Sugarbeet Harvesting Efficiency

R. V. Withers,
J. C. Thompson,
and C. L. Peterson

Introduction

Figure 1: Sugarbeet growing areas in Idaho

Sugarbeets have long been a major crop enterprise on irrigated farms in Idaho, exceeded in value only by potatoes and wheat in recent years. Each year, since 1990, sugarbeets contributed more than $185 million in farm receipts. Areas of Idaho that produce sugarbeets are identified in Figure 1.

Sugarbeets are expensive to produce. By the end of harvest, total production costs often exceed $1,000 per acre with variable expenses as high as $600 or more per acre. Good management and efficient use of resources are required to realize a positive economic return.

This report considers sugarbeet harvesting efficiency and possible cost reducing improvements. Harvesting begins the middle of September and continues until completed, usually by mid-November. Harvesting operations include topping, digging, loading, hauling, and unloading at a piler where beets are stored until processed.

Variable costs associated with harvesting include fuel, parts, labor, and supplies and make up 12 to 15 percent of the total variable enterprise cost. Fixed costs related to harvesting include depreciation, interest on machinery and equipment investments, housing costs, taxes, and insurance. Total harvesting costs account for 15 to 20 percent of all sugarbeet production costs.

Sources of Harvest Data

Two surveys were made for the 1992 harvesting season to gather data related to sugarbeet harvest. One was a sample drawn randomly from a list of all sugarbeet growers in Idaho. These growers were contacted in early December of 1992. The other data set was obtained during the 1992 harvest from a selected sample of 40 growers in the Nampa and Paul areas.

University of Idaho
College of Agriculture
Agricultural Experiment Station
EXT 770

Random Survey

There were 113 eligible respondents in the sample and usable information was obtained from 103 sugarbeet growers. Respondents were contacted by telephone and asked a pre-determined set of questions about sugarbeet harvest. The objectives of the study were to:

1. Collect harvest data and describe current harvesting practices;
2. Analyze the data collected to observe differences among growers;
3. Estimate the economic significance of efficiency differences; and
4. Make recommendations for efficiency improvement.

Farms in the sample had an average of 660 acres of crops and ranged from 15 to 4,995 acres. The average sugarbeet enterprise was 170 acres. Acreage of sugarbeets ranged from 5 to 940 acres per farm. Besides sugarbeets, 32 percent of the farms had potatoes, 95 percent reported grain crops (wheat, barley, oats), 62 percent had alfalfa, and 76 percent had one or more other crops (corn, beans, onion, seed crops, canning or freezing crops, peas, etc.).

All sugarbeets were grown under contract with The Amalgamated Sugar Company. Thirty-nine percent had some early beets and 10.7 percent had surplus beets. Thirty-four percent of the growers hauled some beets directly to the factory and 83 percent hauled to a piler not located at the factory. Some growers hauled beets to both locations.

The sugarbeet harvest began with early beets in mid September and continued into November. The average grower harvested beets over a period of 18 days. Sixty-nine percent of the growers finished harvest in 20 days or less, and 85 percent had completed harvest in 30 days.

The average grower reported spending 11 hours and 50 minutes of harvest time per day of harvest. The average distance from field to piler was 6 miles and ranged from 2 to 39 miles.

Times Required

One of the concerns investigated by this study was the amount of time required for various operations of harvesting. Each respondent was asked which problems were associated with the greatest loss of time. The responses were as follows:

	Percent
Breakdowns	32
Waiting at piler	37
Waiting for trucks in fields	24
Weather delays	7

Waiting time and breakdowns were by far the greatest problems reported for the 1992 harvest. Weather delays were reported as the biggest problem by only 7 percent of the growers. (This, of course, would vary a great deal from year to year.)

Respondents were asked about the time required for various segments of the harvest. The purpose was to learn about the efficiency with which the beets are harvested and transported to the piler. Times were reported for truck in field, waiting to load, field to piler, time at piler, and returning to field. Frequency distributions reporting these responses are given below.

