

FUTURE REQUIREMENTS OF SUGAR BEET HARVESTERS

G. W. Howard, Staff Engineer
The Beet Sugar Development Foundation
Fort Collins, Colorado

No one could stay in the automobile manufacturing business with 1915 model cars. We would have had a hard time winning the war by keeping airplane and ordnance material at the same design as at the time we started the war. And so, beet harvester design must be kept fluid in order to keep up with what we know and will come to know about sugar beet harvester requirements.

No one can have greater effect on sugar beet harvester design than you people and if I can give you some food for thought along these lines, I will feel well rewarded. I have outlined seven major points, each of which have considerable affect upon sugar beet harvester design.

1. THE QUESTION OF CONSERVATION OF BEET TOPS BY THE HARVESTER:

The Beet Sugar Development Foundation is now carrying on some tests in Colorado and Nebraska on the dehydration of beet top material. One test shows that the protein content of beet top material is about 22% compared with 12% for dehydrated alfalfa hay. The vitamin value of beet tops is about double that of alfalfa hay. Tests indicate that there is a certain amount of oxalic acid present which can be neutralized in livestock feeding by the addition of a small amount of calcium carbonate. Consideration of the values of dehydrated tops points to a potential possibility of about \$90.00 per acre at a yield of about 1 ton of tops per acre in comparison with dehydrated alfalfa hay values at between \$65.00 and \$75.00 per ton. The feed value of beet tops, from one acre, has been claimed by some feeding experts, to be worth the same as an acre of alfalfa. In the year 1946, sugar beets in Colorado were worth \$22,500,000.00 to the farmers not including beet by-product values which represented part of farmer income from cattle and calves of \$113,500,000.00 and from sheep and lambs of \$47,500,000.00. This means that in general, Colorado's soil fertility is going in the right direction with a recovery of perhaps less than 50% of the true value of the by-products. How is it back here? We know that beet tops have fertilizer value but we also know that the best green manure fertilizer should be plowed under when it is fresh. This is not always possible to do with beet tops and full utilization of green manurial values is not easily accomplished. A livestock feeding program increases the value of the beet crop as well as increases the yield.

We, of the Foundation, believe that the salvage of beet tops for livestock feed is one of the best ways to build a sound future for the beet sugar industry, and in this manner, the design of a sugar beet harvester enters into the picture. The future harvester should salvage top material for the best possible use of the industry. Maybe there is a better way in which the beet top material can serve the industry than stock feed and if there is we would like also to know it and make it known especially to manufacturers of harvesters.

II. SHALL A MACHINE BE A ONE OR TWO OPERATION HARVESTER?

This is a big problem and it will vary between beet growing areas. Advantages of a one operation machine are that it is in general, or should be, a cheaper harvester in that it tops beets just before they are harvested. Disadvantages are that top disposal possibilities are limited. It is difficult to imagine how two trucks, one for beets and one for tops, can function well along side a moving machine. Perhaps a trailer could help on the tops, in this instance. Another disadvantage is that with both operations in one combined machine, the whole machine is necessarily somewhat more complicated. Considering the two operation machine, we have the advantage of giving more attention to salvage of top material assuming that the tops will come off in one operation and the beet harvest accomplished in another. Also better supervision can be allotted to each operation. Disadvantages are that there is always the possibilities of a whole field being topped in advance of root harvest. This condition will never make for good storage. In general, two operation machinery will be more costly to operate and to buy.

III. SHALL A MACHINE BE DESIGNED FOR ONE ROW OPERATION OR MULTIPLE ROW?

This is a problem that will also have different solutions in different territories. Soil conditions, tonnage, speed of operation, width of row and type of labor are all factors which have a lot to do with whether we choose a one row operation or a multiple row harvester. If the soil is predominantly cloddy, it would seem that a one row machine would be the best to choose. If the soil is friable, a two row machine might be indicated. If tonnage is predominantly low, it would follow that the most economical machine would be a multiple row. If tonnage is high, a one row machine can do an economical job. In 25 ton beets, a one row harvester at 3 miles per hour, will have to travel 3800 feet to get a 5 ton load of beets, but if the yield is 5 tons, it will have to travel 18,600 feet. If a harvester is designed to operate at low speeds, a two or more row machine would be indicated but at high speed possibly a one row machine with a trailer might be the better choice. When we consider width of row, we are also presented with a problem, some types of harvesters work better in wider rows as does the present Scott-Urschel. In 10 ton beets, in 34 inch row widths, such as in the Imperial Valley, a single row harvester will have to travel 7600 feet, to obtain a 5 ton load of beets in comparison with 14,600 feet on the 18" rows commonly used in the Red River Valley of Minnesota. In a general summary of the one or multiple row question, I would point out that the tractor size need not necessarily be a limiting factor because auxiliary power can be added when needed.

