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Harvesting With the Combine In Minnesota

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THRESHING small grains in the same operation with cutting the crop or picking it up from the windrow is spoken of as "combining." Machines used for this purpose are usually called "combines" or "combine harvesters."

Combining was first practiced in Minnesota in 1927. During the following three or four years about 250 machines were put into use by farmers in the state. No machines were sold during the depression years, but in 1936 and 1937 they were sold in larger numbers than ever before.

The first combines were large, ranging in size of cut from 10 feet to 20 feet. Now, most combine manufacturers are building comparatively small machines, with a capacity equivalent to that of a grain binder. The width of the swath ranges from 5 feet to 8 feet. The capacity of the threshing mechanism is in proportion to the width of cut.

The small combine costs considerably less than the larger machine. Consequently, a farmer with an average acreage of small grain may purchase a combine at an investment not much greater than is represented by the ownership of a grain binder and a part interest in a stationary thresher.

ADVANTAGES OF THE COMBINE

Farmers are interested in machines that save time and labor. This is the chief advantage offered by the use of the combine. The large threshing crew is not necessary. With the completion of cutting, the grain is also threshed and in the bin instead of waiting to be shocked and later hauled to the machine for threshing. The cost of twine has also been saved. The actual time required for harvesting is relatively short.

CONSIDERATIONS FOR SUCCESSFUL USE OF THE COMBINE

The combine method of harvesting differs in many respects from the customary use of the grain binder and stationary thresher. The use of the combine introduces new problems, and, if it is to be successful, the practice must be adjusted to provide a solution for these problems.

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Moisture Content

Threshed grain that has too much moisture will not keep well in storage. This becomes important when harvesting with a combine. When normally cut with the binder, grain has a moisture content of about 30 per cent. For safe storage, the moisture content of threshed grain should not exceed 14 per cent. A high moisture content in grain harvested with a combine may be due to the fact that it is not sufficiently ripe. Some fields ripen unevenly, parts of the field being green while other parts are sufficiently ripe for combining.

The presence of green weeds usually results in a high moisture content in the grain. Weed seeds are often less ripe than the grain. Small pieces of green weed plants are difficult to separate from threshed grain and when mixed with it tend to raise the moisture content of the grain. Harvesting should not be started too early in the morning after heavy dews or too soon after rains.

Behavior of the Crop When Not Harvested at Binder Harvest Time

It is desirable not to harvest with the combine until the moisture content of the grain is sufficiently low for safe storage. The length of time to delay harvesting after normal binder harvest time varies with crop and weather conditions. It may be only three or four days, and it may be 18 or 20 days. Most farmers who have been accustomed to cutting their grain at binder harvest time do not care to risk leaving the crop uncut during this period. It is subject to lodging, crinkling, and shattering for varying periods of time. A certain portion of the grain on such fields has either fallen to the ground or is so near the ground that it cannot be recovered with the cutter bar. Losses due to these conditions vary a great deal with weather conditions such as wind, rain, and hail. Studies that have been made indicate that, during favorable weather conditions, such losses range from less than 2 per cent to as high as 9 or 10 per cent. In a field of barley this loss was found to be 10.5 per cent, and in a field of rye it was 15.3 per cent of the yield. In the latter case, there was considerable hail damage. Unfavorable weather conditions when the grain is nearly ripe make losses higher.

It was not determined what the losses were on these fields at binder harvest time. Available data on losses on other fields at binder harvest time, however, indicate that, on the average, the losses at that time are considerably less than they are at the time the grain is sufficiently ripe for direct combining.

Presence of Weeds

Weeds are detrimental to direct combining. Most weeds are still green when the grain is harvested, and the seeds of many of them have a very high moisture content at that time. Parts of green weed plants are separated from the grain with difficulty because of their weight. These, together with green weed seeds that get into the grain, transmit moisture to the grain and reduce its keeping quality.

Threshing difficulty is increased by the presence of green grass and weeds. It is increased still more if the grain has lodged or crinkled in a growth of green material. Under such conditions, it is desirable to cut close to the ground to pick up as much of the grain as possible. While doing so, large quantities of straw and grass go through the thresher, and this reduces the efficiency of the machine. For most efficient threshing, it is best to leave a long stubble and keep the volume of straw going through the machine as small as possible.

Handling Straw

When the combine is used, the threshed straw from the separator is deposited on the ground. On most machines, there is a device for spreading the straw if the operator does not wish to use it. If the straw is to be used, it may be deposited in the form of a windrow and may then be picked up with a hay loader and hauled to the farmstead, or it may be picked up from the windrow and baled automatically with the pick-up baler. Some combines have attachments by means of which straw may be deposited in bunches.

WINDROWING

Windrowing consists of cutting the crop and laying it on the stubble in the form of a windrow. When this practice is followed, the crop is cut at about the same stage of maturity at which it would normally be cut with the binder. It is then allowed to remain in the windrow for several days. The moisture content of the grain is reduced more rapidly in the windrow than when the grain is left uncut. There is also less danger of losses from wind, hail, and rains.

The machine used for windrowing consists essentially of a cutter bar with a platform and canvas so arranged that the cut grain is deposited on the stubble, forming a windrow in which the stems are laid parallel to the direction of travel and are lapped over each other in such a way that the heads are on top of the windrow and the butts of the stems are beneath and covered.

Binders are occasionally used for windrowing. If a grain binder is used, the binder head should be removed so that the cut grain may be permitted to drop freely to the stubble as it is delivered to the deck of the binder.

Grain that has been windrowed is later harvested with the combine which has a "pick-up" device attached to the cutter bar. By means of the pick-up, the windrow is raised off the ground and is, in most cases, deposited on the platform of the combine. From there it is handled in the same way as grain that is cut with the combine and threshed at the same time.

