Harvesting Seed of
VETCHES • WINTER PEAS • CRIMSON CLOVER • RYEGRASS

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Figure 1. A regular grain combine equipped with a pick-up reel, floating cutter bar, and lifter guards for harvesting Austrian winter peas direct. Pick-up reel raises lodged crop and pulls it back over the sickle bar and onto the draper. This is an excellent method of combining lodged crops.

Figure 2. Header on a small combine. The "gooseneck" as shown on the inside and outside shoe help in cutting lodged tangled crops. Lifter guards on the sickle bar assist in either cutting the standing crop or in elevating the windrow onto the elevating draper. For picking up windrowed crops, the reel, in most cases, is not necessary.
Harvesting Seed of Vetches, Winter Peas, Crimson Clover, and Ryegrass

By

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INTRODUCTION

OREGON farmers increased their acreages of winter legumes and ryegrass from an estimated 280,000 in 1941 to approximately 400,000 for harvest in 1942, with another probable increase expected in 1943. Seed of these important nitrogen-gathering and soil-protecting crops is essential to the nation's war program, and its production is one of Oregon agriculture's major wartime jobs.

Many new seed growers and many experienced growers are working with new and different machines. Labor shortages may require shifts to different harvesting methods. The purpose of this bulletin is to furnish practical information on harvesting these seed crops. It is hoped that it may help to prevent loss of seed, delays, and unnecessary expense in harvesting. Included in the text is knowledge gained from the experiences and opinions of many winter legume and ryegrass seed producers of Oregon.

WAREHOUSE AND CLEANING PROBLEMS AFFECTED BY HARVEST

Growers may assist in avoiding warehouse and cleaning "bottlenecks" by good management and, at the same time, may produce a higher yield of clean seed with lower cleaning cost.

Surveys of the fields before harvest may show portions of the field having mixtures of crops that produce seeds of similar size, such as winter peas and common vetch, which are hard to separate.

There may be patches of corn cockle in the hairy vetch or tarweed or Canada Thistle in the ryegrass.

Wild garlic patches in hairy vetch are particularly bad from the seed-cleaning standpoint, and patches of cheat in the lower ground of crimson clover fields may make it necessary to label the seed from such fields as carrying noxious weed seed. If such areas are observed before harvest and handled separately, much of the loss may be avoided. Cutting such mixed or weedy patches for hay or threshing them separately may save warehouse space, cleaning time, loss of seed through cleaning shrinkage, and actual loss of money.
Pure, live seed is what counts. Broken or damaged seed brings less money and dead seed produces no nitrogen-gathering crops.

**CRACKING AND DAMAGING OF SEED**

Probably 95 per cent of the cracked or damaged seed is caused by too high a cylinder speed. Vetch seed and Austrian winter pea seed are damaged very easily in this manner. About 95 per cent of cracked seed caused by cylinder. On many days, it will be necessary to slow down the cylinder and lower the concave adjustment during the heat of the day if cracking is to be kept to a minimum. Austrian winter peas and vetch, with the exception of Hungarian vetch, thresh very easily and often require no concave teeth. The more the cylinder teeth are worn, the better for threshing these crops. Where grain is threshed with vetch and peas, a higher cylinder speed is required than where the grain is not present.

Damage to the seed results, in some machines, from the cylinder or beaters throwing the seed against sharp corners or hard surfaces, such as grate bars or the straw-rack housing. This can be prevented by covering bars with sheet metal or by padding unprotected parts with rubber or canvas.

![Diagram](image)

Figure 3. Illustrating spike tooth concave and cylinder adjustment. A. Cylinder teeth not properly centered with concaves. Worn bearings may cause side play resulting in this spacing. B. Concave adjusted too low. C. Concave adjusted high. D. Concave and cylinder adjustments properly set. After U.S.D.A. Farmers Bulletin No. 1761.

Another source of damaged seed is uneven feeding. A good way to lose money is to run the machine empty for a few seconds. When the crop is again fed into the empty cylinder with no cushion of straw, breaking of seed is inevitable.

In the case of peas and vetch, the return should be worked as little as possible. Seed that comes back to the cylinder through the
return may be damaged. A faulty or badly adjusted auger that crushes seed against the housing is another source of injury.

**REMOVING GRAIN FROM PEAS AND VETCH**

With a likelihood during wartime of overburdened storage and cleaning facilities, farmers should do as much cleaning and separating on the combine or threshing machine as possible. Farmers who feed livestock would find it profitable to keep the grain at home. Scour or “squirrel cage” cleaners can be attached to most machines. If a rotary screen is not used, then a flat screen can be added that will separate peas from grain. Some common vetch can be separated on the machine but not so satisfactorily as peas.

