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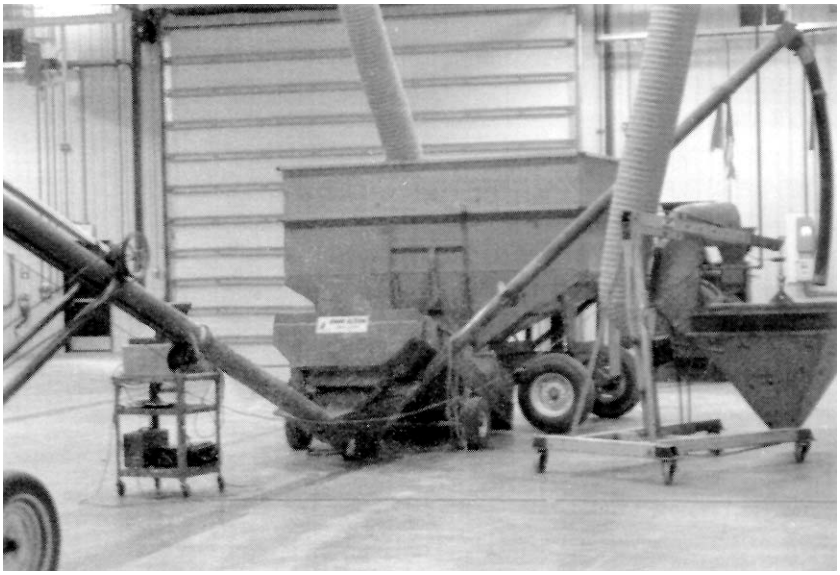
Agtech CENTRE PAMI PRAIRIE AGRICULTURAL MACHINERY INSTITUTE *Research Update* **750**

Does Using Grain Precleaners Make Economic Sense?

Because freight has become a significant cost to Saskatchewan producers, there has been more interest in reducing freight costs by removing dockage prior to grain shipment. A grain precleaner is a tool that farmers can use to remove a portion of the dockage or do some simple grain size selection.

In order to assess the economics of using precleaners to add value to Saskatchewan crops, PAMI obtained three precleaners and did a brief evaluation on each.

The three precleaners tested were the Farm King 480; the Kwik Kleen Model 772, manufactured by Triangle Industries; and the Mobile Screen, manufactured by Bench Industries. For all three precleaners, the maximum capacity, and cleaning effectiveness were compared at different machine operating angles. The effect of grain flowrate on cleaning effectiveness was also determined.



PAMI set up to start testing on one of the precleaners.

The Test

All three precleaners were operated at PAMI in Humboldt while cleaning wheat, canola, and peas. The grain was obtained from a local elevator, and all grain contained a "typical" amount and composition of dockage. Each precleaner was operated at maximum grain flowrate and a lower flowrate (about half of maximum) at different machine settings. During each test run, the desired grain was conveyed into a truck equipped with a weigh scale. The other output streams were combined and conveyed into a container suspended from a load cell. By weighing all material leaving the precleaners, flowrates could be determined. During each test run, samples of the input grain, desired grain, and removed grain were collected. The composition of all wheat samples was determined by passing them through a Carter Dockage Tester and weighing all the portions. The composition of all pea and canola samples was determined by using hand screens and weighing all portions. The screen sizes used in all dockage tests were those suggested by the Canadian Grain Commission.

Does using grain precleaners make economic sense? The answer is both "Yes" and "No" according to a study conducted by PAMI, with funding provided by the Agriculture Development Fund of Saskatchewan Agriculture and Food. If farmers are using grain precleaners to improve the grade of grain they are shipping, then precleaners provide a positive economic benefit. However, there is a net economic disadvantage to using the precleaner to remove dockage in an attempt to reduce freight costs on grain with "average" dockage levels.

Test Results

Farm King

The Farm King 480 precleaner uses two cylindrical rotating screens to remove both large and small particles from the grain mass (Figure 1). The grain that is going to be cleaned is conveyed into one end of the inner screen using an auger supplied with the precleaner. The large particles stay on the interior of the inner screen and move toward the rear of the machine and over the chute on the rear of the precleaner. The clean grain and small particles fall through the inner screen onto the outer screen. The clean grain stays on the interior of the outer screen and moves toward the rear of the machine and over a chute at the rear of the precleaner. The small particles fall through the outer screen and drop into an auger, which discharges at the front of the machine. Three additional conveyors are needed to move the small particles, large particles, and desired grain from the precleaner. Both inner and outer screens can be changed for different grains or cleaning operations. The angle of the machine can also be changed to vary the residence time of the grain in the precleaner, thereby changing the grain flowrate and cleaning efficiency.

Figure 1. Farm King 480 Precleaner.