Truck Time in the Field

Minutes per load	Number of respondents	Percent
Below 10	19	18.4
10-14	28	27.2
15-19	24	23.3
20-24	15	14.6
25-34	9	8.7
35 or over	8	7.8
Total	103	100

Time Waiting to Load

Below 5	16	22.9
5-9	29	41.4
10-14	11	15.7
15-19	8	11.4
20 or over	6	8.6
Total	70	100

Time from Field to Piler

Below 10	8	9.3
10-14	25	29.1
15-19	32	37.2
20-24	11	12.8
25-44	6	7.0
45 or over	4	4.6
Total	86	100

Time at the Piler

Minutes per load	Number of respondents	Percent
Below 10	8	9.6
10-14	13	15.7
15-19	17	20.5
20-29	16	19.3
30-39	11	13.3
40-49	10	12.0
50 or over	8	9.6
Total	83	100

Time Returning to Field

Below 10	12	14.1
10-14	30	35.3
15-19	25	29.4
20-24	10	11.8
25-34	4	4.7
35 or over	4	4.7
Total	85	100

Average times reported per load for the above operations were:

Truck in field	16.4 minutes
Truck time from field to piler	15.4
Truck at piler	23.9
Return to field from piler	14.4
Total time per load	70.1 minutes

Each load required an average of 1 hour and 10 minutes, making it possible to haul 10 loads during an average 12 hour day. Using an average of five trucks, a total of 600 tons could be harvested, or about 25 acres of beets per day. Average load size was 12 tons. There were two sizes of trucks used: single axle and double axle. Single axles hauled around 8 to 10 tons per load and double axles hauled 15 to 16 tons per load. There were a few semis to haul 25 to 30 tons per load.

The above data deal with the number of trucks and drivers. The next chart is concerned with the loader operator waiting for trucks in the field.

Time Waiting for Trucks in Field: Per Day

Minutes per day	Number of respondents	Percent
Below 10	10	10.6
10-29	9	9.6
30-59	10	10.6
60-99	18	19.2
100 or over	47	50.0
Total	94	100

The average reported time per day waiting for trucks was 95 minutes. No information was gathered to determine the reasons for the wide range of waiting times. Some with long waits probably were not using enough trucks to keep the loader busy. This could have been a common problem for farms with small acreages.

Farm operators reported they could get by with fewer trucks if waiting time at the piler could be reduced because they could return to the field in less time. When numbers were aggregated, the operators said they could get by with 4.4 trucks instead of five.

The average operator reported that six and a half workers were required to perform the harvest function. This included five truck drivers and one and a half persons operating harvesters and toppers or beaters in the field.

Selected Sample During Harvest

A sample of 40 farmsteads was selectively drawn from two regions of southern Idaho. This sample was equally divided between the Nampa and Paul factory districts. A letter describing the project and encouraging cooperation was sent to each farm operator in the sample. An enumerator made personal visits to each of the farms. The initial contact was spent further explaining the project, gathering background descriptive data, and instructing respondents on how to keep records throughout the harvest season. Additional contacts were made as needed to assure that records were kept properly. A final visit

The following table is a summary of pertinent data collected:

1992 Sugarbeet Survey Summary

Region	Nampa	Paul	Combined Averages
Beet Acres/Farm	155.0	509.0	332.0
Harvesters/Farm	1.6	1.6	1.6
Trucks/Farm	4.1	7.6	5.6
Loads/Day/Truck	8.4	7.6	8.0
Loads/Day/Farm	34.4	57.5	46.0
Distance from Piler (Mi)	4.2	5.9	5.3
Time in Field (Min/load)	25.4	24.9	25.2
Time at Piler (Min/load)	22.7	27.6	25.1
Total time per load (Min)	65.7	74.6	70.0

was made to gather data sheets and fill out a summary after harvest.

This survey was designed to gain a better understanding of the field to factory beet handling operation from the farmer's point of view. The size and scope of each farmstead was recorded as well as daily operational data such as operating hours, service times, breakdowns, travel times to and from the piling station, and harvester idle hours. Additionally, comments were taken on problems and solutions for the present system with a focus on alternative handling schemes that could alleviate some of the piler congestion and at the same time smooth and speed the delivery of beets to the factories.