Some farmers are installing their own small cleaning plants to rough out their seed and that of some of their neighbors. This “scalping” is a profitable thing to do, at least for the larger growers.

**COMBINING THE STANDING CROP**

Direct combining is the cheapest harvesting method and has been generally satisfactory with Austrian winter peas and Hungarian vetch, which do not shatter as readily as some other seed crops. An increasing number of growers prefer to combine common and even hairy vetch. If the acreage is small so that harvest can be completed within a few days and the crop matures evenly without too many green weeds, direct combining is successful even on the crops that shatter quickly. It is less satisfactory on land irrigated with the corrugation system, since it is difficult to hold the cutter bar down when crossing the corrugations. With crops that shatter readily, it is not safe to plan on combining a larger acreage than can be completed in 3 to 6 days. In other words, if a small combine with a 5- to 8-foot cut is used, 40 to 60 acres of hairy vetch is maximum for one combine without severe loss from shattering. For Austrian winter peas, that acreage could be about doubled. Common vetch is between the two.

Directly combined seed contains more green material and immature seed with a high moisture content; therefore, heating in the bag or bin may result unless proper precautions are taken. Sacks should be stood up in the field, turned end for end occasionally, and left for a few days to dry the seed thoroughly. Some operators fill their sacks only one-half to two-thirds full, which allows more rapid drying.
If one has a large acreage, it is often desirable to use more than one method of harvesting. In order to start the combine earlier, one-third of the acreage might be windrowed and threshed from the windrow. By the time the windrowed portion is finished, the remainder of the field will probably be ready for direct combining. If the field is maturing too rapidly for combining all of it, a portion might be shocked, then threshed last. The oper-

Figure 4. Detail of a swinging swather and "gooseneck" attached to the sickle bar. The above picture shows how the swather tines swing around when the mower makes a turn. A large "gooseneck" such as illustrated on the lower picture is desirable for cutting tall, tangled crops.

ator should determine the ripest portions of the field and harvest those areas first, even if considerable cutting-up of the field is necessary. If the weather is warm as the field approaches maturity, the crop will ripen very quickly. One day the field may appear to be 3 days early for harvesting, and the next day it may be 2 days late in the case of crops that shatter easily. In the early morning or late
evening conditions may be unfavorable for threshing. Seldom should a machine be run with the same adjustments all day. The cylinder speed, concave setting, amount of wind on the screens, and other adjustments that are right in the morning may be entirely too severe in the heat of the day.

Direct combining has an advantage over picking up from the windrow in that the operator can cut the size of the swath to suit the machine. If it is in the windrow, he is forced to take the full amount even though it may be too large for the capacity of his machine.

When combining lodged, viney growth, the crop may tangle on the outside divider. This can be corrected by adding a loop divider or “gooseneck” to the outside divider. The attachment can be made by bending a pipe or strap iron into a loop and fastening it underneath the runner and to the side of the platform. It rides over the lodged crop, pushing it down, enabling the sickle to cut a clean swath. Most of the new small combines come equipped with this device.

A pick-up reel is an excellent addition to any combine for cutting lodged crops. The reel has fingers that raise the crop ahead of the sickle bar and push the cut material onto the draper. Many of these devices are used in eastern Oregon, particularly in harvesting cannery peas. They also can be used on draper-type windrowers or even on mowers.

**COMBINING FROM WINDROW**

Combining from the windrow is the most common practice in harvesting winter legumes and ryegrass in western Oregon. It is used on all the crops and under a wide range of conditions. It is very important that windrows be small, uniform, and unbroken so that a continuous, even flow will feed into the machine. Whenever a space occurs in the windrow, the separator runs empty for a few seconds, and the cylinder speed increases. With no straw in the machine, some seed is sure to be cracked when feeding resumes. When a large “slug” overloads the combine, some unthreshed seed will be carried over with the straw.

