THE SUGAR BEET IN THE WAR AND POST-WAR PERIOD
FROM THE STANDPOINT OF THE
AGRICULTURAL ENGINEER

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THE thinning and harvesting labor requirements of present hand
methods in growing sugar beets are excessive, requiring utiliza-
tion of transient labor in both spring and fall. From the agricultural
engineering point of view these peak labor demands need to be level­
ed to the extent that with proper farm management of other crops,
a smaller labor crew may be maintained throughout the year to
handle all of the farm work in a balanced program. Usually, the labor
requirements for sugar beet production have stood out in the grower's
mind to the exclusion of some of the other factors, but now that there
is promise that the labor curve can be very definitely smoothed out,
the study of some of the other factors is appropriate.

The cost of machinery must, quite properly, be charged against
these new highly mechanized operations in sugar beet growing. With
the purchase of new and specialized equipment, the machinery cost
per acre or per ton of product may be somewhat higher than it was
when more of the operations were performed by hand or when small­
er units were used. It is possible, however, that with a more mecha­
nized system larger acreages will be in order, with the consequent
lowering of unit acre costs. There have been several accepted schemes
of evaluating these costs, systems of figuring based on the probable
life of the equipment, and an expected cost of repairs and interest
as well as operating costs incident to the use of power. In this study,
these systems of computations were used and were found to differ
very little.

Too frequently plans have been evolved for growing sugar beets
with the entire thought centered on this one crop to the exclusion
of other crops of the grower. If a proposed system calls for two trac­
tors and the remaining crops have no need for the second tractor,
then the system is illogical. Hence it is necessary to consider the farm

1Contribution to the symposium on "Sugar Beets in the War and Post-War
Periods" held at the annual meeting of the Society in Cincinnati, Ohio, November
10, 1943. Received for publication February 28, 1944.

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Experiment Station, Fort Collins, Colo.
<table>
<thead>
<tr>
<th>Operation</th>
<th>Man-hours per acre</th>
<th>Man-hours</th>
<th>Itemization</th>
<th>Man-hours</th>
<th>Itemization</th>
<th>Present practice</th>
<th>Mechanized practice</th>
<th>Present practice</th>
<th>Mechanized practice</th>
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</thead>
<tbody>
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<tr>
<td>Manuring</td>
<td>7.7</td>
<td>3.0</td>
<td>1 man, 2 horses, 1 1/2-ton spreader</td>
<td>2 men, 2 tractors, 2 spreaders, 1 loader</td>
<td>3 horses, Spreader</td>
<td>$1.92</td>
<td>$0.85</td>
<td>2 tractors, 2 spreaders, 1 loader</td>
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<tr>
<td>Plowing</td>
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<td>1.3</td>
<td>1 man, 3 horses, 16-inch plow</td>
<td>1 man, 1 tractor, 1 two-bottom plow</td>
<td>3 horses, Plow</td>
<td>$1.50</td>
<td>$0.47</td>
<td>1 tractor, 1 plow</td>
<td>$0.96</td>
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<td>Harrowing</td>
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<td>1.0</td>
<td>1 man, 4 horses, 1 single-disk harrow, 1 drag harrow</td>
<td>1 man, 1 tractor, double disk, drag harrow</td>
<td>4 horses, Disk, Drag harrow</td>
<td>$1.73</td>
<td>$0.35</td>
<td>$0.22</td>
<td>1 tractor, Disk and drag</td>
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<tr>
<td>Planting</td>
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<td>1.0</td>
<td>1 man, 2 horses, 1 planter</td>
<td>2 men, 1 tractor, 1 planter</td>
<td>2 horses, Planter</td>
<td>$0.25</td>
<td>$0.43</td>
<td>1 tractor, Planter</td>
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<td>Crust breaking</td>
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<td>0.3</td>
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<td>1 man, 1 tractor, 1 cultivator</td>
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<td>$0.08</td>
<td>1 tractor, Cultivator</td>
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<td>Blocking</td>
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<td>Cultivating</td>
<td>4.35</td>
<td>2.80</td>
<td>1 man, 2 horses, 1 cultivator</td>
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<td>2 horses, Cultivator</td>
<td>$1.09</td>
<td>$0.26</td>
<td>1 tractor, Cultivator</td>
<td>$2.10</td>
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<td>Thinning</td>
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<tr>
<td>Activity</td>
<td>Time (hr)</td>
<td>Cost ($)</td>
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<tr>
<td>Hoeing</td>
<td>2 men</td>
<td>9.6</td>
<td>11.6</td>
<td></td>
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<td></td>
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<tr>
<td>Irrigating</td>
<td>1 man</td>
<td>12.3</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Pulling weeds</td>
<td>1 man</td>
<td>4.8</td>
<td>4.8</td>
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<td>Lifting</td>
<td>1 man, 4 horses, 1 puller</td>
<td>4.45</td>
<td>4 horses, 2 men, tractor harvester, 6.0</td>
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<tr>
<td>Topping</td>
<td>6 men</td>
<td>35.9</td>
<td></td>
<td></td>
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<td>Loading, hauling</td>
<td>1 man, 1 truck</td>
<td>7.11</td>
<td>4 men, 2 trucks, 1 tractor, 1 loader, 2.9</td>
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<td></td>
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<tr>
<td><strong>Totals</strong></td>
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<tr>
<td>Labor costs a $.50 per hour</td>
<td></td>
<td>47.45</td>
<td>18.01</td>
<td>22.93</td>
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<tr>
<td>Total costs per acre</td>
<td></td>
<td></td>
<td>$77.52</td>
<td>$46.65</td>
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</table>

