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Group 4c

Evaluation Report 645

MacDon Harvest Header

A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

MACDON HARVEST HEADER

MANUFACTURER AND DISTRIBUTOR:

MacDon Industries Ltd.
680 Moray Street
Winnipeg, Manitoba
R3J 3S3
Telephone: (204) 885-5590

RETAIL PRICE:

$24,398.00 [March, 1991, f.o.b. Humboldt, Sask., with a 30 ft (9.1 m) header, c/w adaptor to fit John Deere 7720 combine, pickup reel, bat reel, gauge wheels and skid shoes].

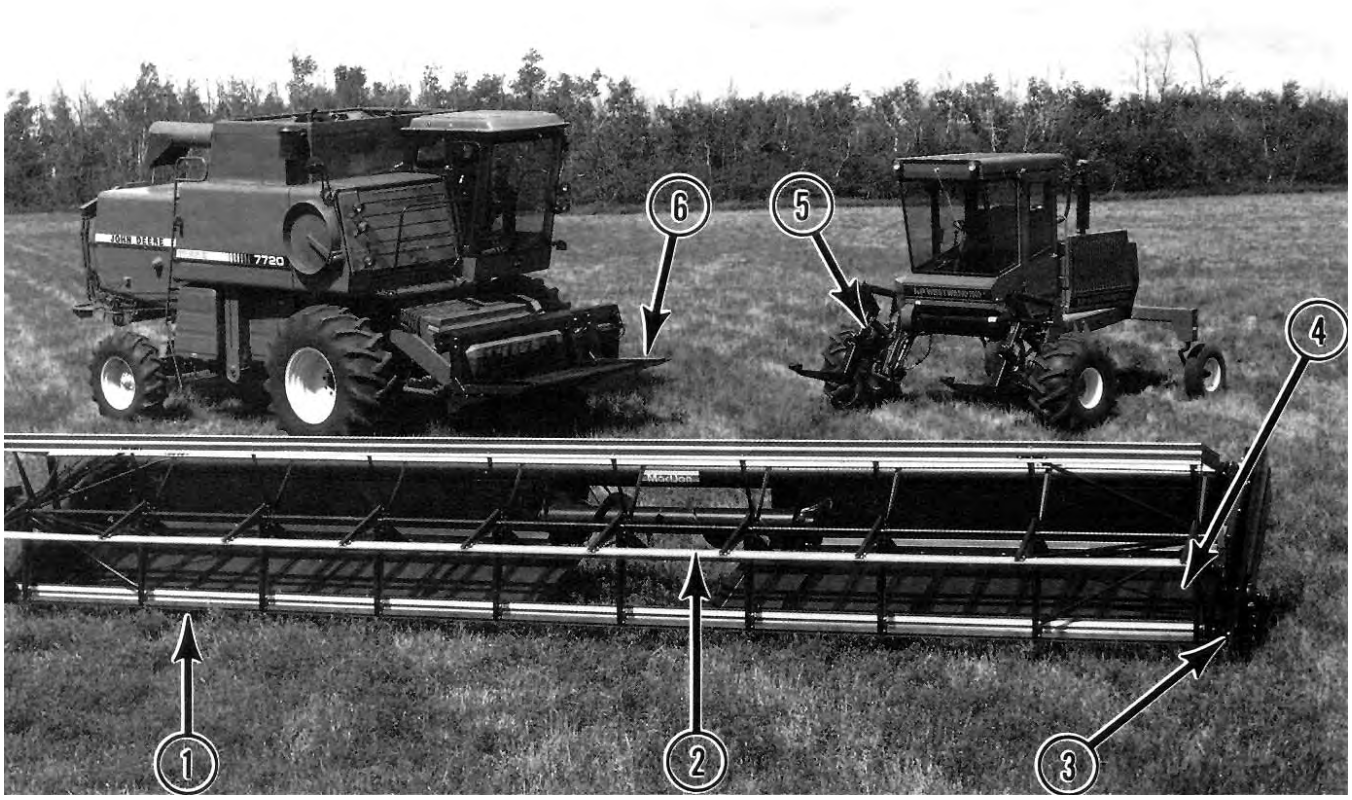

FIGURE 1. MacDon Harvest Header (1) Cutterbar, (2) Reel, (3) Dividers, (4) Drapers, (5) Adaptor, (6) Feeder Draper.

