

The subject of management in beet harvesting could easily take up a whole morning session, but much of that discussion would be conjectural and theoretical. We are just on the threshold of mechanical harvesting of sugar beets, and the American farmer with his usual caniness and ingenuity will work out and evolve those systems of management that best meet his own individual conditions. I have tried only to bring out some points that I believe need consideration in the development of sugar beet harvesting practice.

Mechanical Beet Harvesting From the Eastern Point of View

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Beet growers in the eastern area experienced unusually wet soil conditions throughout the harvest of 1945, with the bulk of the rain coming early in the fall. The rainfall was not far above normal but the cloudy days were so numerous as to prevent, the heavy Brookston clay soils upon which much of the beets are grown from drying out. This prevailing adverse condition in many cases hampered the successful operation of beet combines.

Two types of combines were operated in the eastern area during the 1945 season. One lifts the beets and carries them to the topping mechanism, and the other uses a ground topper. The former will be referred to in this paper as the lifter-topper type.

The 16 bed combines used accounted for less than 1 percent of the harvested acreage. Fourteen were of the lifter-topper type and two were of the ground-topper type. Two of the harvesters were operated experimentally and were not striving for acreage. The acreage harvested by the machines ranged from 10 to 100 acres each.

Soils upon which Combines Operated

The combines harvested beets grown on a wide range of soil types. They include the various types of Brookston soils, which are heavy clays, the numerous loams such as the Miami, Brady, and Conover, and the Carlyle muck.

Michigan has 100,000 acres of muck, a friable organic soil, upon which the sugar beet crop fits well into crop rotation plans. The lifter-topper type has worked quite successfully upon this soil because, as we stated, it first lifts the beets and then tops them. This fact can be borne out by the acceptable tare figures of beets raised on muck shown in table 1.

The ground-topper harvesters did a very acceptable job of topping on the firmer soils such as the Brookston clays and the clay

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Table 1.—Results of 1945 beet harvesting trials with elevator-lifter type combine.

Soil type	Percent soil moisture	Percent dirt tare	Percent crown tare	Percent tare total	No. beets per 100 four	Marketable beet tissue left in field per acre			Tractor used on combine	Speed m.p.h.	Estimated tonnage per acre	Percent dirt in load	
						Whole beets		Total weight tons					
						Number	Weight tons						
A Muck	98	3.5	2.5	0	67	188.7	.160	.49	.650	IHC H	4.25	16.5	13.
B Muck	87	5	3	8	68	180.7	.244	.127	.371	Oliver 70	4.25	15.	8.2
C Brookston	19	4.5	7.5	12	98	1,120.	1,120.	.397	1,517	Oliver 70	4.25	16.	23.4
D Brookston	28	5.5	8.5	14	65	933.5	1,295	.187	1,482	IHC M	4.25	13.	30.7
E Brookston	17	5	9	16	81	93.3	.128	.583	.711	IHC M	4.25	12.	18
F Brookston	20	9	2	11	85	0.0	0.0	.025	.023	IHC H	4.25	0.8	25
G 70 Percent Brookston inclination	14.5	8	2	10	88	180.7	.327	.066	.420	IHC H	3.5	15.8	8.0
H Miami Clayover	22	20	2	22	68	0.0	0.0	.298	.298	IHC H	3.5	4.6	19.1
I Miami Brady	12	11	2	13	100	1,120.0	.400	.000	.550	MH Sr.	3.75	7.	12.9
J Miami Brady	13.4	10	2	12	100	2,613.8	1,206	.224	1,530	MU Jr.	3.75	7.	16.

loams. This harvester has an ideal set-up for windrowing the beets and, of course, that is how they were operated. One of the Michigan growers fitted his lifter-topper combine with a windrowing device, and since he had low-yield beets and was 30 miles from the weighing station, this plan of beet handling worked successfully. However, the remainder of the lifter-topper combines loaded the beets directly into the vehicle which either hauled the beets to the weighing station or dumped them into piles in a suitable place for reloading.

Many combine operators with the exception of those who harvested beets grown on muck encountered much difficulty with stones getting into the mechanism, causing breakage and frequent short stops while the stones were being removed. The little stones gave the most trouble to the lifter-topper combine because they would be picked up by the dirt adhering to the beet root and carried into the machines. Recommendations have been made to remedy this source of trouble.

Testing Program

Michigan State College has been cooperating for the past 3 years with the Farmers and Manufacturers Beet Sugar Association and the U. S. D. A. to further the mechanical harvesting of beets. The 1945 season embodied a program of testing and developing principles applicable to mechanical harvesting. The included chart (table 1) is a self-explanatory summary of the testing program. It will be noted that there is an interesting correlation between the soil moisture content and the percentage of dirt hauled back by the trucker or grower from the weighing station. This relationship is shown graphically in figure 1.

The data shown in table 1 were obtained in the following manner. After the field in which the harvester was working had been looked over, two 100-foot portions of rows were marked out in what appeared to be a typical part of the field; the included beets were then counted. The soil moisture content was determined from a sample taken to the depth of 6 to 8 inches in the beet row. After the combine passed the marked portion of the row, the tops were gathered and the marketable tissue cut from the crowns and weighed. All marketable beet-tissue figures are calculated on an acre basis. The tare figures, as well as those with respect to dirt hauled back, were obtained from the tare men at the weighing station from the load which hauled the "test run" beets. In all test runs the beets were hauled directly from combine to weighing station.

Limited similar tests were run on hand-harvested beets. It was quite obvious that beets from the combines were more uniformly topped than were the hand-topped beets. These tests indicated that if the laborers were unfamiliar with the crop there was much more marketable beet tissue left in the field when hand topping was used.