The importance of small windrows cannot be overemphasized. Few, if any, of the combines have been built to handle windrowed material. They are adequate for heading standing grain but not for threshing the entire growth from the full width of the cutter bar. If
a 5-foot swath of heavy growth is picked up with a 5- or 6-foot machine, there is likely to be too much straw to permit an efficient job of threshing. With all crops discussed, except ryegrass, a 12- to 15-foot combine will handle a 7-foot windrow; a 10-foot machine is required for best work on a 6-foot windrow; and a 5- to 8-foot machine should not be expected to handle more than a 4- to 5-foot windrow. A larger cut can be handled in grass seed crops. Slower forward speed and more time will be required to thresh windrows too large for the combine. The most important point, however, is that more seed will be saved by the better threshing if the windrow is small enough for the machine. In a small windrow there is less straw to handle, which is very important with the smaller combines. Small windrows will dry more readily than large ones, thereby reducing length of time exposed to wind and rain damage.

A distinct disadvantage of windrowing is the hazard from wind. A hard cross-wind, or a twister, may pile up the windrows along the fence or twist them into a tangled mass resulting in a great loss of seed. Some follow the practice of picking up the windrowed crop a few hours behind the mower. Hairy vetch is most easily carried by the wind, but any windrowed crop may be damaged. Rain often causes more shattering to the cut crop than to a standing crop.

Figure 5. Windrowed hairy vetch piled against a fence by a heavy wind. This is one hazard involved in this method of harvest. A condition like this, of course, results in much seed being lost.

THRESHING WITH A STATIONARY SEPARATOR

The stationary thresher method of harvest has several advantages over combining; however, the cost is higher mainly because more labor is required. When a threshing machine is used, the crop
is generally mowed, shocked, and hauled to the machine on a wagon or slip. Binders are also used for cutting the crop. Weak-stemmed crops, such as vetch, peas, and crimson clover, do not lend themselves to binding as well as grain. In poor curing weather, the inside of the bundles of vetch, peas, or crimson clover may mold. The tangled vegetation results in strings of bundles that generally need to be cut apart when shocked. On the other hand, binding can be done earlier than mowing, thereby lengthening the harvest season. Binding and threshing with a stationary separator is an excellent method of harvesting ryegrass.

Threshing machines are built to handle more straw than most combines. Threshing machines can be fed at a rate and in amounts to permit maximum threshing efficiency. With this method, all the material can be uniformly dry before threshing. If a separator is not available when the crop is ready, it can be stacked and threshed later.

The thresher or huller generally saves the most crimson clover seed.

An excellent method of threshing hairy vetch is to windrow and push into big shocks with a buckrake, and then haul it to the machine on slips, low wagons, or with the buckrake.

**MOWING AND WINDROWING**

The most common method of windrowing is to use a swinging swather on the mower. It rolls the swath into windrows out of the way of the tractor on its next round and into a position for picking up with a combine. The mower should be in good condition and the sickle sharp. In cases where the crop is badly lodged, pea guards or stub guards do a better job of cutting. Some use alternate pea and standard guards, and some use two standard guards to one pea guard. A power mower is superior to a horse-drawn mower in cutting heavy tangled growth.

If difficulty is experienced in cutting under the lodged crop, lifter guards on the mower may help. In many cases, however, they are more of a hindrance. Many of the guards have a tendency to raise the sickle bar, and they increase the side draft. If used, lifters should be placed about a foot apart along the sickle.

There are other types of windrowers that are satisfactory and often superior to the swinging swather where a large windrow can be handled. Most of them consist of a unit with a draper behind the
Binder can be made into a windrower

Figure 6. A type of windrower with pick-up reel and floating sickle bar. This type windrower is commonly used in the harvesting of canning peas in eastern Oregon. It can also be used on many other crops.

Figure 7. A swinging swather used on tractor mower to cut and windrow seed crop.

cutter bar and running parallel with it. The draper carries the cut crop to one end and deposits it in a windrow.

An old binder can be made into a windrower. It can be converted by removing the binder attachment and installing a longer deck or an extension to the regular one. The deck should extend down close to the ground so that the windrow is laid gently on the stubble and not dropped.
SELECTING THE COMBINE

There are many different makes of combines on the market and probably all of them have their places. A mistake commonly made is to buy a machine too small for the job to be done. For small acreages, small combines may be satisfactory, but on the larger places the medium- or large-sized machine will prove the cheapest in the long run.

The straw capacity of the combine is very important. A large-capacity cylinder is of little value if the machine does not have capacity to separate the straw and the seed. No combine can operate at maximum efficiency on a power take-off from the tractor. It is very desirable that it be powered from its own engine. Power take-off from the tractor may be ample for heading standing grain but is not satisfactory for combining either direct or from the windrow where all the growth is handled as is required with peas and vetch. The speed of the combine can be kept uniform if it is powered independently of the tractor.

