

A Versatile New Experimental Thresher¹

THE improvement of machines for threshing nursery rows and test plots of small-seeded grasses and legumes is a continuing problem confronting agronomists, plant breeders, plant pathologists, and other agricultural scientists. The principal problems encountered in test plot threshing have been (1) recovery of essentially all of the seed present in widely varying amounts of harvested material in an undamaged condition, and (2) the avoidance of seed mixtures when different species and varieties are being threshed. Also, there has been a need for an easily transportable machine that can be readily adjusted to thresh not only the small-seeded grasses and legumes, but also vetches, peas, and cereal grains.

An experimental thresher to meet all of these requirements was developed recently by the United States Department of Agriculture and the Oregon Agricultural Experiment Station, cooperatively (see figure 1). Before constructing the thresher, several references were consulted and agricultural workers contacted to gain information on experimental type threshers already in use, and to determine the merits of the different types of threshing cylinders.

Allen,² Jones and Bunnelle,³ and Park, et al.,^{4, 5} showed the relationship of cylinder speed to seed quality, which

¹ Miscellaneous Paper No. 20, Oregon Agr. Exp. Sta. Received Dec. 27, 1955.

² Allen, C. E. Threshing damage to Tualatin tall oatgrass (*Arrhenatherum elatius* var.) seed. Unpublished data. Farm Crops Department, Oregon State College, Corvallis. 1954.

³ Jones, Luther G., and Bunnelle, Philip R. Alfalfa seed harvesting. Unnumbered mimeographed publication, University of California, Davis.

⁴ Park, J. K., Dunkelberg, G. H., Craig, J. T., and Vaigneur, O. H. Crimson clover harvesting tests. Unpublished special report. U.S.D.A. and South Carolina Agr. Exp. Sta. cooperating. 1952.

⁵ Park, J. K., Richardson, J. B., and Hilliard, J. W. Crimson clover harvesting tests. 1954. Unpublished special report. Clemson College, Clemson, S. C.

emphasized the need for easy, quick speed adjustment and an accurate speed indicator. Park,^{4, 5} reported the superiority of the angle bar cylinder for threshing crimson clover. Hawthorn^{6, 7} suggested the use of interchangeable screens for greater efficiency. Elling⁸ reported the use of an adjustable thresher sieve. Vogel, et al.⁹ described a thresher that is especially well adapted for threshing cereals, but which lacks screen capacity, ease of cylinder speed adjustment, and concave clearance adjustment for small-seeded crops, vetches, and peas.

Description

The new machine is a mobile unit, mounted on a 2-wheeled, rubber-tired trailer and is designed so that the over-all height is at a minimum and the center of gravity is low, thus facilitating transportability, operation, and storage. The principal features of the machine are as follows:

A feed regulating cylinder running at 65 rpm and driven through a slip-clutch, meters the flow of material into the threshing cylinder. This feature avoids overloading, aids in maintaining a constant flow of material through the machine, protects the operator from objects that might be thrown from the threshing cylinder, prevents valuable seed from being thrown out, and provides a safety device in the slip-clutch that reduces possibilities of serious injury to the operator, and damage to the machine, should the

⁶ Hawthorn, Leslie R. Successful small thresher. *Seed World* 64:28-31. Feb. 7, 1949.

⁷ Hawthorn, Leslie R. Supplementary information for aid in the construction of the Utah thresher. Mimeographed publication. U.S.D.A., A.R.A., B.P.I.S.A.E., Division of Fruit and Vegetable Crops and Diseases, in cooperation with the Utah Agr. Exp. Sta. March 1949.

⁸ Elling, L. J. Letter and descriptive material dated April 27, 1954, to J. R. Cowan.

⁹ Vogel, O. A., Hermann, Wilford, and Nofziger, Loy M. Two improved nursery threshers. *Jour. Amer. Soc. Agron.* 30:537-542. 1938.



FIG. 1.—Versatile new experimental thresher that can be quickly and easily adjusted for use in processing either cereal or small grass and legume crops.

