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Evaluation of the Oregon Plot Thresher For Threshing Forage Samples

G. B. Hergert R. W. Robertson

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G.B. Hergert,
Engineering Research Service,
Research Branch,
Agriculture Canada,
Ottawa, Ontario.

R.W. Robertson,
Forage Section,
Ottawa Research Station,
Research Branch, Agriculture Canada,
Ottawa, Ontario.

1.0 Introduction

An Oregon Plot Thresher[1] (Fig. 1) was purchased for threshing legumes and grasses. The following is a summary of the modification and techniques necessary to make the thresher functional for threshing forage crops and an evaluation of its performance.

2.0 Description.

The Oregon Plot Harvester is a portable, 50.8 cm (20 in.) wide seed plot thresher claimed to be adaptable for a wide variety of crops. A safety feature, exclusive to this machine, is a feed beater before the threshing drum to receive hand fed material from the hopper and to feed the material at a controlled rate into the threshing cylinder. The 45 cm (18 in.) dia overshot cylinder is available with either Morgan[2] rubber or conventional rasp-bar type threshing bars. A retarding beater is used after the cylinder to slow the discharge of material from the threshing cylinder. The cleaning section consists of a single adjustable sieve 90 cm (36 in.) long. A fan is located below the sieve to aim an air blast up to the sieve.

The thresher was fitted with a 7 H.P. gasoline engine and a variable speed belt drive to the cylinder.

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[1] See References, Section 10.0.

[2] R.M. Morgan Co., 2335 N.W. 30th AVe., Portland, Oregon 97210.

3.0 Initial Evaluation and Modification

After initial tests, the following changes were made for the reasons stated:

3.1 Feed Beater: The feed beater, as delivered, was ineffective. One of the factors in the initial recommendation was the presence of this beater for safety and for easier feeding. In use, this beater was hard to feed and when material was forced in, the beater jammed and slipped at the slip clutch. Addition of rubber paddles, extending out from the beater to within 6 mm of the beater housing, provided even and well controlled feeding. This type of beater is considered essential to safe operation of a plot thresher, as it provides a block between the cylinder and the feeding platform to prevent injury to the operator. It is, therefore, essential that this beater work perfectly as tampering or removal of the beater or slip clutch will cancel any safety it provides.

3.2 Slip clutch on feed beater: A shop constructed slip clutch was provided on the feed beater to prevent over feeding and as a safety device. The clutch consists of a plate keyed and set screwed onto the beater shaft, a free running sprocket, a piece of rubber between the plate and sprocket, and a spring to apply pressure against the sprocket to provide a friction drive. As the plate was held in axial position by set screws only, spring pressure forced the plate to move, thus reducing pressure between plate and sprocket. A collar was inserted between the bearing and plate to prevent this movement. Further, this clutch is questionable in operation, and should be replaced with a serrated hub type which is audible when slipping and is less affected by dirt, grease and wear.

3.3 Cylinder: Morgan rubber rub bars are bolted to a round drum to form a threshing cylinder. To reduce power requirements, the bars are fastened to the drum at a slight diagonal to produce a shearing effect against the concave bars. The rubber bars are manufactured by vulcanizing rubber onto a flat steel backing. When the flat bars are bolted to the round drum, a gap between the bar and drum is left. The gap is of variable width due to the diagonal mounting of the rub bars. This gap is covered with sheet metal covers fitting between adjacent rub bars. After some use, the bars tend to tip slightly and slip away from the cover, leaving a gap where seeds can lodge. This gap could be eliminated by vulcanizing the rubber to a form fitting backing plate, or by attaching the bars to a flat surface.

At high cylinder speeds the rubber bars pulled away from the drum due to the centrifugal force (See Fig. 3). Only three bolts were used to attach the bars. Two more bolts on each bar were added to secure the bars which prevented any further bending.

3.4 Initial Cylinder Clearance and Wear

On receipt of the thresher and after initial tests, measurements on cylinder-concave clearances were made. The cylinder was tested for concentricity by aligning a steel bar with the cylinder axle and using a dial indicator to measure the difference in axial radius of each bar. Maximum difference was 1.2 mm (0.50 in.) which is probably acceptable for large seeds but inefficient for small forage seeds.

