

# Onion Harvester

new machine digs, lifts, tops  
and sacks at 1½ miles an hour

Coby Lorenzen



Mechanical harvester in operation on bed planted onions. After topping, onions are pulled, carried up along conveyor belt and dropped into a sack.

**Important changes** have been made toward mechanical harvesting of California speciality crops since World War II. The University's sugar beet harvester, a farmer's almond harvester, a machinist's prune harvester, an engineer's peach harvesting platform—all have contributed to lowering production costs and improving the working conditions of the farm laborer.

During the past four years, work has been carried on at the Experiment Station on development of a mechanical onion harvester designed to combine the operation of lifting, topping and sacking by machine. The present machine is built to harvest on bed planted onions. Minor changes will allow its use in flat planted onions. Field tests have been made in both transplanted and direct seeded beds. In beds direct seeded, both plain and pelleted seeds have been used. These tests have shown a slightly higher recovery in the transplanted areas and a better per-

formance in fields where precision planting was done with pelleted seed. The reason is that the spacing and row alignment are more uniform in these two cases. The recovery during measured runs has varied from 88% for seeded to over 99% for transplanted onions under the most favorable conditions.

The machine will handle weedy conditions where the weeds are not heavy. Separation of dirt from the onions, especially in cloddy soils, presented the major design problem and led to the principle of lifting the onions by their tops.

The machine may be considered from the standpoint of the four operations of digging, pulling or lifting, topping and sacking.

## Digging

The roots of the onions are cut by a narrow blade supported from the furrow side by a single standard and adjustable

as to depth and angle of cut. The knife depth is varied according to the furrow depth, and its angle is varied from zero degrees for light, sandy soils to about 18° for cloddy soils. Operating at steep angles in light soils tends to move the soil and onions ahead of the machine, while a shallow setting in heavy soil results in the soil being raised in slabs. It is necessary then to set the knife at a shallow angle for light soils and at a steep angle for heavy soils.

The knife is mounted on the standard so as to make a 45° angle with the row, the free end being to the rear of the supported end. This allows the knife to clean itself by shedding tough weed roots.

In fields where vine types of weeds are prevalent, there will be hairpinning on the knife standard. A coulter and joiner mounted ahead of the standard cuts clearance for the standard and removes excess soil from the side of the furrow, prevent-

Continued on page 12

## AVOCADO

Continued from page 4

in one-foot squares, or some sort of measuring device should be used so that the area can be injected uniformly at 12-inch intervals in a diamond pattern.

For a dosage of 60 gallons an acre, the weed gun should deliver slightly less than one fifth of a fluid ounce—5.2 milliliters—a stroke; for 100 gallons an acre the gun should deliver a bit less than one third fluid ounce a stroke—8.7 milliliters—at 12-inch intervals. One fluid ounce equals 29.6 milliliters, or two tablespoons or six teaspoons. The amount delivered by the gun is regulated by adjusting the position of the set screw on the plunger.

The material should be injected six to eight inches deep and the hole closed by stepping on it immediately after the injection. To insure adequate kill of the fungus in the central area of the new planting site, four extra, double shots six inches from the center and 1½ to two feet deep are suggested. Most of the work to date has been done in the typical avocado hillside soils, which are not over two

to three feet deep. On deeper soils the injection pattern probably would have to be supplemented in the central area with several shots at a four-foot depth, as in fumigation for the oakroot fungus.

There is a little indication that where feasible, lightly sprinkling the plots with water to wet the top one half to one inch of soil may be of benefit in retaining the chemical. This is not as essential with Dowfume N or Shell D-D as it is with the more volatile chloropicrin or carbon disulfide.

Following treatment the areas should not be replanted for at least four weeks, to permit all of the chemical to escape from the soil. Otherwise, considerable injury to the young tree will result. The planting hole should be dug 24 to 48 hours prior to planting the new tree to permit additional aeration of soil that will immediately contact the balled tree.

### Caution Urged

Ample precautions should be taken in handling these materials, in accordance with instructions on the labels on the con-

tainers in which the products are marketed, and in pamphlets issued by the companies marketing the chemicals. These fumigants are poisonous to humans as well as to fungi and higher plants. If any chemical is spilled on the clothing or shoes, the articles should be removed immediately and not worn until the odor of the chemical cannot be detected. Otherwise a serious blister will result from confinement of the vapor. If the chemical comes in contact with the skin, immediate washing with soap and water or with large quantities of water is recommended. All work with the materials should be done in the open air; prolonged inhalation of the vapors may prove to be harmful to the operator.

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*Treatment of test plot soils by tractor or jeep-drawn applicators was accomplished with the cooperation of Dr. L. J. Meuli, Seal Beach, California.*

## HARVESTER

Continued from page 9

ing any piling up of the soil in front of the knife standard.

At maturity, the onion tops break over at a point about 1½" or 2" above the bulbs. It is then necessary to mechanically lift the tops to feed them into the pick-up belts. This is accomplished by a pair of two-bladed, rotating, flexible rubber flippers mounted on shafts which are inclined forward at about 30° with the vertical. The flippers are driven at such a speed

as to cause their tips to brush the ground every 2" along the row when the tractor is moving at 1½ miles per hour.

The onions are lifted between two round, endless belts 13/16" in diameter and 105" long. These belts are driven by two 8", C-section, sheaves at the rear end of the machine and are supported by six pairs of spring mounted idlers. This arrangement allows heavy and light tops to be held firmly while being elevated. Two 5" diameter fixed idlers are set on 12 centers at the front of the machine, forming a 6" throat into which to feed the tops. The pick-up belts are mounted so as to provide a short horizontal section parallel with the ground at the front of the machine followed by an inclined section making an angle of 30° with the horizontal. The belts are driven about 10% over ground speed in the reverse direction, of course.

Directly above the pick-up belts, and driven at the same speed, are a pair of top disposal belts, extending rearward from a point about halfway along the machine to about 14 inches beyond the drive sheaves. Mounted between these two sets of belts are two driven, overlapping, five-inch topping discs. The tops are thus held above and below the topping discs as the onions are carried through the machine. After topping the bulbs are dropped at the end of the pick-up belts and the tops carried out the rear of the machine.

The topped onions are dropped into a hopper and elevated to a sacker at the side of the tractor. The field practice is to catch about 60 pounds of onions in a barley sack, twist the top and set it off in the field to dry.

Any green material coming through the machine will be sacked along with the onions of all sizes, so that it is necessary to grade these field sacks and resack for market or storage.

Lack of uniform topping is a weakness of the harvester. The onions are not uniform in the row at harvest time, so each top is not held at the same distance above the bulb. It is important to set the horizontal section of the pick-up belts at the position, with respect to the ground, which yields the best topping and recovery. This does not always give either close or uniform topping.

The performance of the machine reflects the condition of the field and crop at harvest time. Field experiences from Siskiyou to Los Angeles counties have shown that cultivation practices resulting in uniform stands in clean fields result in premium crops, even though machine harvesting is not contemplated. It would appear that growing methods may profitably be altered to yield optimum harvesting conditions for the machine.

The machine is not yet commercially available, although it is ready for manufacture. Plan drawings for the machine are expected to be made available soon.

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Knife blade of harvester, adjustable as to depth and angle of cut, frees onion bulbs from roots.