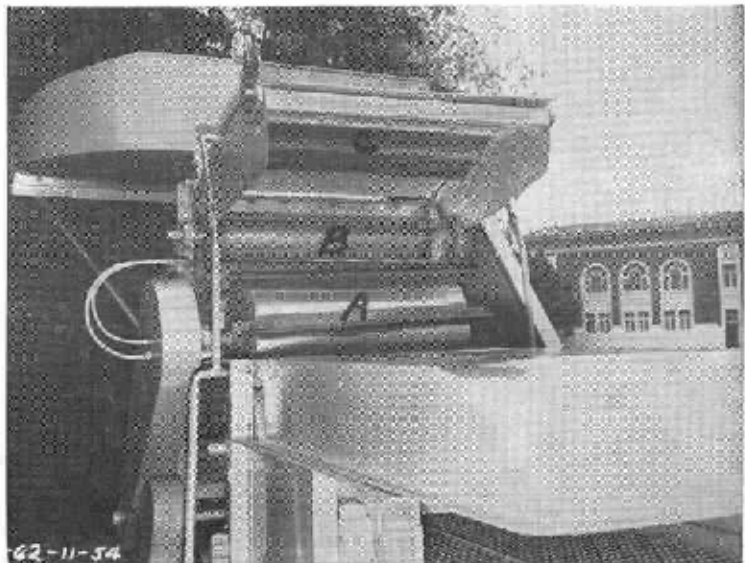


FIG. 2.—Experimental thresher with lever-opening hood in the raised position exposing threshing cylinder—A; feeder cylinder—B; and concave bars—C. The hood can be quickly raised for inspection and cleaning.



FIG. 3.—Experimental thresher with sieve hood raised, and a section of the seed chute removed exposing the sieve for inspection and cleaning.

operator get his hand, a brush, broom, or other solid material into the feeder cylinder (see figure 2).

The threshing cylinder is a modified unit from the AC All-crop Harvester No. 40.¹⁰ The cylinder is 15 inches in diameter, is of light construction, and operates on the over-shot principle, with the concave bars above the cylinder. The cylinder drum is completely enclosed to eliminate places where seed might collect and result in mixtures. The threshing surfaces are rubber-covered angle bars on the cylinder and rubber-covered concave bars. These rubber surfaces are effective in reducing damage to seeds.

Different crops require different cylinder speeds and concave clearances for most efficient threshing. Proper cylinder speed is particularly important in that excessive speed has been shown to contribute more to seed damage and reduction in seed quality than any other part of the threshing process. A lever-adjusted variable speed V-belt regulator is used to obtain the desired cylinder speeds, which can be varied from 400 to 2,000 rpm, giving peripheral speeds of from 1,572 to 7,860 feet per minute (see B in figure 4). A built-in speedometer accurately indicates cylinder speed in revolutions per minute. A chart beside the speedometer transposes the rpm speeds into peripheral

¹⁰ For identification and does not imply endorsement or recommendation of a manufactured product.

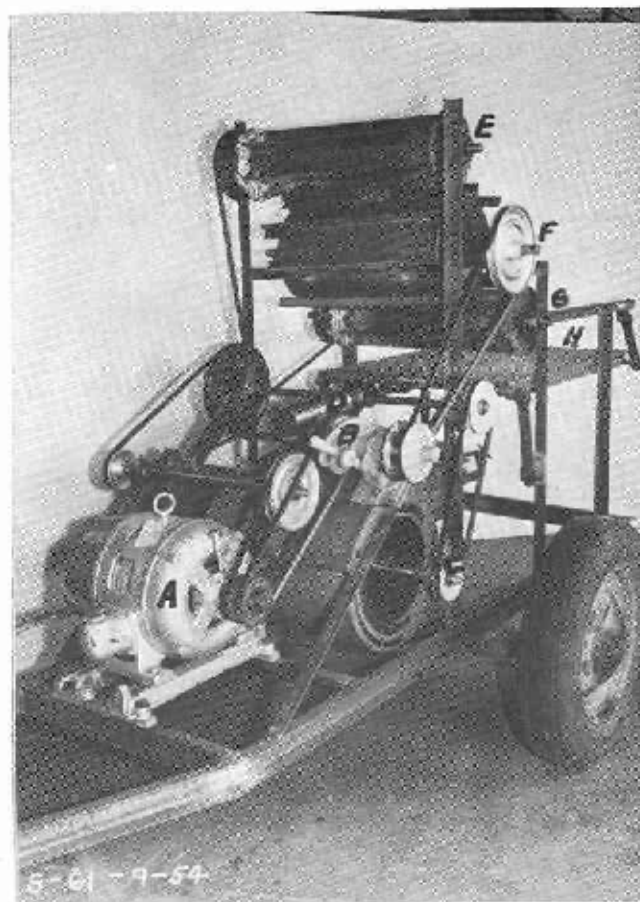


FIG. 4.—Experimental thresher under construction, showing the pertinent parts: A—Electric motor; B—Variable speed, 5 to 1 ratio for threshing cylinder; C—Fan; D—Counter weight for the adjustable sieve; E—Feed cylinder; F—Threshing cylinder; G—Retarder cylinder; H—Adjustable sieve.