Observations

It was observed that in wheat, neither the maximum flowrate or cleaning effectiveness is affected by the operating angle, but decreasing the-flowrate results in increased cleaning effectiveness. In canola, it appears that there is an optimum operating angle to maximize the cleaning effectiveness and at this angle, the cleaning effectiveness is not affected by grain flowrate. When cleaning peas, the cleaning effectiveness is not affected by operating angle and is slightly improved with a reduction in grain flowrate. Maximum capacities for the Farm King varied from 38 t/h (1,420 lb/min) in peas to 31 t/h (1,140 lb/min) in wheat.

Kwik Kleen

The Kwik Kleen 772 Precleaner has seven augers in cylindrical screens to remove small particles from the grain (Figure 2). The input grain is dumped into a receiving hopper from a truck and the flow into the bottom of the auger is regulated using an adjustable slide gate. As the input grain moves up the seven augers, the small particles fall through the screens. The input grain continues through the augers and is discharged at the end of the precleaner opposite the receiving hopper. Paddles in the auger righting mix the grain as it travels along the auger. The small particles drop into a bed of three augers that move the material to a discharge auger that expels the material into a truck or container. One conveyor is needed to move the cleaned grain from the precleaner back into storage or into a truck. All screens can be changed to remove different sizes of particles from the grain mass. The angle of the machine and auger speed can be changed to vary the grain flowrate and cleaning efficiency.

Figure 2. Kwik Kleen 772 Precleaner.

Observations

Tests showed that in wheat there is no effect on the maximum flowrate or cleaning effectiveness by change in the operating angle. There is no test data for canola, because it was not able to consistently operate without the screens plugging. When cleaning peas, the Kwik Kleen showed an increase in maximum flowrate as the operating angle was decreased. The cleaning effectiveness is not affected by flowrate, but gets better as the operating angle is increased. Maximum capacities for the Kwik Kleen varied from 116 t/h (4,320 lb/min) in wheat to 101 t/h (3,770 lb/min) in peas.

Mobile Screen

The Mobile Screen Precleaner has two oscillating screen decks to remove both large and small particles from the grain (Figure 3). The input grain is conveyed to the front end of

the screen using an auger supplied with the precleaner. The grain passes through a distributor and then onto the top screen. The large particles stay on top of this screen until they fall off the rear end of the screen, where they pass over a chute that directs them to one side of the rear of the precleaner. The desired grain and small particles fall through the top screen and on to the bottom screen. Rubber balls between the screens help dislodge any particles stuck in the top screen. The desired grain stays on top of the bottom screen and when it gets to the rear of the screen, it is funneled into a stream that falls off the rear of the precleaner. The small particles fall through the bottom screen on to a shaker pan that moves them to the rear of the machine, where they are directed to the same chute as the large particles. Two additional conveyors are needed to move the desired grain and removed particles from the precleaner.

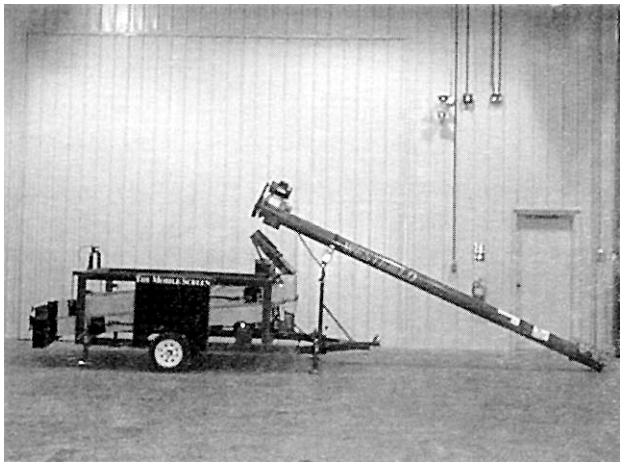


Figure 3. Mobile Screen Precleaner.

Observations

The maximum flowrate in wheat is attained with the intake end raised 4 inches, and at this position the cleaning effectiveness is improved by reducing the flowrate. In canola, it appears that reducing the flowrate increases the cleaning effectiveness in most cases, and that the level position may be the optimum angle. When cleaning peas, it appears that there is no consistent relationship between the maximum flowrate and the operating angle. The cleaning effectiveness is not affected by operating position, and is only slightly improved with a reduction in grain flowrate. Maximum capacities for the Mobile Screen varied from 18 t/h (670 lb/min) in peas to 15 t/h (570 lb/min) in wheat.

Economic Analysis

To arrive at an objective measure of the economic benefit of using a grain precleaner, an economic model was developed. It involved comparing the net return to the producer when the grain was not cleaned versus the net return when the grain had been cleaned using the grain precleaner. For this analysis, no specific model of precleaner was investigated but typical values from the testing were used as inputs into the economic model.

The objective of the economic modeling was to provide answers to the following two scenarios:

1. Can a producer save money on freight costs by utilizing a grain precleaner to remove dockage prior to shipment?
2. Does it make economic sense to preclean grain in an attempt to get a better grade for the grain?

Following are the results of the investigation into using a precleaner to save money on freight costs.