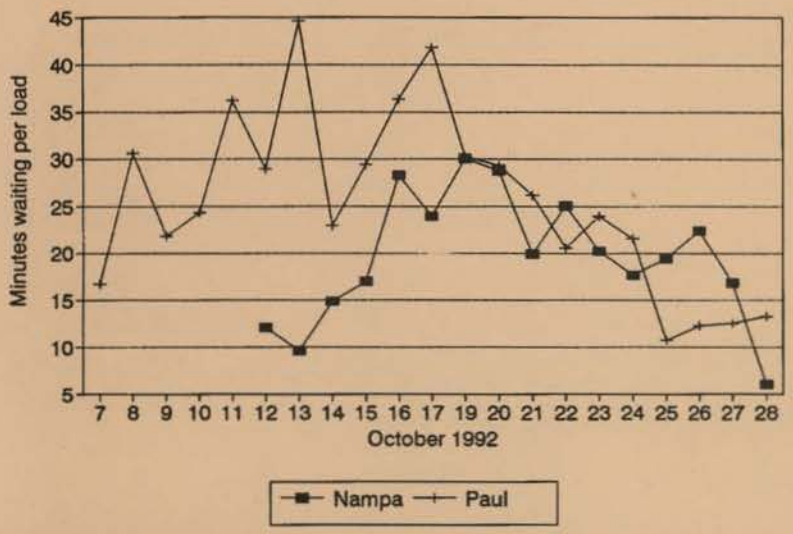

Figure 2: Wait time at piler increases considerably at the peak of harvest.

Grower comments suggested there were more problems in the Paul region with the delivery of beets causing excessive harvester idle time and the use of extra trucks. This table somewhat explains this disparity. Growers in the Paul area had more acres of beets, a greater number of trucks per farm, and hauled more loads per day, but had fewer number of loads per truck per day. Pilers in the Paul area process a larger volume of beets than the ones in the Nampa region.

The graph of waiting time at the piler related to harvest date (Figure 2) shows more congestion during the middle two weeks or peak of harvest. Scheduling off days for growers on a rotating basis is being used to ease the pressure on some of the piling stations. Extending the piling operation by a few hours a day could accomplish the same objective and allow all growers an uninterrupted harvest. Alternative handling methods that are discussed later should also be considered as possible approaches to the problem of delays during sugarbeet harvesting.

The bar graph of figure 3 depicts the average time trucks spend at the piling station. It is broken down by station to show that not all growers are faced with the same situation and that some piling stations unload more quickly than others. These differences should be studied to learn how to improve the flow of trucks.

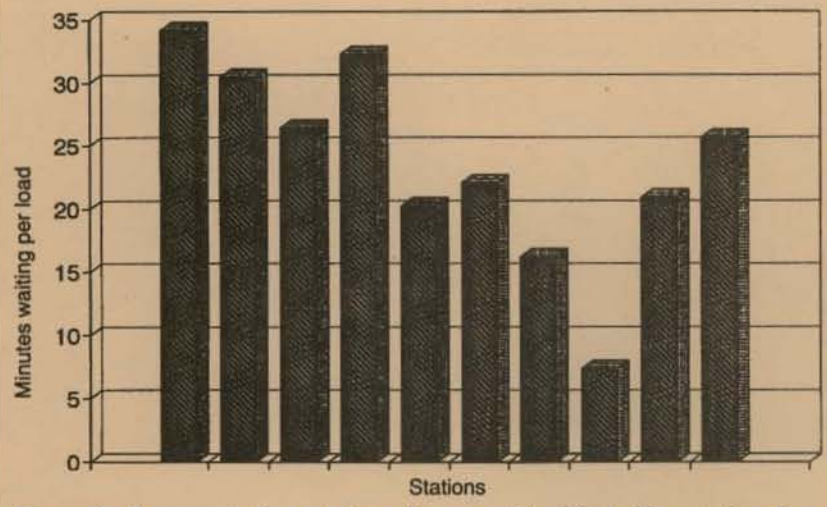

Figure 3: Representative wait times for ten unidentified piling stations in southern Idaho.

In general, the sugarbeet harvest would seem to be relatively efficient, given the many things that can cause delays. Three areas can be improved. Thirty-two percent of the farm operators reported that breakdowns caused the greatest delay during harvest. This problem may be reduced by better conditioning of equipment and more training for equipment operators. This, however, is speculative as no data were collected to deal with these practices.

The other two areas causing delays were waiting at the piler and waiting for trucks in the field. Both of these problems relate to the fact that sugarbeet harvesting must be completed in a short time. The starting date is delayed to give beets maximum growing time but must be completed before the chance of freezing or wet weather is too great.

The processor provides machinery and employees at the piling grounds. In order to get the best return from their investment, they do not want to be over-mechanized and spend more than necessary on equipment. As the volume of beets delivered to a piler varies throughout the harvesting season, with peak volumes about mid-October, there are times when the piling crew is under-employed and times when large volumes are delivered and trucks delivering beets are delayed. This in turn results in harvester delays in the field unless additional trucks and drivers are obtained. This common solution adds to the harvesting cost on the farm.