In a second test, the clearance between the concave and cylinder bars was measured by placing a pliable putty on four places on the concave bars, the machine set at the closest possible clearance and run for a few seconds. Clearance ranged from 0 to over 12 mm. An adjustable pivot was installed at the hinge point of the concave to permit verticle adjustments, and new adjustment cams keyed to a cross-shaft were installed to allow more precise adjustments of the lower end of the concave. This allowed the concave to be adjusted to touch the rub bars, and also provides adjustment for the wear.

To even the run out of the cylinder, a technique was developed to grind the rubber bars on both the concave and cylinder to ensure the maximum rubbing effect which is important in threshing forages. This technique has since been developed to redress the bars once each season to prolong the life and efficiency of the bars.

A 1 inch square steel bar was drilled with appropriate holes to replace one concave bar. The corners of the outward face of the steel bar were ground to a 6 mm radius. A sheet of #40 closed coat garnet cloth was clamped under the bar and folded over the top of the bar, and fitted between the concave and cylinder. The concave was set to the thickness of the garnet cloth and the thresher run for 30 minutes. The rubber concave bar was replaced and the process was reversed by clamping the garnet cloth under one sheet metal filler on the cylinder. The machine was again run for 30 min. After removal of the garnet cloth, the edges of the concave bars were trimmed with a portable grinder and the concave was set to touch over the radial segment. This technique permits the bars to be used several seasons before replacement. At the third dressing, it was necessary to add shims behind the concave bars to extend the bars into the cylinder. The technique can be used until holes drilled in the rubber bars for attachment begin to show.

Clear plastic windows were installed in the side of the concave at the first concave bar to assist in setting clearances.

4.0 Curtains

Two weighted curtains were added to the straw deck cover to slow the flow of material on the straw walker for better seed recovery.

5.0 Auxiliary cleaning sieve

It was difficult to obtain a clean sample from the single cleaning sieve. A second sieve was added below the adjustable sieve. A sieve from a Clipper M-2B[3] seed cleaner was chosen because of availability of a wide range of sizes. Sheet metal sides were suspended from the adjustable sieve and a sloped grain pan installed between the sides to direct all material falling through the adjustable sieve to the front of the second sieve. The second sieve fits into grooves formed in the sheet metal sides. The back of the original seed plenum was removed to allow debris from the second sieve to exit from the machine. Operation of the blower on the adjustable sieve was not altered appreciably as the grain pan confined the air flow to the same pattern as existed before the alteration. Seed is collected in the same collection pan. While this method of attachment of the second sieve is satisfactory, a better method would be to oppose the motion of the lower sieve to the upper sieve to balance the vibratory effect of the sieve movement.

6.0 Engine

The recommended engine for the thresher is a 7 H.P. air cooled gasoline model with disc clutch to be operated in the speed range of 2000 to 2100 rpm. In use for forage threshing, this engine is under powered as starting the thresher while the cylinder is in the upper speed range requires slipping the clutch for an excessive period. Also, as the engine is operating at a speed below its torque peak, any extra loading

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[3] A.T. Ferrell & Company, Saginaw, Michigan, U.S.A. 48602.

of the cylinder will slow the engine. A larger engine, possibly 12 H.P. operating at 200 rpm over its torque peak, is recommended. An engine with a counterbalanced crankshaft would be an advantage to reduce the amount of vibration at the operator's platform.

7.0 Safety

The machine included, as standard equipment, guards for the belt drives, and a guard rail around the operator's platform. Controls for the engine and clutch were extended to the platform to give the operator control of the engine.

A removeable pin was placed in the concave lifting mechanism to lock the concave in the up position to prevent the heavy concave from falling accidentally.

8.0 Performance

The thresher has been used for four years with the modifications as noted. Species included: timothy, brome, orchard, kentucky blue grass, fescues, reed canary, tall oat grass, crested dogs tail, meadow fox tail, alfalfa, red clover, ladino, trefoil, zig-zag clover, vetches and flat pea. Some species required two passes through the machine.

Dressing of the cylinder and concave bars was required annually. The remainder of the machine required little servicing and has proven to be dependable except for the tachometer which was not secured properly.

