to the tomato industry is likely to increase as “new” land becomes unavailable. Since most growers are unfamiliar with Verticillium wilt, a description of the disease as it occurs in Dade County and a review of certain of the known facts about it seems desirable.

Bewley (2), an English plant pathologist, made the original description of Verticillium wilt of tomato in 1922. The disease was first reported in the United States in eastern Ohio and in Erie County, Pennsylvania, by Bryan in 1925 (3). Since that time Verticillium wilt has been reported from a number of tomato-growing areas in the United States, but except for California and Utah, the disease is considered of minor importance (9). The disease...