SUMMARY AND CONCLUSIONS

Rate of Work: In most conditions, uniform windrows were formed by the MacDon Harvest Header when mounted on the Westward 7000 traction unit at typical speeds of 5 to 8 mph (8 to 11 km/h). Workrates while windrowing at typical operating speeds varied from 17 to 24 ac/h (6.8 to 9.6 ha/h). The maximum rate achieved was 30 ac/h (12.1 ha/h).

The rate of work for straight cut harvesting depended on the capacity of the combine. With the combine used, a ground speed of 3 to 4 mph (4.8 to 6.4 km/h) was typical in moderate wheat crops that yielded 35 bu/ac (2.3 t/ha).

Quality of Work: Crop dividing was good. The dividers bent most crop slightly but it was easily recovered on the next pass. When cutting low in tangled crop, the divider trampled some crop. Crop loss was reduced by cutting back-and-forth.

Header flotation was very good when mounted on both the combine or traction unit. The flotation system allowed the header to pivot and follow field contours in rolling terrain when mounted on the combine or traction unit. The header bounced over most rocks without cutterbar damage. The optional skid shoes adequately protected the ends of the cutterbar from contacting the ground in dry firm soils.

Cutting ability was very good. The knife had adequate power and never stalled during the test.

Crop handling was very good for both windrowing and feeding the combine. The bat reel worked well in straight even stands, as well as in very short and thin crops. The pickup reel worked well in even crops, and provided a lifting action that was ideal for handling tangled or lodged crops. Performance was reduced in very short and thin crops.

The draper angle was adjustable. The steeper angle was best suited for canola, flax, or taller cereal crops, while the shallow angle was more suitable for short crops. The drapers had adequate power and the speed range provided was appropriate for windrowing and straight cutting. The windrow opening width was adjustable and did not cause restriction of crop flow.

The feeder draper and cross auger conveyed most crops easily into the combine feeder house. At the beginning of the season, feeding was restricted by rust in the combine feeder house. Once the feeder was polished, feeding improved. Material bridged across the feeder house opening when cutting very short crop. Removing the shield over the combine's feeder house inlet helped improve crop flow in short crops.

Windrow quality was very good. Windrows were uniform and usually laid in a parallel pattern.

Ease of Operation and Adjustment: Ease of attaching the header to the combine was very good. Installing the header on the combine was easy when instructions in the operator's manual were followed. Ease of mounting the header on the Westward 7000 traction unit was good. Mounting the header on the traction unit was made difficult by mounting pin misalignment. The flotation spring links were also difficult to install.

The controls were very good. The regular controls in the combine cab were used to control most header functions. However, the draper speed control was located on the adaptor and was inconvenient to adjust. The Westward 7000 tractor controls provided suitable response for raising and lowering the reel and header, and adequate speed adjustment for the reel and drapers.

Ease of adjustment was very good. All adjustments were accessible and easy to make using common wrenches.

Handling was very good when the header was mounted

on the combine, and good when mounted on the traction unit. The header was easily maneuvered when straight cutting crop. The offset header extended 20 in (0.5 m) further to the right of the feeder than to the left. Combines needed unloading augers that extended 20 ft (6.1 m) out from the center of the feeder to conveniently unload on the go. The header was easily maneuvered when windrowing. However, the header gauge wheels did not adequately clear high windrows. The windrower tipped forward on abrupt stops when the heavier pickup reel was used even with 450 lb (204 kg) of counter weight.

A trailer was required to safely transport the header on roadways. A windrower transporter that pulls the unit sideways could be used to transport the traction unit with the header attached.

