Improved Sugar Beet Harvester

gives high quality performance but more development required

John B. Powers

A sugar beet harvester developed at Davis and tested in dry, peat-loam soil at Clarksburg, October 16, 1947, gave 93.7% root recovery and only 6.8% dirt pickup..

Further dry-ground tests—which will be required before final judgment of the efficiency of the harvester can be rendered—were stopped by fall rains.

During the remainder of the 1947 harvesting season, 294 tons of beets were harvested from three fields in the same area under conditions ranging from moist to muddy. Root recovery in these tests ranged from 90% to 95% with factory screenings from 5.6% to 11.9%.

Peak performance was obtained in moderately wet soil where the harvesting rate was approximately 7.5 tons per hour; dump screenings, 7.3%; top and dirt tare, 2.4%; and topping losses, 1.5%.

All losses, excepting those due to low topping, were recovered by one man following the machine.

As soil moisture increased above the optimum level, root recovery improved, but dump screenings increased because of adhesion of dirt to the beet roots. Reconstruction of the beet elevator to provide greater agitation of the roots lowered screenings from 18.8% to 5.7% under very muddy conditions, but appreciable tap-root damage, from the rough handling of the beets, was definitely evident.

The sugar beet harvester development work at Davis has been terminated and appraisal of its success or failure must be based on the performance of the harvester.

It is the opinion of those men who have worked with the machine, that the following fundamental objectives have been attained:

1. All apparatus can be mounted on a standard wheel tractor for ready maneuverability.
2. No unusual skill is required in operation of the machine.
3. All operations can be completed in one transit of machine through the field.
4. The machine is capable of opening its own lands, adapting it for work in small fields.
5. Topping is satisfactory in beets ranging up to nine inches in height and in tops of any size.
6. Topping loss under ordinary conditions does not exceed 1.5% and top tare does not exceed 3.5%.
7. Tops are left in good condition for forage or harvesting.
8. Root losses after scavenging do not exceed 3% by weight. Unharvested roots are left on the surface of the ground where they may be recovered readily.

The following objectives have been partially fulfilled, or have been satisfied only under certain field conditions:

1. The harvest crew should consist of one machine operator and not more than one scavenger but in its present state of mechanical development, an additional man, to watch for mechanical failures and other field contingencies, is required.
2. Under dry field conditions, damage to roots by bruising or other injury is no greater than in manual harvest but under muddy conditions, the vigorous agitation required to clean the roots results in appreciable tap-root damage.

Wider harvesting experience will be necessary as a basis for judgment regarding the following requirements:

1. Operation should be possible in all ordinary soil types and field moisture conditions which permit operation of a wheel tractor.
2. Dump screenings should not exceed 5% of beet weight except in muddy conditions.

The harvester delivers a high quality of product with a minimum of loss. Beets are cleanly topped and topping losses do not exceed those for hand-topped beets.

Under most conditions, the roots are delivered free of injury which might result in tonnage loss to the farmer or in storage loss to the processor. Dirt inclu-

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The harvester accumulates 1¼ tons of beets which are delivered to a truck at the edge of the field.

Klamath Weed

imported beetles promising as part of general control program

C. B. Huffaker

The principal hazard of Klamath weed is its displacement of desirable forage plants, though much has been said concerning its moderate toxic effects.

Striking success in weed control by use of imported weed-eating insects has been attained in various parts of the world, particularly in Australia and New Zealand.

The attempt to control Klamath weed in California by the biological method is the first of its kind in this country. It was set up as a coöperative program between the United States Department of Agriculture and the Division of Biological Control of the University of California.

The first beetles destined for use in the test program arrived from Australia in October, 1944.

Releases of two leaf-feeding beetles—*Chrysolina gemellata* and *Chrysolina hyperici*—were made in California only after extensive tests in Europe, Australia, and in California established the fact that these beetles will accept nothing but Klamath weed as food. They will not feed on desirable plants.

Field Releases of Beetles

During the winters of 1945 and 1946, field releases of the beetles were on a small scale.

Approximately 17,000 adults of *Chrysolina hyperici* were released at 11 sites in six counties, and a total of 13,650 adults of *Chrysolina gemellata* were released at one site in each of four counties.

In 1947, releases were on a much larger scale. A total of 350,000 beetles, mostly *Chrysolina hyperici*, were released in the state.

Approximately 380,000 beetles have been released at 80 locations in 18 counties of the state, the numbers received by each county having been proportioned according to the relative abundance of the weed in the respective counties. These early colonies should serve as breeding areas for the second phase of the program—general distribution where needed. The 18 counties which have received beetles to date are: Amador, Butte, Calaveras, Del Norte, El Dorado, Humboldt, Madera, Marin, Mendocino, Nevada, Placer, Shasta, Siskiyou, Sonoma, Tehama, Yuba, Tuolumne, and Trinity. Other counties needing beetles will be supplied within another year or two.

Prospects of Control

In no case have the beetles failed to become established when the releases were made sufficiently early—except where fire swept the area.

Reproduction of one species—*Chrysolina hyperici*—has been very much less than that of the other, even though they both have demonstrated an ability to build up in sufficient numbers—in two generations—to destroy the weed at the center of release.

The more promising species has multiplied enormously, now covering an area of one-half mile diameter at each of the two older sites.

Destruction of the weed has been such that this beetle—*Chrysolina gemellata*—holds much promise, barring unforeseeable occurrences. The biological control program is still in the investigative stage. Other control methods now being followed should be continued.

C. B. Huffaker is Assistant Entomologist, Division of Biological Control, Experiment Station, Berkeley.

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sion is not sufficient to interfere with milling operations.

The over-all harvesting losses are kept at a level which compares favorably with those incurred in manual harvest. Since, at present price levels, each 1% of root loss is equivalent to an increase in harvesting cost of 15¢ per ton, this item plays a greater part in determining the cost of harvest with present machines than is generally recognized by beet growers. Operation is possible under a wide variety of field conditions. Hard ground, mud, high beets, heavy top growth, and light top growth interfere less with the operation of this harvester than with other machines now in commercial use. The beet hopper permits operation in fields far too wet for truck operations.

The most unfavorable feature of the machine is its mechanical complexity. This is due in part to the fact that all mechanism is mounted on a single tractor and that some of its operating principles appear to demand mechanism which is undesirable from a construction and maintenance point of view.

The performance of the harvester is adversely affected by beets in multiple combinations, by a preponderance of small beets, and by beets of odd shape. In these respects, the machine is less tolerant than most of those in commercial use. These faults appear to be inherent, and their correction must occur through cultural improvements—such as precision planting—rather than through improvement in implement design.

Root recovery is reduced in hard dry ground; but to what extent this might limit the usefulness of the machine has not been determined. Experience with previous models, however, justifies the assumption that this factor would not reduce the recovery to an impractical operating level.

The university harvester will require further improvement and extensive field trials to establish its ultimate merit in field operation.

J. B. Powers is Associate Agricultural Engineer in the Experiment Station, Davis.

The lifting unit. Beets are loosened by the helical plow points and elevated by gathering chains.