Time loss was noted primarily in starting the cylinder from a stop after inspection between samples. Elevation of unthreshed samples to the elevated hopper is time consuming.

The sample obtained with the secondary cleaning sieve is suitable for subsequent cleaning without overloadng the cleaning device with trash. The controls permitted seed to be threshed with minimum damage, but leaves the responsibility for accurate settings to the operator.

Operator convenience is good for controlling and feeding the machine after extension of the controls, but operator comfort is lacking due to excessive vibration of the motor and shaker sieve. Safety for the operator is probably best for any machine commercially available after the feed beater is modified. All drives are well guarded and the platform is large with a railing. Dust level is comparitively low for a hand fed thresher because of the seal afforded by the feed beater.

9.0 Conclusion

The problems encountered with this machine were communicated to the manufacturer along with suggested improvements. This thresher can be recommended for threshing of experimental samples providing the following improvements are incorporated into the manufacture.

1. Rubber extension paddles attached to the feed beater to improve the operation and safety of the feed beater.
2. A serrated slip clutch should be installed on the feed beater drive.
3. Each rubber rub bar should be attached with 5 bolts, or a heavier back plate used.
4. The cylinder concave housing should have adjustable pivot points, and the adjusting cams should be keyed to the adjustment control shaft.
5. A locking pin should be available to lock the concave in the up position for safety reasons.
6. Clear plastic windows - easily removeable - should be placed at the periphery of the cylinder drum on the side of the concave housing to aid in cylinder-concave adjustments.

7. Curtains should be installed over the straw sieve to retard the flow of threshed material.

8. An auxiliary counterbalanced screen should be incorporated if the thresher is to be used for hard to clean crops.

9. If a gasoline engine model is to be ordered and the thresher will be used for crops requiring a high cylinder speed, a 14 h.p. counterbalanced engine should be considered. Controls should be extended to the operator's platform.

10. The manufacture should ensure that the tachometer is properly mounted.

11. Efficiency would be improved somewhat with the addition of a sample elevator.

10.0 References

Harmond, J.E. and L.M. Klein. A versatile plot thresher. USDA - ARS 42-4-1. Rev. June 1964.

Manufacturer: Mater Machine Works,
520 S.W. First St.,
Corvallis, Oregon 97330,
U.S.A.