*Data derived from large-scale tests in Colorado in 1942 and 1943.*
as a whole so that the entire power, labor, and machinery program may be a smooth one. Certain phases of mechanization may require pooling of mechanical resources of two neighboring farms. For example, as a one-farm job, spreading manure is not only arduous but is time-consuming. Two neighbors could to advantage join forces for this operation. One tractor could be equipped with a power manure fork for loading one spreader, while the other tractor is pulling a spreader. In this operation both the spreaders should be rubber tired to make possible rapid movement to and from the field. The equipment cost, of course, would be greater than with the present practice. The hand labor is not only less arduous, but the time saved is very appreciable. Probably the most important advantage gained is that the operation can be more timely than with present methods. Naturally a grower will think twice before he will want to invest in the added equipment required to mechanize the operation of spreading manure but his time would have to be worth only 60 cents per hour to break even and he would have any advantage of the timeliness of the operation or benefits of lighter labor in addition.

After several years experimentation on mechanical thinning, in order to get a measure of the effect of a mechanized practice on the sugar beet crop, trials on a commercial basis were conducted in 1942 and 1943. Often a mechanical practice is difficult of scientific interpretation because the larger plot size that is necessary prevents setting up of replicated plots. In the 1942 and 1943 tests, the plots were laid out to fit the machine operations and were extensive enough to give sufficient acreage for time studies. Sugar beet fields large enough to afford replications for satisfactory analysis were chosen. The quality and quantity of the product was then measured by sampling cleaned beets.

Comparison between our present practice of producing beets and the proposed mechanized system is shown in Table 1. The data are based upon time studies conducted in Colorado in connection with these tests. It is evident that the cost in time or money for most of these operations will vary in different localities and with different degrees of skill of available labor.

As shown in Table 1, one of the most noticeable time-saving operations is that of mechanical thinning of beets. More than 20 man-hours per acre were saved. To mechanize this operation, it is not necessary to buy much additional equipment so that the total time saved in all the operations is very great and the total increased machinery and power costs are not materially greater than for present practice. Mechanical thinning has progressed to the point where it is a commercial practice. Comparative results on crop yields in the Colorado experiments in 1942 and 1943 are shown in Table 2.

Attention is also called to the very great saving of time from use of machines for harvesting. The developments in this field of agricultural engineering are extremely promising. Mechanical harvesting is nicely emerging from the experimental stage into the practical. Mechanical harvesters are now built that mechanically top the beets, place the tops in windrows for curing or for immediate transporta-
tion to stack or silo and place the beets in cleared windrows for mechanical or hand loading, both the tops and roots being so located that it is practical to load from the field without running over the windrows.

The mechanization of the operations involved in the production of such a crop as sugar beets is certain to raise several questions in the minds of the producers such as, "Can I afford the machinery?" "What will be the effect on the quality and quantity of the crop?" "How will such a program fit into my other farm operations?" "What will be the effect on the labor requirements?"

The four questions in the beet grower's mind can be answered definitely. He can afford the equipment necessary for mechanizing the production of the crop since he is going to save over $30.00 per acre by increasing his machinery costs less than $5.00.

The grower may, in some cases encounter reduced yields from mechanization, as evidenced by the 1943 data. His saving in dollars and cents by the mechanical methods may therefore be strongly decreased, but there is still on the credit side the freedom from the disadvantages of present dependence upon transient labor. There is also both mechanical and agronomic possibilities of improved technics to hold this loss to a small figure, or actually to give yields superior to those obtained by present hand methods.

The mechanized beet program can fit into the general farm plan to advantage as illustrated by the fact that the same power equipment is just as usable for other crops as for beets and has a decided advantage in making possible a year around constant labor use.

The mechanization of the beet crop has several direct results, some of which have post-war implications. The changing of the production of beets from a laborious hand and back-breaking operation to a machine job will aid in making it more tempting to the returning soldier. The elimination of need for transient labor will help to stabilize the farm job and especially is this true if the farm manager will organize his crop program so that his labor curve will be a more nearly smooth one throughout the year.

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Table 2.—Comparison of sugar beet yields obtained in Colorado tests in 1942 and 1943 with four types of thinning operations.*

<table>
<thead>
<tr>
<th>Type of thinning operation employed</th>
<th>Comparative yields, %</th>
<th>Man-hours per acre, 1942</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1942</td>
<td>1943</td>
</tr>
<tr>
<td>Hand blocking and thinning</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Mechanical thinning, followed by trimming by long handled hoe</td>
<td>93.9</td>
<td>96.5</td>
</tr>
<tr>
<td>Thinning by long handled hoe only</td>
<td>94.9</td>
<td>97.6</td>
</tr>
<tr>
<td>Mechanical thinning, machine operation only</td>
<td>101.0</td>
<td>86.5</td>
</tr>
</tbody>
</table>

*Man-hours per acre as determined in 1942 are shown.