To calculate the net value of the grain if no precleaning was done, the first consideration is price. A price for the grain was obtained from the Canadian Wheat Board and other grain purchasers. This value represents the price that would be paid to the producer before any freight and grain handling costs were added. The actual quantity of grain used in calculating the total paid to the producer is the total mass delivered minus the dockage. Custom hauling rates were used to calculate the cost of transporting the grain from the farm to the point of sale.

To calculate the net return when using a precleaner for dockage removal, the cleaning cost was first calculated. Some of the values used were based on test results. These included 5 per cent of the grain mass removed by the precleaner, and that the dockage level in the cleaned grain is 40 percent of the original value. Therefore, after putting the grain through the grain precleaner, 95 percent of the original mass was transported to the point of sale. This grain would include 40 percent of the original dockage amount. The value of the dockage is based on density, and could vary from $10 to $80 per tonne. The dockage value was calculated as a typical value of $50 per tonne.

Other costs that were included in the economic model were depreciation, investment, repair, insurance, and housing costs. These other costs were calculated using the Farm Machinery Custom and Rental Rate Guide 1998 published by Saskatchewan Agriculture and Food. For this project, a salvage value of 10% was used, along with 100 hr/yr use, 10 year lifetime, 6.5 percent interest rate, $10/hr labour rate, electrical power requirements, and grain flowrates that were typical of the machines tested in this project. The calculated net return to the producer was the total revenue after freight, dockage, and elevation charges minus transportation and cleaning costs, plus dockage revenue. This net return was compared to the net return if no cleaning was done.

Several variables were changed to try and find a scenario where the precleaners would result in an economic advantage. Changing the hauling distance from 0 to 200 miles did not result in a positive return. Even with the dockage calculated at $80/tonne, the return was not a positive value. More dockage resulted in a higher return but

the dockage level had to be greater than 7 percent (not common) to result in a positive return. Cleaning more grain only resulted in more of an economic disadvantage to the producer. Higher freight and handling charges would increase the incentive to preclean but would only be of economic benefit if the freight and elevation rates exceeded $165 per tonne. Raising the price of the grain made precleaning an even less economically viable option. One other variable in these scenarios is that cleaning the grain with the precleaner results in some otherwise good grain being removed from the original mass and then being sold as dockage. The gains from lower transportation, freight and handling costs do not offset this disadvantage. Even if the precleaners removed only genuine dockage, the reduced trucking and dockage revenue would not result in a net positive economic return for the producer.

This study therefore demonstrates that there is no net economic benefit to using a grain precleaner to save money on freight and transportation costs if dockage is less than 7% (which it generally is in most crops).

The second scenario where precleaners are used to gain a grade advantage was also investigated using the same data for the economic model as previously described.

Improving the grade received for a shipment of grain is another possible reason for using a grain precleaner. If for example, a shipment of malting barley was put through the grain precleaner to remove thin kernels, then there is a possibility that the seller would be able to move from one grade to the next and therefore gain a significant economic advantage. The scenario used as a baseline is barley that is 70 percent "plump". This barley would not grade malting, but if it was 85 percent plump the barley would meet the grade determinant for malt quality. Therefore, if the precleaners removed twice as much material as necessary then (85-70) x 2 = 30 percent of the original material would be removed. Typical values for a comparison baseline are given in Table 1.

Table 1. Baseline Values

Mass removed by precleaner	30% of original
Original 9rain mass	450 tonne
Original grain **price**	$132/tonne
Upgraded grain **price**	$185/ton ne

The same as previous examples, the net return using the above values is $16,171. This is a very good economic return and argues for using a grain precleaner in a case such as this. If the amount of material removed is as high as 95 percent, the net return is still positive, using the baseline prices. The removed material would be sold at the lower grade and this dollar value added to the value of the 5 percent of the grain that received the better grade would produce a net gain for the producer. A price increase of as little as $11/tonne is needed for a net positive return at 30 percent material removed. Because cleaning costs are small compared to other costs in this situation, the capacity could be halved and the purchase price doubled, and the net return would still be $14,900. It is clear that using precleaners to improve grain grade can be a significant economic benefit to producers.

PAMI produced a spreadsheet that farmers can download from our website and use to do calculations for their own scenarios. Visit the PAMI website at www.pami.ca.

Conclusion

There is no net economic benefit to using grain precleaners strictly to reduce freight and transportation costs at normal dockage levels. In fact, there is a net economic disadvantage to using these machines for this purpose.

There can be a significant net economic benefit to using grain precleaners when the use of the machine allows the producer to improve the grade of grain that they are delivering.

The investigation of the three brands of precleaners in wheat, canola, and peas indicates that some models are better suited to some crops than others and making adjustments to the machines is a compromise between cleaning efficiency and flowrate. In some cases though, adjustments had no effect on the precleaner's performance.

To obtain the complete research report you can access it on the Saskatchewan Agriculture and Food website at www.agr.gov, sk.ca/apps/adf/adf_admin/reports/19980269_1210200015024.pdf. You can call PAMI at 1-800-567-7264 and ask for Research Report 7099E and have it mailed out to you for a charge of $5.35 to cover shipping and handling.

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