

Evaluation Report

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Eagle Sunflower Harvesting Attachment

A Co-operative Program Between



EAGLE SUNFLOWER HARVESTING ATTACHMENT

MANUFACTURER and DISTRIBUTOR:

Eagle Engineering and Manufacturing Corp.
 P.O. Box 295
 Welcome, Minnesota 56181
 U.S.A.

RETAIL PRICE:

\$4,300.00 (April 1981, f.o.b. Welcome, Minnesota,
 3.8 m width with 255 mm row spacing, installed price).

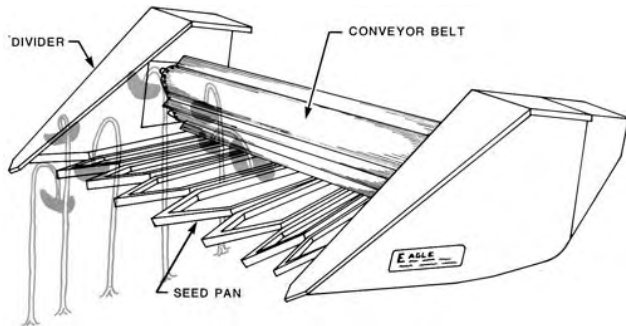


FIGURE 1. Eagle Sunflower Harvesting Attachment.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Eagle sunflower harvesting attachment was very good. Performance of the conveyor belt assembly was excellent, while the seed pan performance was very good. Performance of the stalkwalker was fair.

Crop flow was smooth, as long as conveyor speed was properly synchronized with ground speed. The most suitable ground speed was dependent upon crop conditions, especially crop moisture. Speeds up to 8 km/h (5 mph) were possible in ideal conditions.

Crop losses were acceptable in both dry and tough crops. The seed pans, which covered 76% of the ground area in front of the cutterbar, collected most of the shattered seed in dry crops, while the gentle feeding action of the rubber conveyor greatly reduced shattering.

The 255 mm (10 in) seed pan spacing permitted on-row cutting for this row spacing and its multiples. These pans were also suitable for cutting continuously seeded crops and crosscutting of row crops.

Installation was not difficult. Total time required for factory representatives to install the attachment was about 20 man hours.

No assembly instructions were provided, however a detailed parts list, and basic operating instructions were included. Lubrication was not required.

No serious mechanical problems occurred during testing. The stalkwalker plugged frequently in weedy conditions.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying the optional chain and sprocket conveyor drive as standard equipment on all units.
2. Modifying the lips around the edges of the seed pans so that shattered seeds fall into the pans.
3. Manufacturing the left divider and two seed pans shorter than the others, for some types of pull-type combines, to eliminate tractor tire interference on sharp right turns.
4. Providing an operator manual with detailed assembly instructions and more detailed operating procedures.
5. Modifying the shape of the tops of the dividers to reduce hairpinning.

Chief Engineer - E.O. Nyborg

Senior Engineer - J. C. Thauberger

Project Engineer - Gregory R. Pool

THE MANUFACTURER STATES THAT:

With regard to recommendation number:

1. Optional roller chain and sprockets, along with torque limiters (slip clutches) for conveyor and walker drives are standard equipment on 1981 units.
2. Seed pans for 1981 units will have the upper edge of pans slope inward at a 10° angle so seeds will gravitate into the pans in order to minimize seed loss.
3. The units may be operated on most pull-type combines. Tractor tire interference on sharp turns can be eliminated and is subject to proper operation of tractor.
4. Detailed operator manual and assembly instructions will be provided and shipped with all 1981 units.

Side panels for all 1981 units are of a tapered conical shape, which will reduce sunflower hairpinning. Streamlined outside panels, on both ends, guard operator and all moving parts.

Note: This report has been prepared using SI units of measurement. A conversion table is given in APPENDIX III.