IV. SHALL BEETS BE WINDROWED, CART-HARVESTED OR PUT DIRECTLY INTO THE TRUCK?

Many of the sugar beets today are windrow harvested but I believe that this method will have very little place in future beet harvesting operations, for the following reasons: (1) The farmers will receive better tonnage, more total sugar with a minimum of loss by harvesting directly to a truck or cart; (2) The elimination of windrowing in general eliminates an extra operation thus making a less costly harvest and (3) Cooler and fresher beets in warm weather and unfrozen beets in cold weather will be available for storage. Mr. Myron Stout, of the U. S. D. A., who has been

working on sugar beet storage, made a study of the temperature of growing beets compared with topped and pulled beets during the period of September 23rd to 30th, 1946. Lifted beets warmed up 20 degrees in one hour as compared to a temperature rise of only 1 to 2 degrees in the same time. A lot of cool air would have to be blown through one ton of windrowed beets in a storage pile to remove the heat absorbed in even an hour's time in the sun.

It is my belief that many harvesting problems can be solved by either the direct-to-truck delivery or by the cart method and by that I mean a cart which will discharge directly into a truck and preferably not make use of any farmer storage piles at ends of the fields.

V. WHAT SHOULD BE KEPT IN MIND WITH REGARD TO CHOOSING OF THE TYPE AND SIZE OF TRACTORS AND SUPPLEMENTARY EQUIPMENT FOR THE FARMER?

Most of us believe in the future of the sugar beet crop as representing the foremost crop in economy of areas where we operate and I do not believe that its progress should be hindered or limited by any one particular size of tractor. If the sugar beet requirement is for a certain type or size of tractor, I believe we should encourage its use rather than to have the tractor size dictate the sugar beet farming processes. Within the next few years, lots of farmers will buy lots of tractors and you can help them choose the right type for the beet industry. The requirements of the future sugar beet harvesters should be kept in mind when this selection is made. So many times we have heard the statement - "We cannot use this equipment because the size of tractors in our territory makes it prohibitive." We would rather hear a statement like this - "We are recommending such and such a size tractor because it fits in with our program and makes for economical beet production". There are different power requirements to consider in the production of the crops which would include power for fertilizer application, plowing, seed bed preparation, planting, cultivation, cross cultivation or mechanical thinning and harvesting, and your thorough study can aid materially in choosing the correct tractor and supplementary equipment.

VI. SHALL A HARVESTER BE A MOUNTED OR A TRAILED MACHINE?

Most of the implement companies choose a mounted machine type for obvious reasons. It sells their tractors and makes for better maneuverability. Lighter weight should result because tractor wheels and frame members are already available for the job.

Disadvantages are, of course, that the tractor is tied up for the season. A trailed harvester will go on most tractors and does not limit tractor operations to harvesting, but is not quite as convenient at the end of the field. It is also generally true that more men are necessary for the trailed machine work.

VII. GUIDANCE OF FARMER IDEAS.

Once in a while a farmer idea springs up which needs some guidance. On December 19th and 20th, 1946, it was my pleasure to visit the Nampa, Idaho, sugar factory area. The purpose of this visit was to study the new beater toppler idea which has grown to considerable potential proportions

during the past beet harvest season. The beater topper has many variations, including the following: Single, double or four row operations with belts, frayed cable or chain as the beating medium. The beater shaft may be positioned horizontally, vertically or horizontally at an angle with the row. The driving mechanism may be power take-off or an individual drive. The beets may be gone over once or several times depending upon top growth and the speed of the machine. The speed of the rotor depends, of course, upon its diameter and the type of beating material and ranges between 300 and 1000 R. P. M.