The survey shows that an average of 24 minutes was spent per truck at the piler. It takes less than 5 minutes to unload a truck with the remaining time spent waiting to get to the piler.

Assuming that 10 minutes per load could be saved by better piler efficiency, each load could average 1 hour instead of an hour and 10 minutes. This could reduce average harvest time from the current 7 to 6 days.

Another way to look at cost savings relies on the farmer respondents who said that the number of trucks could be reduced from 5 to 4.5 trucks if unnecessary time waiting at the piler could be eliminated. The cost of a truck and

The following is a summary of the estimated cost savings.

Labor	
Harvest field operations (1.5 persons x $7 x 12 hours)	$126
Truck drivers (5 persons x $7 x 12 hours)	420
Truck rental	
Average of 1 and 2 axle trucks ($3,350 per month, used 25 days 134/truck x 5 trucks)	670
Total savings per farm*	$1,216

* Assumes a farm with 170 acres of sugarbeets and a yield of 24 tons per acre.

driver was estimated to be $263.12 per day. If a half a truck per day was saved for 7 days of harvest, the savings for the average farm harvest would be $921 ($263.12 x 7 days x .5 truck = $920.92). Using the conservative harvest savings of $921 per grower and 1,500 growers in Idaho, a total savings of $1,381,500 could be realized for the season. This calculation does not consider extra waiting time by the harvester in the field.

As indicated earlier, there are several facets of harvesting that could potentially be improved for greater efficiency. Some possible solutions are listed here.

1. Reduce breakdowns of harvest equipment.
   - Condition and repair equipment before harvest season.
   - Keep a supply of spare parts on hand.
2. Make better use of waiting time.
   - Have tasks available for those waiting in the field (pick up loose beets or service equipment).
3. Save time at the piler and in the field.
   - Train equipment operators and coordinate hauling schedules.
4. Alternative handling systems.
   - Larger trucks
   - Farm storage

Suggestions for saving time at the piler could be more expensive. These include more training for the piler crews, double shifts at pilers to increase the time of piler operation, adding pilers where waiting is a problem, upgrade piling equipment, and others.

While adding pilers looks like an obvious solution to reduce waiting time this may not be feasible for most stations. It may cost as much as $200,000 to add a piler

plus labor and energy to operate it. Not many pilers could be added with the waiting cost savings and only a few stations would benefit. Other possible ways to reduce waiting time loss are considered in the next section.

Alternative Handling Systems

Some other possible means to reducing delays at the piler involve alternative handling of sugarbeets at harvest time. Some alternative handling systems have been tried on a limited scale. These consist of on-farm storage, transloading into semi trucks on the farm, or direct loading into semis and hauling to the factory instead of a piler.

Respondents were asked about these practices. One respondent was using transloading, six had considered using this method, 81 had not considered using this method, and 14 had not heard of it. Some of the larger acreage farmers who own potato loading equipment and semis could easily make the transition. For small farmers, however, the cost would be prohibitive unless a cooperative were formed or some other arrangement made to share the expense.

When asked about direct use of semi trucks, six said they use this method, six others have considered it, 44 had not considered it, and one had not heard of this method.

No one in the sample reported using on-farm storage. There were six who had considered using it, 83 who had not considered on-farm storage, and 10 who had not heard of this method as an alternative.

Three alternative handling situations were observed by UI researchers to evaluate their effectiveness and possibly make recommendations for their implementation by others.

1. **Transloading**: A farmer near Twin Falls decided that he was not going to let his harvesters sit idle while waiting for trucks so he set up his potato loading equipment for beets. It consists of a receiving belt where the 10 wheelers unload, an accumulator that can hold 10 tons, and a boom for loading into semis. In the case that a semi is not available, the beets are fed into a cellar for short term storage. Two years ago this grower was able to get his beets out of the ground before a severe frost hit that stopped many of the other growers from digging for more than a week.

2. **On-Farm Storage**: At Glenns Ferry, one farmer practices on-farm storage in order to keep his harvest running smoothly. He uses a small boom to form temporary (2 to 3 weeks) storage piles then loads into semis for transport. A weight loss study indicated that shrinkage can be expected—especially for surface beets. While the present contract does not compensate the grower for this weight loss, policy on this matter could be changed if needed.
3. **Cooperative On-Farm Storage**: This is where the nearest processing plant is over 200 miles away from the farms. Two company pilers are supplied to establish a standard piling ground to serve a group of farmers near Prosser, Washington. Beets are trucked to the Nyssa, Oregon, plant.