GENERAL DESCRIPTION

The Eagle Sunflower Harvesting Attachment (FIGURE 1) is designed to mount on straight-cut combine headers. It consists of an assembly of seed pans which attach to the combine cutter-bar, two crop dividers, a bottom mounted stalkwalker, and a belt conveyor assembly consisting of a rubber belt with five rubber flights. The conveyor assembly and stalkwalker are powered by the combine hydraulic reel drive motor.

The seed pans are spaced to correspond with sunflower row spacing. The stalks pass between the seed pans to the cutterbar, where the heads are severed from stalks. The stalkwalker and the conveyor assembly depress the plants, hold the heads down for cutting, and deliver the cut heads to the combine header. The seed pans, which extend ahead of the conveyor assembly, collect shattered seed that may dislodge during cutting.

The test attachment was 3.8 m (12.5 ft) wide, between divider points, with fourteen row openings spaced at 255 mm (10 in). Attachments with various header widths are available to suit existing combines. Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Eagle was mounted on an International 914 pull-type combine, with a 3.8 m (12.5 ft) header. It was operated in the conditions shown in TABLE 1 for 30 hours while harvesting about 43 ha (106 ac) of sunflowers, sown at 760 mm and 915 mm (30 and 36 in) row spacing. It was evaluated for ease of installation, quality of work, ease of operation and adjustment, and operator safety.

TABLE 1. Operating Conditions

Row Spacing (mm)	Hours	Field Area (ha)
760	26	36
915	4	7
Total	30	43

RESULTS AND DISCUSSION

EASE OF INSTALLATION

Installation Time: It took factory personnel about 20 man hours to attach the Eagle to a combine header, using tools normally found in most farm shops. The company has factory trained personnel available to install the attachment as part of the list price.

Conveyor Assembly: The conveyor assembly ran on three rollers, mounted on sealed bearings at each end, which were attached to the two crop dividers. The conveyor was factory assembled, reducing set-up time. The assembly weighed 200 kg (440 lb), which made it necessary to use a front-end loader or hoist to install it.

Seed Pans: Each seed pan was fastened to the cutterbar with two long carriage bolts. Due to their split design, the pan width could

be made either 230 mm (9 in) or 150 mm (6 in) at the cutterbar. By using an arrangement of wide and narrow pans across the width of the header, an average spacing of 255 mm (10 in) could be maintained between pan points.

Each pan was also supported from underneath by a tubular brace (FIGURE 2), to provide rigidity and to permit vertical adjustment of the pan points. One end of each brace was bolted at the front of each seed pan, while the other end was fastened to the stalkwalker support bracket, bolted to the combine header. One person could easily install the braces.

Dividers: The dividers were easy to install. They were bolted to the cutterbar and the reel arms. The sheet metal for the dividers was fabricated on site to fit the specific combine header used. The mounting arrangement was rigid and secure. Adequate shields covered the conveyor assembly drive.

Stalkwalker: The stalkwalker was difficult to install. It was completely assembled at the factory, was heavy and awkward to handle, and had to be blocked up while the combine header was lowered to match with it. Holes had to be drilled in the combine header for the attaching bolts.

General: The manufacturer prefers to initially install attachments for customers. The foregoing discussion points out any problems, which may occur during a subsequent removal and installation. All shields, mounting and drive hardware were supplied with the attachment. Detailed mounting instructions were not provided.

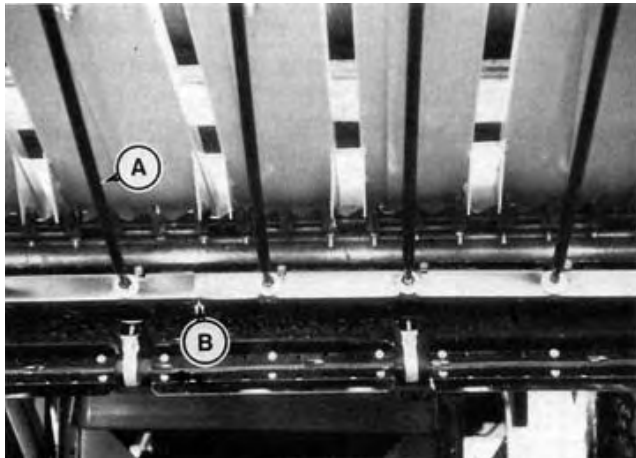


FIGURE 2. Seed Pan Supports: (A) Braces, (B) Support Bracket.