It is desirable to have a cylinder speed and concave adjustment that can be changed easily and quickly. Often it is necessary to change these adjustments during the day to provide for the change in condition of the crop. A cylinder speed and concave adjustment that is right for threshing in the morning may be
entirely wrong in the heat of the day. Many of the newer machines have provided for this rapid adjustment by use of cranks or by simple expanding or tightening of pulleys with V-belt drive. It should be possible to change the speed of the cylinder without affecting that of other parts of the machine.

AREA ONE COMBINE CAN HANDLE

A common tendency on the part of most operators who have not had experience with the harvesting of viney crops is to overestimate the acreage that one machine can handle efficiently. Here again it is not possible to give any hard and fast rule, but a thumb rule that some follow is that a combine will thresh 1 acre per 10-hour day for each foot of cut up to 10 feet. Machines larger than 10 feet will not handle proportionately more because they do not have a proportionately larger straw capacity.

In general, a 5- to 8-foot combine can be expected to harvest in one season 40 to 60 acres of hairy vetch plus 50 to 75 acres of Austrian winter peas; and an 8- to 10-foot machine, 50 to 75 acres of hairy vetch and 150 acres of peas. A combine larger than 10 feet should handle 65 to 90 acres of hairy vetch and 150 acres of Austrian winter peas. The small combines should harvest 50 to 75 acres of crimson clover. Most of them will thresh 4 to 6 acres a day.

ATTACHMENTS FOR PICKING UP FROM WINDROW

There are several different attachments for use on the combine to aid in harvesting from the windrow. The method to use is the one that will get the material into the combine with a minimum of loss from shattering. On combines where it is possible to put the header down to the ground, some good operators do not use any pick-up attachment. The windrow in this case is fed onto the draper merely by the sickle bar slipping beneath it. In many cases, lifter guards spaced about a foot apart and attached to the sickle bar are distinct aids in feeding the windrow onto the draper. Most of the newer small- and medium-sized machines can be used to pick up the crop in this manner. It may be necessary to slow the speed of the platform draper in relation to the forward movement of the combine. If the draper speed is too fast, it tends to pull the windrow into the machine, whereas the windrow should slide upward onto the draper.
If the combine header cannot be lowered to the ground or if the land is uneven, revolving pick-up fingers are necessary. This type of pick-up attachment has a beating action on the dry crop and may shatter seed. The loss may be considerable on those crops that shatter readily.

**HARVESTING HAIRY VETCH**

Many farmers are changing from other methods to direct combining of hairy vetch. If the crop matures evenly and enough equipment is available to combine the entire crop in 3 to 6 days, this method should be satisfactory. A hot period, drought, or some other factor during bloom may cause one set of blooms to fail to set seed. It will be necessary to study the field to determine which pods are filling best. Hairy vetch is cut when the early pods are ripe. As much as 10 per cent of the pods may still be green; otherwise extreme loss from shattering will occur. Sacks of threshed seed should be left standing in the field for a few days and turned end for end occasionally to dry out the immature seed and green material. The safest practice for handling combined hairy vetch is to fill the sacks only about two-thirds full to facilitate drying. If the crop is to be combined from the windrow, it should be cut when the seed is well formed and starting to color. Threshing should start just as soon as possible to prevent shattering and damage from wind and rain. When

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**Figure 9.** Hairy vetch in large shocks. This is one of the best methods of handling hairy vetch to keep shattering loss to a minimum. Shocks are either hauled to the stationary with a buckrake or rolled onto a canvas-covered slip.
mature vetch dries out after a rain, severe loss from popping pods will result. A “gooseneck” on the outside shoe of the mower is often helpful in cutting the tangled crop.

Windrowing and shocking into big shocks by use of a buckrake is an excellent method of saving hairy vetch seed. The buckrake should follow immediately behind the mower. Usually in 4 to 6 days the shocks are dry enough to thresh. Some use the buckrake to push the shocks to a stationary thresher; others pull a combine to the shocks and feed by hand into the machines. A canvas spread in front of the feed will catch much shattered seed. The shocks can be rolled onto the canvas and fed from the canvas into the machine. Another method is to haul to a stationary thresher on canvas-covered wagons or slips. The crop should be handled as little as possible to prevent shattering loss. Canvas should be spread under the feed of the threshing machine or combine to catch shattered seed. The cylinder speed should not exceed two-thirds that normally used for grain. In the spike-tooth machines, very few, if any, concave teeth are usually necessary. The seed threshes out very easily, and much damaged seed will result if the cylinder speed is too high. If the crop is grown without grain, a lower cylinder speed should be used.