Visibility was excellent. The crop on the drapers was easily viewed. The pickup reel provided less reflected light at night since it was painted black.

Ease of servicing was very good. Daily service took less than 10 minutes. Power Requirements: The power to operate the header while straight cutting a 50 bu/ac (3.4 t/ha) wheat crop was less than 20 hp (14.9 kW). The Westward 7000 power unit and the combine used during testing had adequate power for all conditions encountered.

Operator Safety: Normal safety precautions were required while operating the MacDon Harvest Header. The operator's manual emphasized safety. Warning decals, shields, and appropriate safety locks were provided. However, the control lever for draper speed was located on the header adaptor in a potentially dangerous area. Care was required for transporting. Trailers used should be adequately sized and should be equipped with electric brakes when transport speeds exceed 20 mph (32 km/h).

Operator's Manual: The operator's manuals were very good. They contained much useful information that was easy to follow and well illustrated.

Mechanical History: Very few mechanical problems occurred during testing. One draper was torn, and a few knife sections and guards were replaced or straightened.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to enable easier attachment of the header to the windrower traction unit.
2. Providing more permanent identification marking for the hydraulic hoses.
3. Providing a draper speed control that can be operated from the combine cab.
4. Providing a guard or deflector for the left adaptor drive shaft.

Senior Engineer: J.D. Wassermann
Harvesting Manager: L.G. Hill
Project Technologist: A.R. Boyden

THE MANUFACTURER STATES THAT

With regards to recommendation number:

1. As mentioned in the attachment instructions, it is very important that the traction unit be reversed slightly before lifting the header. This causes the hole in the header leg to align with the tube on the lift linkage.
2. The coloured tape for hose identification is more securely fastened to the hose. Future production hoses will be identified with a coloured plastic marker.
3. For combine operation, draper speed is seldom changed and because of the complication of fitting controls to a variety of combines, the expense of providing a remote control was not justified.
4. We have not experienced this problem, but will monitor the situation and make modifications if necessary.

MANUFACTURER'S ADDITIONAL COMMENTS

We do not agree with the statement in the report regarding dangerous draper speed control lever location. The lever is on top of the adapter drive frame away from any drives. It is not necessary to open any shields to operate the lever. The control is in front of the combine drive tire but we cannot imagine anyone adjusting draper speed when the machine is moving. Again our experience is that draper speed is set at approximately 6 on the speed control scale and is seldom adjusted.

GENERAL DESCRIPTION

The MacDon Harvest Header is a draper type cutting platform. It can be mounted on a combine or self-propelled windrower traction unit. The test machine was a 30 ft (9.1 m) wide model.

Special adaptors are available for different makes and models of combines. The adaptor provides the mechanical link between the header and combine feeder. It also provides suspension for flotation, mechanical drive adaptors, a feed draper to convey crop to the combine, and a hydraulic power system.

The knife is driven through a "wobble box" powered by the combine's header drive shaft. The reel, drapers, and feed auger are driven from a combine hydraulic circuit and a booster pump located on the adaptor.

Adaptors are also required to mount the header to a MacDon traction unit. When mounted on the traction unit, the header is capable of laying centre delivery windrows. The knife is mechanically driven and the reel and drapers are hydraulically driven. The hydraulic lift cylinders for the reel and header lift systems are operated by the traction units hydraulic system.

Two wheels mounted behind the header are spring loaded to assist header floatation. Windrow opening width is adjustable by repositioning the draper idler rollers at the opening. Optional header skid shoes and a pickup reel were used in the test.

Detailed specifications are given in APPENDIX I, while FIGURE 1 shows the location of major components.

SCOPE OF TEST

The machine evaluated by PAMI was configured as described in the General Description, FIGURE 1 and the Specifications section of this report. The manufacturer may have built different configurations of this machine before or after the PAMI tests. Therefore, when using this report, check that the machine under consideration is the same as the one reported here. If differences exist, assistance can be obtained from PAMI or the manufacturer to determine changes in performance.