During my two day visit in this territory, I saw several combinations of the above features incorporated in various machines. This type of beater is very attractive to a farmer for the following reasons: (1) It is simple and can be manufactured in small blacksmith shops and its possibilities blend themselves with the inventive mind of our present day mechanized farmer; (2) It leaves a maximum of beet tissue intact for marketing; (3) It can be used in conjunction with already developed harvesters and loaders; (4) Its possibilities as a general farm implement are great because of the fact that it may be used as a potato vine disintegrator which helps ripen the potatoes at a predetermined time and aids materially in their harvest. It can be used as a weeding machine next to fence rows, on roads and stubble fields. Its possibilities for summer fallowing are good; (5) Its simple form is a good manufacturing package for medium sized manufacturers such as Olson Manufacturing Company, of Boise, Idaho, who have taken pains to do all possible to obtain patent coverages on this machine; (6) Some beets in the visited area were about one-half out of the ground at harvest time and farmers are therefore having trouble with conventional knife or disc toppers. The beater topper does the job with a minimum of trouble from this angle. (7) Interference from heavy foliage in the beet digging operation is completely eliminated by use of this type of machine.

The disadvantages of this type of machine are very evident: (1) It completely chops up the resulting top material which in itself would not be detrimental to top material as stock feed were it not for the fact that it is mixed with sand and dirt. It is, however, possible, from experiments which the Foundation has carried on in the dehydration of beet tops, to effect some amount of separation between beet top material and the heavier sand and dirt, in one of the processes affiliated with artificial drying. However, this has not yet reached any commercial value at the present time. (2) The manufacturing of sugar from crown tissue presents its problems in purity, molasses and individual sampling. However, factory improvements point toward about a 5% increase in total sugar which would otherwise not be available. Some Nampa beets are about half covered with leaf scar. (3) With such a machine, the possibility of a farmer topping a whole field of beets in advance of root harvest, is always present. This will, of course, increase the temperature of unharvested beets in hot weather and will not protect them from freezing in cold weather. Both of these conditions are detrimental to good storage practice.

It is very evident from what the Amalgamated people showed me at Nampa, that this type of machine will spread like wildfire in that area, the Yakima Valley and possibly to other territories within the beet sugar producing areas even though they do not have as high crowned beets as grown in that section.

The Amalgamated people are very closely watching these farmer developments, have studied their possibilities and detrimental effects to an amazing degree and have done considerable to answer the problems presented. They have placed the conventional topper of an I. H. C. harvester tractor out in front of the tractor and used an angle beater topper on it at the location where the present disc topper is located. They are attempting, with some degree of success, to salvage possibly 90% of the top material by a higher cut of the beets, leaving the job of cutting off the remaining leaf tissue to the beater topper, which also does a wonderful job of cleaning the row of topped beets for the conventional I. H. C. puller points and Rienks rolls. In their work to attempt to guide this beater topper development, the Amalgamated people have kept foremost in their minds, the possibilities of salvage of top material along with the beater topper.

In conjunction with my trip to this area, a visit was made to the Olson Manufacturing Company, whose representative stated that he believed from present indications that their company would manufacture quite a number of the simple power take-off beaters, which, after talking with the Amalgamated people, they stated they would not necessarily recommend as beet toppers but would be merchandised as a general farm implement. My prediction would be that practically every one of the machines that they produce will be used as beet toppers.

I believe, as does Mr. A. E. Benning and the Amalgamated organization, that our best thinking should immediately be directed in guidance of this beater topper idea into channels most advantageous to the industry.

We work in very close contact with the designers of farm machinery and know that they have a lot more problems than most people credit them with having. They have to make assembly drawings and detailed material lists in order to put the jobs in their shops for castings, welding, machining and fabricating. Assembly is then made and a try-out follows. This all has to be repeated several times for ordinary machinery but literally hundreds of times in the beet harvester business. Before a manufacturer can start on a design development job of this nature, they must know exactly what is required by the industry, and that is where you men can help tremendously. There are lots of good men in the machinery design business. Let them know what you are thinking - work with them conscientiously and results more in keeping with the desires of the industry will be accomplished.

Attached is a list of harvesters which we hope we will approach through 1947. The first two vertical columns - that of harvesters prior to December 31st, 1945 and of machines built in 1946 are approximately correct. The third is what we hope the implement manufacturers will supply the industry during 1947 which would result in the last column, which represents a total of harvesters which we would like to have working on sugar beets next fall.

SUGAR BEET HARVESTERS

	<u>Prior to Dec. 31 1945</u>	<u>Machines built in 1946</u>	<u>Proposed Estimate</u>	<u>Probable total 1947 harvest</u>
Marbeet	140	260	110	510
John Deere	625	500	700	1825
I. H. C.	3	300	600	903
Scott-Urschel	14	106	250	370
Kiest	20	207	200	427
Harvall	1	6	62	69
Sishe	1	3	60	64
Ferguson	1	3	500	504
TOTAL	805	1385	2482	4672