The machine that is used for windrowing should have the cutter bar on the same side on which the pick-up attachment is located on the combine. For example, a windrower with a left-hand cut goes around the field counter-clockwise. The windrow which it makes has the heads pointing in the direction opposite to the direction of travel. It will be necessary to pick up this windrow while traveling in the same direction that the windrower traveled when making it. It is obvious that a combine with a left-hand cut must be used if one is to start around the outside of the field and follow the same course that was followed by the windrower. If a combine with a right-hand cut is used for picking up the windrow that has been made by a windrower with a left-hand cut, it will be necessary to start in the middle of the field and work toward the outside. This method is not very satisfactory because the tractor must travel over the windrow at each corner before that portion of the windrow is picked up, and it is difficult then to get all of the grain at the corners.

It is important that the windrow be laid on stubble that is standing up well and that has not been broken down with a wheel of the tractor or of some other machine.

Size of Windrower Compared with Size of Combine

When the windrow method is used, it is advisable to use a windrowing machine that has a width of cut which is the same or nearly the same as that of the combine. The threshing and separating parts of the combine are designed to handle the quantity of straw that will normally be obtained by the cutter bar of that combine. If, for instance, with a normal stand of grain, a 10-foot windrower is used to cut a crop which is later to be picked up and threshed with a 6-foot combine, it is obvious that the thresher will be seriously overloaded. Such overloading will result in a poor job of cleaning and in poor separation, permitting large quantities of grain to go out with the straw.

A windrow made from a swath wider than the cutter bar of the combine is permissable in a very light stand, or where the combine is pulled at a very low speed. Such a combination of circumstances, however, is the exception rather than the rule. It is best, as a regular practice, to keep the size of the swath cut by the windrower about equal to the width of the cutter bar on the combine.

MACHINE OPERATION AND ADJUSTMENT

Proper adjustment of the machine is necessary for good results. One should be familiar with the functions of the various parts of the machine and should know the purposes of the adjustments that are possible. The combine may be adapted to the handling of a variety of crops under many conditions by the use of proper sieves, air blast, concave adjustment, and speed of the various parts as well as the speed at which it is drawn over the ground. Tests conducted on small combines indicate that losses of grain in the threshing operation need not be very high. In fact, some combines were operating with threshing losses of less than 1 per cent, and many had losses within the range of 1 to 3 per cent. In a few cases, these losses were very high, running up to 22.5 per cent. In practically all cases it is possible to reduce the losses due to threshing and separating to 1 per cent or less by proper operation and adjustment.

Each crop requires certain adjustments of the machine. The best way to find out what these are is to study the service manual furnished by the firm making the machine. Besides the regular adjustments required for any particular crop, judgment must be exercised for the most successful handling of any particular situation. When straw is heavy and when for some reason it is necessary to cut close to the ground, it is easy to overload the straw racks. This can be controlled by the rate of travel. While the rate of travel may be relatively high (3 or 4 miles an hour) where the crop is light, it must be reduced when a large quantity of straw is to be handled. In tests last summer, the rate of travel of most machines varied from 2.25 to 3.5 miles per hour. One traveled 1.38 miles and another 5.25 miles an hour. The average was 2.82.

The setting of the concaves or threshing bar with respect to the cylinder is also important. There should be a sufficient number of concaves and they should be set close enough to the cylinder to insure all of the grain being removed from the heads. It is unwise, however, to have them set so that the straw breaks smaller than is necessary. Too much chaff interferes with the proper functioning of the cleaning shoe, and small pieces of leaves and stems are difficult to separate from the grain.

All of the grain is not recovered by the cutter bar or pick-up attachment. The losses resulting from these operations vary with conditions. They should be added to the losses resulting from the threshing operation to obtain the total loss of grain in the combine method of harvesting. The losses at the cutter bar on machines that were tested last summer ranged from a trace to as high as 15.3 per cent. The average of all machines tested was 3.73 per cent. This loss need be no higher than similar losses with a grain binder. In fact, they should be lower, because when cutting lodged grain with the combine one is not concerned with making bundles. The only concern is to get the grain on the platform of the combine.

Total losses with combine harvesting are usually less than losses with the binder and stationary thresher method of harvesting under similar conditions.

CAPACITY AND RATE OF PERFORMANCE

The number of acres that may be harvested per hour or per day depends on the width of cut, the rate of travel, and the amount of time lost in stopping. A formula that will give approximately the daily capacity of a machine is the following: Acres per 10-hour day = width of machine in feet $\times$ speed in miles per hour. A machine that cuts a swath of 5 feet traveling at the rate of 3 miles per hour might be expected to do 15 acres in a 10-hour day if the only time lost is that which would normally be lost in turning.

The number of hours per day during which combining may be done varies with weather conditions. If there is dew during the night, it will be necessary to delay starting in the morning until the dew has dried off. This may be nine or ten o'clock or even later. When there is no dew and the crop is sufficiently dry and ripe, combining may be started early in the morning. After rains or on damp days, the grain must be allowed to dry well before harvesting.

To prevent unnecessary losses, it is advisable to harvest the crop as soon as possible after it has become sufficiently ripe. Enough machine capacity should be available so that the harvest may be completed without too much delay. The number of acres that may be harvested in a year will depend on the range in the ripening dates of the crops to be harvested as well as on weather conditions.

On the other hand, if the investment in the machine is to return most profits, the combine should be used to harvest as many acres as possible during the season. In many communities, combine owners harvest crops for their neighbors. The charge is usually on the acre basis and varies in different communities. It varies from $2.50 to $3.00 an acre for the use of the combine, tractor, and operator for direct combining. The cost of windrowing depends on such factors as the size of machine used and the number of men needed. The minimum cost is about 50 cents an acre.

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