The MacDon Harvest Header was operated for 114 hours in conditions shown in TABLE 1. The header was operated on a 7720 John Deere combine for 51 hours and operated on a Westward 7000 traction unit as a windrower for 63 hours. During this time, observations and measurements were made in the various crops to evaluate the header for rate of work, quality of work, ease of operation, adjustment, power requirements, operator safety, and suitability of the operator's manual. The intent of this test was to evaluate functional performance. Durability tests were not conducted, however, a record of mechanical failures, which occurred during the test, is provided.

RESULTS AND DISCUSSION

RATE OF WORK

When mounted on the Westward 7000 traction unit, uniform windrows were formed at typical speeds of 5 to 7 mph (8 to 11 km/h). The slower speeds were required for good windrow formation in heavy, tangled, or leaning crops. Work rates while windrowing at the typical operating speeds varied from 17 to 24 ac/h (6.8 to 9.6 ha/h). The maximum rate achieved was 30 ac/h (12.1 ha/h) in a flax crop.

The rate of work of the Harvest Header while straight cut harvesting depended mostly on the capacity of the combine. With the John Deere 7720 Titan II combine used, a ground speed of 3 to 4 mph (4.8 to 6.4 km/ h) was typical in moderate wheat crops that yielded 35 bu/ac (2.3 t/ha). Higher ground speeds could be expected when using a larger capacity combine.

Typically, slower ground speeds were required in adverse crop conditions such as in lodged, tangled, or weedy crops while windrowing or straight cut harvesting.

TABLE 1. Operating Conditions

Operation	Crop	Variety	Yield		Hours	Area	
			bu/ac	t/ha		ac	ha
Straight Cut Harvesting	Winter Wheat	Norstar	30-35	2.0-2.3	8	60	24
	Wheat	Katepwa	20-50	1.3-3.4	21	260	105
	Barley	Bonanza, Harrington	40-70	2.3-4.0	16	130	53
	Flax	Norlin	25	1.5	6	65	26
				Total	51	515	208
Windrowing	Winter Wheat	Norstar	35	2.3	5	90	36
	Wheat	Katepwa	30-45	2.0-3.0	21	395	160
	Barley	Harrington	40-60	2.3-3.4	19	325	130
	Canola	Legend, Regent	30-35	1.7-2.0	11	210	85
	Flax	Norlin	30	1.8	7	150	60
				Total	63	1170	471
				Overall Total	114	1685	679

QUALITY OF WORK

Dividing: Crop dividing was good.

Dividing effectiveness is determined by the ability of the ends of the header to pass through standing crop with minimal crop loss and tangling.

The divider rods usually bent the crop over slightly. The bent crop was easily cut on the next pass. When cutting low, the divider trampled tangled crop. The trampled crop was usually left uncut on the next pass when windrowing around the field. However, cutting back-and-forth recovered most of the trampled crop. No tangling occurred at either end of the header.

Header Flotation: Header flotation was very good when mounted on both the combine or traction unit.

A header flotation system is intended to help lift the header over rocks, round irregularities and other contacted objects without damaging components while providing enough vertical stability to maintain a regular and uniform stubble height.

The leaf springs and linkage on the combine adaptor provided vertical flotation and allowed the header to pivot laterally and follow field contours while cutting in rolling terrain. The springs on the traction unit header lift mechanism provided the same vertical flotation and flexibility to follow field contours as they would on a regular header. Springs on the gauge wheels helped support the outer ends of the header and cushioned the header from sudden bumps or ridges.

The header bounced over most rocks without damaging the cutterbar. Over the season only three knife sections broke. Several guards required straightening and one was replaced.

The optional skid plates prevented the cutterbar from contacting the ground. In most conditions, the skid plates rode over the ground. However, as is typical of most skid plates, in soft damp soil, ground was occasionally pushed ahead of the skid plates. Care was required when straight cutting to prevent a mound of soil from being pushed up. Soil passing over the cutterbar was conveyed to the combine feeder where it restricted crop flow and collected under the feeder draper.