While these methods do not seem feasible to most growers at the present time, the processor may consider one or more of these methods as a means of taking pressure off a particular piler where delays are common. Subsidizing two or three larger growers to divert their beets using one of these alternatives may well be worth the investment. It may be less expensive to pay to divert beets to another piler or to store on the farm for two or three weeks than to invest in additional piling capacity.

The Amalgamated Sugar Company has taken steps to increase the efficiency of the piling operation and is in a continual process of evaluation and improvement. Naturally, some areas will benefit before others, and some upgrades such as new pilers are costly and difficult to justify because they are used only two months out of the year. Some recent innovations of the company drew positive comments from growers in the Nampa area. They were the addition of a new piler at one station and the retrofit of load cells on the older pilers in order to weigh tare dirt between truckloads. This allows all tare dirt to be handled by the company increasing truck flow through the station and reducing harvester idle time. An additional benefit is better control of diseases and pests by prevention of tare dirt mixing and returning to local areas.

Grower Comments

The telephone survey gave responding farm operators an opportunity to comment on sugarbeet harvest and what problems they observed. Responses ranged from "no problem" to a variety of concerns.

Favorable comments included:

- ✓ 1992 was a good year
- ✓ harvest goes smoothly
- ✓ this year went really well

Comments about problems:

- ✓ pilers not up to date
- ✓ waiting at piler
- ✓ need bigger, faster pilers
- ✓ weed problems
- ✓ piler too slow
- ✓ pilers unable to handle large equipment
- ✓ tare dirt problem
- ✓ difficult to find harvest labor
- ✓ weather
- ✓ short of water, small beets, hard ground

Grower suggestions for improving harvesting efficiency:

- ✓ update pilers
- ✓ increase piler capacity
- ✓ split piler shift, run longer hours during peak periods
- ✓ continue to put load cells on tare dirt chutes
- ✓ better cooperation from sugar company
- ✓ no more surveys

Summary

Sugarbeets rank third behind potatoes and wheat in farm receipts for Idaho crops. However, production costs are also high so that sugarbeet growers must manage carefully to realize a return above costs. Sugarbeet harvesting is a high cost operation because of the bulkiness of sugarbeets and the short time available to complete the harvest. A study of sugarbeet harvesting was made for the 1992 crop to evaluate efficiency and to look for improvement possibilities.

About the Authors
Russ V. Withers is a professor of Agricultural Economics;
Joseph C. Thompson is a Research Associate in Agricultural Engineering; and Charles L. Peterson is a professor of Agricultural Engineering.
All are at the University of Idaho.

Two surveys were made to obtain information from growers. One was a personal interview of about 40 selected growers and the other was a telephone survey of 103 randomly selected growers. Types of problems associated with the greatest loss of time were trucks waiting at the piler, breakdowns in the field, waiting for trucks in the field, and weather delays. The average grower worked 12 hour days during harvest, used five trucks, and completed harvest in 7 work days. Trucks traveled an average of 6 miles to the piler and took an average of 70 minutes per load. This consisted of 16.4 minutes in the field, 29.9 minutes going and coming, and 23.9 minutes at the piler. Harvesters waited an average of 95 minutes per day for trucks to return to the field.

Surveyed farmers were asked if they had used or considered alternative methods of sugarbeet handling during harvest to avoid losing time hauling beets to the piler. The three methods considered were transloading at the farm, on farm storage, and use of semis to haul beets. Of the survey respondents one was transloading, six used semi trucks, and no one reported on-farm storage. Not enough data were obtained to evaluate the economic feasibility of these methods.

Recommendations for improving harvesting efficiency came from observation and from grower suggestions. They were not evaluated in terms of importance or cost of adoption.

1. Recondition and service equipment prior to harvest to reduce costly breakdowns in the field.
2. Continue to upgrade pilers and scales. Add load cells and handle tare dirt.
3. Train employees before harvest begins (farm crews and piler crews).
4. Schedule more hours at the piler during the peak harvest period.
5. Continue to evaluate alternative harvesting methods that may improve efficiency.

In general the beet harvest is fairly smooth. However, there are changes that could be made to save time and money and to avoid the risk of having sugar beets frozen in the ground because of harvesting too late.

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