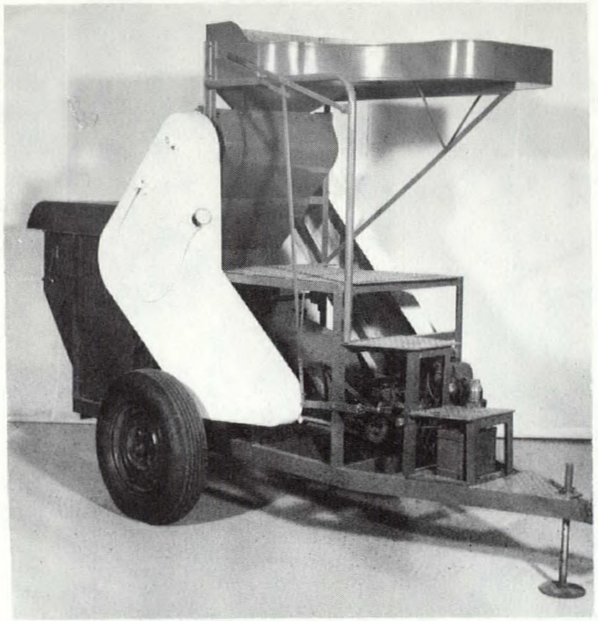

Fig. 1. Oregon Plot Thresher

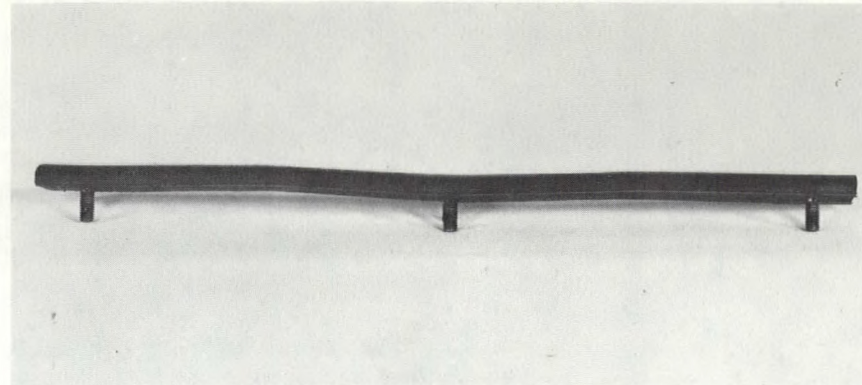

Fig. 3. Rub Bar bent by centrifugal force

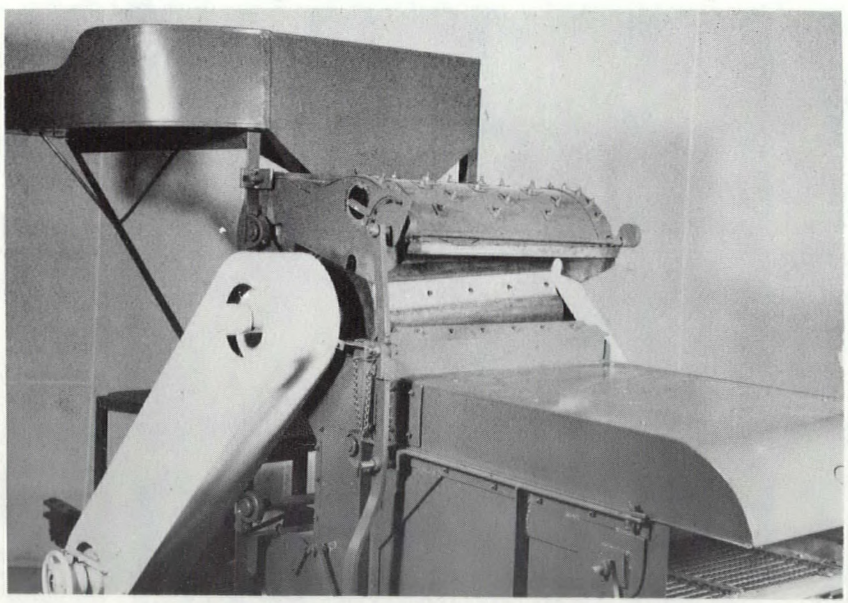

Fig. 2. Concave open

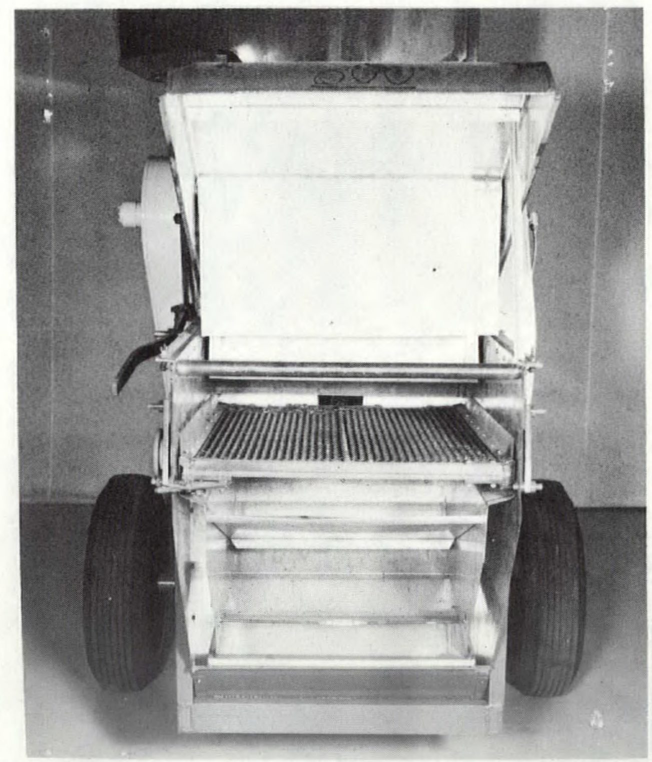

Fig. 4. Straw deck cover open showing straw deck & auxiliary screen