Use not over two-thirds the cylinder speed used for grain

Figure 10. Threshing hairy vetch with a stationary threshing machine. The buckrake is used for shocking and hauling to the threshing machine. This is a good method of handling hairy vetch.

Harvesting Hungarian Vetch

Hungarian vetch is harder to thresh out of the pods than any of the other vetches discussed. It is almost nonshattering so is not exacting in its harvesting methods. This vetch can be left until the last to harvest and then can be combined direct. If too many green weeds are present, the crop can be windrowed and picked up with a combine. Hungarian vetch requires a higher cylinder speed to thresh than the other vetches.
HARVESTING COMMON VETCH

Common and Willamette vetch do not shatter so badly as hairy vetch. The principal method used to harvest this crop is to pick it up from the windrow with a combine. These vetches can be combined direct if there is not too much green growth and if the acreage is small enough so that the combine can harvest it in 5 to 10 days. A cylinder speed of one-half to two-thirds that used for grain should be satisfactory.

The same general harvesting methods and practices discussed under Austrian winter peas and hairy vetch are applicable to the harvesting of common and Willamette vetch.

HARVESTING AUSTRIAN WINTER PEAS

Most of the Austrian winter peas in eastern Oregon are combined direct. The use of this method of harvesting is increasing in western Oregon. If the fields have been properly dusted to control weevil and do not have too many green weeds, direct combining should work satisfactorily. Peas do not shatter badly and can be allowed to mature before they are harvested. Direct combining does not work so well on land corrugated for irrigation because of the difficulty in-

Figure 11. A side-hill type combine with pick-up reel and floating cutter bar. These machines are self-leveling and of the type which should be used on hilly land.
volved in keeping the cutter bar down when crossing the corruga-
gations.

Many growers in western Oregon combine the crop from wind-
rows. Some shock and haul to a threshing machine. After a rain,
less shattering will occur to standing peas than to those in the wind-
row or shock. The crop is ready to windrow when 75 per cent of the
pods are mature.

Peas thresh and crack very easily. The cylinder speed should
not exceed half that normally used for grain. For threshing straight
peas without grain, the speed can be further
reduced. Worn cylinder teeth will crack less
seed than new ones with sharp edges.

Screens can be used on the machine to
separate the grain from the peas. If this separation is made, it will
reduce the volume of peas to be cleaned and will materially relieve
congestion at the warehouse.

HARVESTING CRIMSON CLOVER

Crimson clover is one of the most difficult crops to thresh. The
seed is produced in pods which, in turn, are enclosed in a tight
papery hull. It is very easy to remove from the stems, but the dif-
ficulty comes in removing the papery hulls that enclose the pods.

With present harvesting machinery and knowledge, direct com-
bining should be discouraged. Occasionally this method is satis-
factory if the field matures evenly and is free
of green weeds; however, for every case of
success with this method, there are many cases
of failure.

The two most satisfactory ways of harvesting are: (1) wind-
rowing, followed by shocking and threshing with a stationary
thresher, and (2) combining from the windrow.

Threshing with a stationary thresher or huller has given the
highest yields. The crop is ready to mow when the seed in the early
bloom is in the hard dough stage. Mowing
and shocking should be done at night or on
cloudy days to prevent excessive loss from
shattering. The shocks should be kept small for rapid drying and
easy handling. As soon as the shocks have dried, they can be loaded
onto a canvas-covered slip or wagon and hauled directly to the thresh-
ing machine. A slow even feed into the machine is essential so that
the cylinder does not run empty at any time. A canvas spread under
the feed will catch much shattered seed. In
some cases, rerunning the stack a second and
even a third time will be profitable. At least
that portion of the stack under the blower should be rerun. It is very difficult, and in most cases impossible, to do a finished job of threshing Crimson clover in one run. As much of the seed will not be removed from the hulls the first time through the cylinder, the return should be worked to capacity all the time.

The second best method of harvesting crimson clover is to combine from the windrow. It is very important that the windrows be small and uniform so that a continuous, even flow is fed into the machine. Three- to 4-foot windrows are as large as a 5- or 6-foot combine can handle satisfactorily. This point is extremely important. It is easy to go faster with a small windrow, but if the windrow is too large, it is impossible to go slowly enough to do a satisfactory job. Actually a larger acreage can be threshed in a day from small windrows than from large ones, and much more seed will be saved.

