Influence of Machine Harvest on Receiving Facilities

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Beet-receiving facilities embrace all of the mechanisms needed to receive sugar beets from field trucks, weigh the beets, remove and weigh foreign matter, and deliver the clean beets to factory bins or piles. The devices currently in use are, for the most part, adaptations of much earlier equipment, originally designed for receiving handharvested beets delivered by horse-drawn wagons. To be sure, the improvements to accommodate modern methods or harvesting and delivering sugar beets have kept pace fairly well. Nevertheless, there is some reason to believe that a fresh approach to the problem as it now exists would yield a receiving station design far superior to the present modification of earlier designs.

Peculiarities of Machine-Harvested Beets

It would be well if this heading included also "machine-thinned beets." The present trend toward mechanizing all cultural operations from land preparation to the delivery of harvested beets has brought about a condition of the beets as delivered which merits close examination. The tabulation to follow will list the principal physical characteristics of beets as delivered from fields where all cultural operations have been fully mechanized. Such beets are:

1. Brittle—easily fractured by impact.
2. Odd-shaped—from inaccurate topping or partial breakage.
3. Slippery—as a result of surface bruising and adhering undried mud.
4. Trashy—frequently mingled with weed roots, beet leaves, and soil particles from dust to large clods.
5. Widely varying in size—as the combined result of machine thinning and the ability of harvesting machies to recover beets of all sizes.

A receiving station capable of meeting this array of conditions must differ from existing installations in all of the respects in which the above characteristics differ from those of hand-harvested beets. These differences may be tabulated in a manner parallel to the foregoing list.

1. Fracturing of beets must be avoided by dropping them a minimum distance, and onto a sloping surface or other means for minimizing damage.
2. The irregular shape of mechanically produced beets precludes any handling or cleaning devices which depend on the uniform shape or size of beets.
3. The slippery surface characteristic of machine-harvested beets reduces the slope of belt conveyors which will operate satisfactorily.

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4. The trashy nature of machine-harvested beets as presently encountered calls for marked improvement in cleaning devices.

5. The small size of many of the beets now received is also reason for revising present cleaning methods.

The first requirement is being met by reducing the distance through which beets must be dropped into the receiving hopper from the field truck, and in delivering beets to bins and piles. The most recent designs of receiving hoppers present a sloping surface on which the beets fall so that the impact is less violent than would be the case of beets falling on to a horizontal surface. There is, however, still room for improvement, because broken beets and small beet fragments lead to substantial losses either through diffusion in the flumes or loss of fragments through the screens.

The irregular shape of beets as now received results not only from topping irregularities and breakage, but also from the extended harvesting season which causes the crown of beets to grow from a roughly hemispherical shape to a steep conical shape ("pineapple crowns"). The tendency of these odd-shaped beets to roll backwards on conveyor belts conspires with their tendency to slide backwards because of their slippery surface. The result is that many uncleated belts which conveyed the old hand-topped beets with complete satisfaction have become almost useless for beets as now received. A smooth belt with a slope of 23 degrees has been considered perfectly satisfactory in the past and slopes up to 30 degrees have been used, although cleats were generally applied after the slope exceeded 23 degrees.

A contrasting situation was encountered last year with a 48-inch conveyor belt with a 13 degree slope which failed to transport machine-harvested beets after cleaning on a conventional Rienks screen. It was necessary to apply cleats of fabric-reinforced rubber one inch high in order to prevent back-slip.

The shortcomings of existing cleaning devices probably represent the most unsatisfactory aspect of existing installations. There is need for serious study and perhaps radical redesigning of cleaning devices so that they will sharply distinguish between beets of all sizes and foreign matter in all of the varieties now encountered. Then, after the discriminating ability has been achieved, the physical behavior of the screen toward the beets should be considerably less violent than now encountered, so that damage to beets will be reduced. It is, of course, useless to strive toward a screen which perfectly achieves these characteristics, so that certain tolerances should be established in relation to:

A. Percent by weight of foreign matter remaining in clean beets.

B. Maximum diameter of beets or beet pieces which may pass through the screen.

Trends Which Affect Receiving Station Design

The discussion so far has been concerned with the physical nature of machine-harvested beets. But concurrent with mechanical harvesting, there

have been other changes affecting the design of receiving stations. Trucks are longer and carry heavier loads.

The large capital investment in harvesting machines and trucks calls for a minimum of unloading time. There appears to be a growing acceptance of large transport trucks as a partial replacement of railroad cars; this means that rail dumps must accommodate both railroad cars and transport trucks.

Finally, the transient nature of beet growing in certain areas emphasizes the need for greater portability of receiving stations.

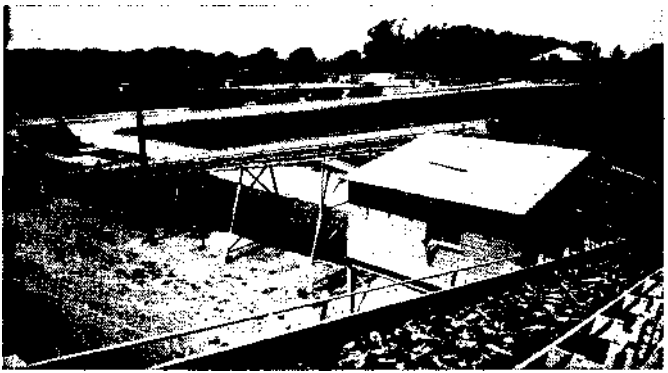

Figure 1.—Both conveyor belts on this receiving station (built in 1953) have a slope of 13 degrees, yet screened, machine-harvested beets could not be conveyed on the second belt (foreground) until it was provided with cleats.

Summary and Conclusions

This discussion has been somewhat obviously lacking in specific recommendations. It has been, rather, a broad definition of the problem of beet receiving and a demonstration of the shortcomings of the existing equipment. The discussion may be considered as basically a recommendation for a further study on the widely differing physical characteristics of sugar beets as now received, leading up to a design of a receiving station to be made without dependence on preceding designs, except as these may offer valuable design guidance. The need for research on the design of cleaning screens is emphasized, and a realization of all the cultural and custom trends in beet growing and harvesting is urged.