QUALITY OF WORK

Feeding: The flow of crop into the combine was very smooth, as long as conveyor speed was synchronized with ground speed. It was important to maintain a Conveyor Index* between 0.9 and 1.1. With a conveyor index less than 0.9, the conveyor could not effectively clear the crop from the cutterbar, resulting in plugging in heavy crops. With the conveyor index greater than 1.1, the conveyor was too aggressive, causing undue shatter loss in dry crops.

Stalkwalker plugging sometimes occurred in weedy crops. Wrapping of weeds on the stalkwalker caused the conveyor drive chain to come off the sprockets, if the slip clutches were not properly adjusted.

For most of the test, the Eagle was equipped with an optional chain and sprocket drive to power the conveyor assembly and the stalkwalker. Although a belt drive was standard equipment for headers narrower than 4.5 m (15 ft) it was found inadequate due to plugging and was replaced with a chain drive. It is recommended that all models be equipped with the chain and sprocket arrangement to improve performance.

Stubble Length: The conveyor was operated at the point where the 100 mm (4 in) rubber flights on the conveyor belt just touched the tops of the seed pans above the cutterbar. The maximum amount of stalk cut off with each head was about 250 mm (10 in). To maximize combine capacity, the stubble should be as long as possible, with only the sunflower heads fed into the combine. The stalkwalker (FIGURE 3) helped pull the taller plants down to the level of the seed pans before they were cut off.



FIGURE 3. Stalkwalker.

Shatter Loss: The seed pans were effective in reducing seed loss, especially in dry crops. Individual pans were either 150 mm (6 in) or 230 mm (9 in) wide with a 65 mm (2.5 in) space between pans. The seed pans covered 76% of the ground area in the front of the conveyor and cutterbar. Adding to the effective open area was a 28 mm (1 in) flat rim or lip around the top edges of each pan. It is recommended that the lips be modified so that shattered seeds falling on them are directed into the pans.

Since shattering was very significant in dry crops, maintaining a proper ground speed and conveyor index was very important in reducing shatter loss. The losses were dependent on the moisture content of the crop. Head shattering and seed losses were negligible in crops with high moisture content.

Dividers: Performance of the crop dividers was very good. Their size and shape ensured that very few sunflower plants were knocked down while the crop was being harvested. Some cut sunflower plants occasionally hairpinned around the flat-shaped top of the right divider. It is recommended that the dividers be modified to reduce hairpinning of cut heads. The narrow 75 mm (3 in) half pans, attached to the dividers, had to be checked frequently as they occasionally filled with seeds, and would not properly empty into the header.

EASE OF OPERATION AND ADJUSTMENT

Row Spacing: Tests were conducted in sunflowers seeded at 760 mm and 915 mm (30 and 36 in) row spacings. Although the 255 mm (10 in) seed pan spacing permitted on-row cutting for multiples of this row spacing there was little need to closely follow rows. This spacing was also suitable for continuously seeded crops or for cutting row crops at an angle or across headlands. When not operating on the rows, the points of the seed pans occasionally knocked down some large sunflower plants.

Turning: When mounted on an IH 914 combine, right turns required a great deal of care to prevent interference between the tractor tire and the left divider. It is recommended that the left dividers, and the two seed pans adjacent to it, be manufactured shorter than the regular pans, for mounting on this and similar pull-type combines.