speeds. The variable speed mechanism affects only the threshing cylinder. All other machine parts, except the fan, run at a constant speed. The fan has a high and low speed, adjusted by exchanging the drive and fan pulleys.

Clearance between the cylinder bars and the concave bars is accurately controlled and indicated by a lever which changes the clearance $1/32$ of an inch for each $1/4$ inch of lever motion. Clearance can be varied from $1/64$ of an inch to 1 inch.

Below the threshing cylinder is another regulating cylinder which travels at 65 rpm and serves as a check for the material that is being discharged at high velocity from the threshing chamber, and distributes it evenly onto the sieve.

The sieve is a standard adjustable unit from a Case A-6 combine,¹⁰ altered so that the openings are set by means of a graduated scale and lever. It may be opened to 1 inch or completely closed (see figure 3). Adjustment of this sieve is important, particularly in the case of certain legumes which do not thresh easily and which may require re-running. In such instances the sieve is set to admit only the threshed seed. The remaining material travels over the sieve, is caught in a box at the end of the machine and is then re-threshed. The machine is usually operated with the sieve at the level position. An increase in the screening action is obtained by tilting the sieve upward. This is

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accomplished by setting the adjustable stand-post under the trailer tongue to give the desired sieve angle.

The fan is a standard item of the AC All-crop Harvester No. 40. It is equipped with a graduated lever by which the baffles at the fan discharge are adjusted, thus controlling the air blast from full-closed to full-open. In this way, the air volume can be reduced to clean light grass seeds and increased to clean heavy grains. The fan operates at a constant speed of about 632 rpm on high speed and 217 rpm on low speed (see figure 4).

The threshing machine is designed for rapid and thorough cleaning and easy inspection of the various parts. The cylinder and sieve are easily and quickly inspected by raising the respective hinged covers (see figures 2 and 3). In most cases the machine can be cleaned between lots by increasing the cylinder speed to around 2,000 rpm and by opening and closing the sieve. An auxiliary compressor provides air for blowing around the cylinder ends and the sieve, should it be necessary.

The unit is powered by a 3-hp electric motor, but is designed so that a small air-cooled gasoline engine can be used.

Among the legume seed crops threshed with the machine are birdsfoot and big trefoils, white, sub, and crimson clovers, *Astragalus* species, vetches, and peas. Cereals and forage grasses threshed include wheat, oats, barley, proso

millet, red fescue, chewings fescue, tall fescue, tall and intermediate wheatgrass, perennial and common ryegrasses, tall oatgrass, Merion Kentucky bluegrass, orchardgrass, and bentgrasses. Miscellaneous plants include buckwheat and burnet.

The threshing cylinder is designed to have a maximum capacity of about 30 pounds per minute of wheat plant material under continuous feeding. With grass seed crops such as tall and red fescues, perennial ryegrass, and orchardgrass, the machine will easily thresh 10 to 20 pounds per minute of plant material, depending upon its condition. When threshing different lots of identical material, no more than 15 seconds are required to let the machine run clean, and empty and replace the seed pan in readiness for the next lot. When different species, varieties, or strains are being threshed and seed mixtures must be prevented, 1 to 2 minutes' cleaning time between lots, depending upon the crops involved, is required to thoroughly clean the machine.

The machine was efficiently operated with a two man crew during the 1955 season for threshing many of the seeds produced in the breeding and other research plots of the Oregon Agricultural Experiment Station.—JESSE E. HARMOND and HENRY H. RAMPTON, *Senior Agricultural Engineer and Agronomist, respectively, U.S.D.A., A.R.S., Agr. Eng. Research Branch and Field Crops Research Branch, cooperating with Oregon Agr. Exp. Sta.*