Cutting: Cutting ability was very good.

Cutting effectiveness is determined by the ability of the drives to power the knife through tough hard-to-cut crops without stalling. It is also judged by how cleanly it cuts the crop. Three typical types or patterns of stubble that can be left are shown in FIGURE 2. Stubble, which is torn, indicates reduced cutting efficiency.

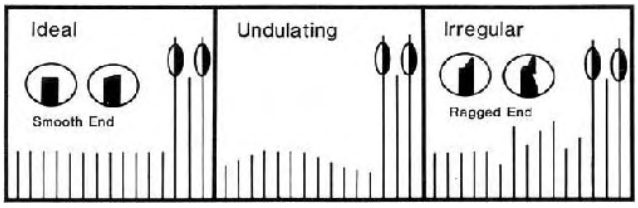

FIGURE 2. Types of Stubble.

The knife had adequate power and never stalled during the test, even in adverse conditions or cutting at high speed. In most crops, the stubble left by the Harvest Header was ideal or undulating. The undulating stubble was caused by header bounce in rough fields. Header bounce was never excessive with the flotation properly set.

Crop Handling: Crop handling was very good when both windrowing and straight cutting.

Crop handling refers to the flow of crop from the time it is cut until it is formed into a windrow or, for this machine when mounted on a combine, until it is in the combine feeder. Many components, adjustments and design features contribute to the flow or crop handling characteristics. These include the reel, table, drapers, feed auger and windrow opening.

The bat reel worked well in standing crop from heavy to short, thin stands. Its performance was reduced in lodged and tangled crop. The optional pickup reel was ideally suited to handle lodged and tangled crop and also worked well in heavier stands. However, it was not suited to short thin stands. Both reels aided crop movement back over the cutterbar and helped lay the crop properly on the drapers.

Reel height was typically set so the reel bats entered the crop to the depth of the heads in standing crop. In lodged crop, the bat reel could not enter the crop. The fingers on the pickup reel easily penetrated the dense layer of crop. The angle of the fingers was adjusted according to the amount of lifting action required.

The vertical height adjustment range was adequate for the crops and conditions encountered. Minimum height was set at about 2 in (50 mm) above the cutter-bar, which generally kept it clear in short crops. For most crops, the fore-and-aft reel adjustment was set so the reel bats were vertical when directly over the knife. The pickup reel was positioned further forward. Reel speed was typically set just slightly faster than ground speed and the adjustment range was suitable for all crops and conditions encountered.

The table angle could be adjusted to provide a draper angle of either 11 or 14 degrees for windrowing and anywhere between 13 to 16 degrees when straight cutting. The shallower angles were well suited for short crop as less crop slid back down the drapers as it was conveyed. The steeper angles were more suited for conveying tall crops, canola and flax, especially when windrowing.

The drapers had adequate power to convey all crops encountered. The speed adjustment range provided draper speeds up to 610 ft/min (3.1 m/s), which were adequate for typical harvesting speeds.

The windrow opening width adjusted from 42 to 67 in (1070 to 1700 mm) and the clearance was 37 in (940 mm) which enabled unrestricted crop flow for all crops encountered.

The feeder draper conveyed most crops into the combine feeder. In feeding heavy or fluffy crops, the cross auger aided by directing the crop under the combine feeder chain. This feeding system was susceptible to plugging if any restriction occurred at the combine feeder. At the beginning of the season, rust on the combine's feeder floor caused crop to frequently hesitate at the feeder opening. The feeder draper quickly pulled crop around and plugged the underside of the feeder draper. Feeding improved greatly once the rust was removed. Similarly, even after the feeder was polished, very short barley also bridged at the inlet to the combine feeder. Again, the feeder draper pulled crop around and plugged. Feeding was improved by removing the shield over the opening to the combine feeder house (FIGURE 3). This provided a wider opening minimizing the restriction and reducing the amount of material caught in the corners in front of the feeder house.