Revolving pick-up attachments cause severe shattering of the seed and should be used only as a last resort. Lifter guards will pick up the crop just as well in most fields and will shatter less seed. Some combines will pick up the crop without even the use of the lifter fingers.

In some cases, it pays to rethresh the straw rows. Growers have salvaged a sack of seed or more per acre by this practice. It is not possible to reclaim as much seed from the straw rows as from rerunning a stack because the seed from the combine goes on the ground first with the straw on top. Considerable seed filters into the stubble and is not picked up the second time. Some growers propose pulling a second combine directly behind the first so that the straw of the first combine falls on the platform of the second, thus rerunning the straw without letting it touch the ground.

If the platform draper has a tendency to pull the windrow into the machine, the speed of the draper should be slowed to prevent the stripping action on the heads.

Threshing should not be attempted early in the morning or late in the evening because the seed will not thresh out satisfactorily if the straw is not thoroughly dry. Adjustable lip screens on the chaffer and shoe are generally most satisfactory. The chaffer should be adjusted so that all unthreshed seed will fall through to the shoe sieves. The cylinder will have to be run at a high speed and a full set of concaves used.
The seed coat of crimson clover is thin and soft and can be damaged easily in threshing. If the machine is not fed evenly, the cylinder speeds up for a few seconds when empty. As a result, the seed coming through the return back to an empty cylinder will be damaged. Some of this injury may be imperceptible but will show up in a low germination test. New cylinder teeth with sharp edges damage seed until the sharp edges are worn off. Faulty augers are also sources of damage.

**HARVESTING RYEGRASS**

The two methods that can be recommended for harvesting rye-grass are to bind and thresh or to combine from the windrow. Direct combining generally is not satisfactory. The crop shatters very quickly when it is ripe enough to combine. Unless the seed is nearly mature when it is cut, a material shrinkage will result. Seed that is even a little green will heat very quickly, and the germination will be lost within a short time unless it is spread out to dry and turned frequently.

Binding and threshing is the safest method and the one that generally gives the highest yield. Binding should start shortly after the grass takes on a reddish-brown color. Binding is safest method

After this stage, ryegrass ripens very rapidly in warm weather. A method of determining when the crop is ready to cut is to pull a few heads through the palm of the hand, and if a few seeds thresh out, the crop is ready to bind or windrow. The bundles should be shocked as soon as possible after they are bound to prevent shattering. The heads dry out very quickly after cutting. The bundles should be hauled to the threshing machine on a canvas-covered slip or wagon. When loaded onto a wagon or truck, the bundles should be pitched with the heads up so that seed will not fall out. A canvas spread under the feed of the threshing machine will often save several sacks of seed in a day's run.

Much seed can be saved in binding by covering all the under side of the binder with sheet metal. A sled under the bundle carrier section can be pulled along by a hitch from the binder tongue. A man riding on the sled can set the bundles off by hand. The under side of the elevating draper and packer parts should be covered with sheet metal to direct the shattered seed into the sled.
A pan attached underneath the junction of the platform draper roller and the lower roller of the elevating draper will catch in a day many pounds of seed that might pay the entire harvesting bill.

Figure 12. Binder adapted for harvesting grass seeds. Bundle carrier has been removed and sheet metal placed underneath packer and tyer. A pan has been made which goes between the inside platform draper roller and lower elevating draper roller to catch the seed. The seed is then scraped into a small sled. Another larger sled is pulled by a hitch from the tongue in a position which catches shattered seed from tyer and packers. A man rides on the sled and sets off the bundles.

Figure 13. A self-propelled combine with windrow header attached. This type machine has the advantage in direct combining of not losing any of the crop in opening up the field. Having its own power of locomotion, no tractor is needed to pull it,
Windrowed crops should be picked up as soon as dry enough to thresh. A few hot days and a little wind may cause severe shattering. Pick-up fingers, instead of revolving pick-up attachments, should be used if possible on the combine to reduce shattering.

The cylinder speed used for grain is usually satisfactory for rye-grass. No more concave teeth or bars should be used than necessary in order to keep from breaking up the straw. If the straw is fine, it will overload the chaffer and require more wind, and as a result, more seed will be blown over. The wind should be directed the full length of the sieve and should be strong enough to float the straw and chaff along until it leaves the machine. A fast shake on the sieve helps to separate the seed and chaff when the wind must be reduced.

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G. R. Hyslop, Head of the Division of Plant Industries, E. R. Jackman, Extension Farm Crops Specialist, and F. E. Price, Agricultural Engineer, Agricultural Experiment Station, read the manuscript and made many helpful suggestions.