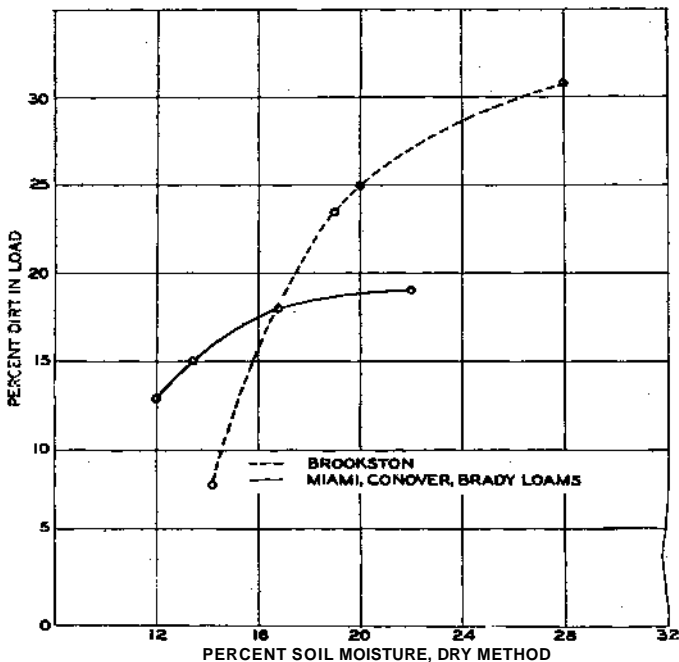


Figure 1.—Effect of soil moisture and type of soil upon percent of dirt hauled back from weighing station when using the Scott-Urshel harvester, loading directly into the vehicle.

Cost of Operating a Combine

If we are to make the data related to mechanical harvesting complete, we must consider the cost of mechanical harvesting. At the present purchase price of combines, allowing for their depreciation, interest, taxes, and housing, and the cost of maintaining a tractor plus the wages of two operators, the total cost should not exceed \$12 per acre. A few of the growers who have harvested an annual acreage nearing the 100 mark computed their costs at about \$9 per acre. In view of these figures and the present hand-harvesting rates in Michigan, it would be financially sound for a grower to purchase \$1,500

worth of mechanical harvesting equipment for an annual production of 25 acres of 12-ton beets.

Capacity of the Harvesters

The two makes of harvesters operating in the eastern area have a limiting factor in that they are one-row machines. Growers operating the lifter topper type machines report that they are able to harvest up to 5 acres per 8-hour day on 28-inch row beets, and operators of the ground-topper harvesters report a daily acreage of 3 on the same width rows.

Windrowing Beets and Loading Direct

As has been stated, much of the eastern combined beets were hauled directly from the machine to the weighing station. Yet there is a definite need for a machine which will windrow or pile the beets prior to hauling. Growers who have stands less than 5 to 7 tons per acre would find it impractical to drive a truck or draw a wagon next to a harvester for loading. Also, because it is advisable to keep a combine in continuous operation throughout the harvest season, the grower with heavy yields whose fields are more than 20 miles from the weighing station would find it impossible to maintain sufficient transporting facilities. Only the growers who have a comparatively short distance to travel have found it financially successful to carry out the practice of direct loading. There are two more points to consider on this matter—(1) It is found that beets which have been windrowed or piled and reloaded contain from 10 to 15 percent less dirt than those hauled directly from the machines; (2) piled beets may shrink approximately 12 percent by weight in 9 days or 18 percent in 16 days.²

Conclusion and Summary

Michigan State College called a meeting on December 27, 1945, of many men interested in sugar beet mechanization. At that time the fact was emphasized that as far as the eastern area was concerned the development of mechanical harvesting should take precedence over the mechanization of the Spring and Summer work. This is indeed reversing the chronological order, but it has been found that many of the migratory laborers which have been available for the planting and growing of the crop are not in the area during the harvest season. Had it not been for the German prisoners of war, many more acres of beets would not have been harvested in 1945.

²From unpublished data courtesy J. G. Lill U.S.D.A.

At this same meeting there was a thorough discussion of mechanical harvesting difficulties in the eastern area, and many concrete suggestions were made for their solution. It was found that three main difficulties confronted the grower. They are (1) numerous mechanical weaknesses in the present combines; (2) under wet soil conditions, an excessive amount of dirt in the loads of beets loaded directly from the combine; (3) an apparent excessive amount of leaves and trash in the load. An accelerated program was set up at that time for their solution.

This program is in part as follows:

1. Make recommendations to combine manufacturers for the elimination of mechanical deficiencies.
2. Study, under field conditions, a number of existing combines in early Spring with a view toward their possible introduction into the eastern area.
3. Continue and improve the present program of investigating and testing available machines during our harvest seasons.
4. Continue search for basic ideas and principles which will aid the harvesting program.
5. Promote an interest in mechanical harvesting among beet growers.
6. Assist in an educational program to help growers and processors to make the best use of the mechanical harvesters.

Future of Mechanical Harvesting in Eastern Area

Interest in mechanical harvesting runs high with the eastern grower. This fact was borne out by the success of the open forum on the subject of the Ohio and Michigan Annual "Sugar Beet Days." Farmers are anxious to rid themselves of much of the laborious tasks connected with the growing of the crop. It is for these reasons and others that the supply of combines will fall far short of the demand. All this plus the comparatively low harvester operation costs and the saving of marketable beet tissue are reasons why many growers and processors are quite willing to accept the work of the present harvester.