Seed Pans: The seed pan angle was easy to adjust with the threaded rods on the end of the tubular seed pan braces. The pans required only minor adjustments during the test. The total time required to adjust all the pans was about 20 minutes. It was important to have the seed pans sloping toward the combine header to permit the collected seeds to flow back into the combine. It was also important to have all the pans at the same height to prevent sunflower heads from falling between the pans.

Seed pan vibration effectively conveyed collected seeds into the combine. Operation on rough fields did not cause excessive bouncing of the seed pans. Cutting ability and feeding characteristics were not affected by field roughness.

Conveyor Drive: The conveyor drive chain, on the right side of the header, was well shielded from the standing crop. The supplied shields prevented the sunflower plants from lodging in the drive chain and sprockets. Due to the length of chain needed to drive both the conveyor and the stalkwalker (FIGURE 4), care had to be taken that

*Conveyor Index is the ratio of conveyor belt speed to forward travel speed.

the idler sprockets were adjusted periodically to prevent excessive chain slackness. Mechanical slip clutches on the conveyor and stalkwalker shafts protected the drive mechanism when plugging occurred.

Stalkwalker: Performance of the stalkwalker was fair. Wrapping of weeds on the shaft and plugging occurred frequently in weedy fields. Performance in weed-free fields was good. The drive chain occasionally came off due to a gradual loosening of the chain.

Unhooking: The complete combine header assembly, with the Eagle in place, was easily unhooked from the combine, and placed on the ground without damage. Care had to be taken that the divider points were blocked or the header would tip too far forward making hooking up difficult.

Conveyor Belt Tension: The tension of the rubber flighted conveyor belt assembly was adjustable on both ends of the attachment. The tension adjustment was easy and took about five minutes to complete.

Lubrication: No lubrication was required. All components used sealed bearings.

OPERATOR SAFETY

The Eagle was safe to operate provided normal safety procedures were followed. No safety instructions were provided with the attachment, but four appropriately located decals were supplied to warn of hazards.

OPERATOR MANUAL

A booklet combining operating instructions and a parts list was supplied. The operating instructions were very brief and limited in scope. It is recommended that the manufacturer supply an operator manual with detailed assembly instructions, which includes detailed operating procedures.

DURABILITY RESULTS

The Eagle sunflower harvesting attachment was operated in the field for 30 hours, while harvesting about 43 ha (106 ac) of sunflowers. The intent of the test was functional evaluation. No extended durability evaluation was conducted. No mechanical problems occurred during testing, however the conveyor and stalkwalker drive chain needed frequent tightening.



FIGURE 4. Conveyor and Stalkwalker Drives.

APPENDIX I SPECIFICATIONS

Make:	Eagle
Model:	810-125
Serial Number:	10003
Overall Dimensions:	
-length	2420 mm
-width	4230 mm
-height	1120 mm
Total Weight:	518 kg
Feeding System:	
-type	seed pans and rubber conveyor belt with flights to straight-cut combine header
-attachment	
Seed Pans:	
-length	1510 mm
-width	150 mm
-depth	50 mm
Conveyor:	
-length	3620 mm
-number of flights	5
-height of flights	100 mm
-spacing between flights	260 mm
-drive	chain and sprocket from hydraulic motor
Stalkwalker:	
-length	3800 mm
-number of bearings	9
-diameter	90 mm
-drive	chain and sprocket
Optional Equipment:	
-3960 to 7315 mm widths	
-various drive sprocket ratios	

APPENDIX II MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

- | | |
|---------------|--------------------|
| (a) excellent | (d) fair |
| (b) very good | (e) poor |
| (c) good | (f) unsatisfactory |

APPENDIX III CONVERSION TABLE

1 metre (m)	= 3.3 feet (ft)
1 millimetre (mm)	= 0.04 inches (in)
1 kilogram (kg)	= 2.2 pounds mass (lb)
1 kilometre/hour (km/h)	= 0.6 mile/hour (mph)
1 hectare (ha)	= 2.5 acres (ac)



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