FIGURE 3. Feeder House Inlet.

Windrow Quality: Windrow quality was very good.

Windrow formation refers to the pattern formed by the plants laying in the windrow. There are four main types as shown in FIGURE 4. Windrow uniformity refers to variations in the density of the windrow, which is seen as bunches or wads.

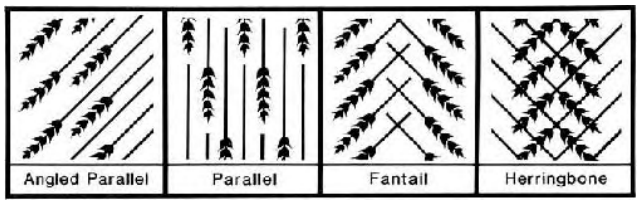

FIGURE 4. Windrow Formations.

FIGURES 5 to 8 show typical windrows laid by the MacDon Harvest Header in four different crops. In most crops, the windrows were uniform and laid in a parallel formation. Canola and flax windrows were very even, however, at the centre of the windrow, cut crop stood upright and when rolled with a swath roller, was pushed ahead. This caused the crop in the centre to lay in the wrong direction. Increasing the draper angle to the maximum angle, and widening the windrow opening allowed the crop to lay in the proper direction.

FIGURE 5. Wheat Windrow: 45 bu/ac (3.0 t/ha).

FIGURE 6. Barley Windrow: 60 bu/ac (3.4 t/ha).

In short barley crops, the windrows often had no distinct formation. This is typical of most windrowers, however, the low platform angle of 11° for the MacDon Harvest Header provided better windrow uniformity than the 14° platform angle as less crop material collected on the cutterbar.

Depending on the windrow opening used, the windrows were 4 to 6 ft (1.2 to 1.8 m) wide. Canola windrows were 6 to 9 ft (1.8 to 2.7 m) wide after they had been rolled into the stubble.

Acceptable windrow quality was obtained over a wide range of reel and draper speeds. Reel or draper speeds had to be excessively fast or slow to reduce windrow quality. Very slow reel speeds caused bunchy windrows and excessive draper speeds resulted in a herring-bone windrow with the heads concentrated in the centre.

FIGURE 7. Canola Windrow: 35 bu/ac (2.0 t/ha).

FIGURE 8. Flax Windrow: 30 bu/ac (1.8 t/ha).

EASE OF OPERATION AND ADJUSTMENT

Installation: Ease of attaching the MacDon Harvest Header to the combine was very good while ease of attaching it to the windrower traction unit was good.

When familiar with the operator's manual instructions, the combine adaptor could be attached to the combine in about 10 minutes. Attaching the header to the combine adaptor took about another 15 minutes once the operator was familiar with the procedure. More time was required for initial set up to properly align the components. When removing the adaptor from the combine or traction unit, the header and adaptor had to be set on blocks to provide proper alignment for reattaching.

Initial set up required mounting an adaptor on the windrower. This adaptor had to be coupled to the linkages, and the hydraulic lines on the traction unit had to be replumbed. Hooking the header to the windrower traction unit then took about 20 minutes when familiar with the procedure and if all the pins properly aligned with their holes. Installing the header mounting pins was often difficult as the rubber mounting lugs twisted when the header was raised. The flotation spring links were also difficult to install as both pins of each half of the link had to be inserted in their holes at the same time. It is recommended that the manufacturer consider modifications to enable easier attachment to a windrower traction unit.

All of the hydraulic hoses were colour coded with tape to identify them for easier connection. Several of these tapes came off making hooking up inconvenient. It is recommended that the manufacturer consider providing more permanent identification marking for the hydraulic hoses.

Controls: The controls were very good.

The regular combine controls set the cutting height, reel height, and reel speed of the MacDon Harvest Header. The draper speed control was located on the header adaptor. Frequent adjustment was not required, however, the operator had to leave the operator station to adjust draper speed. A draper speed control within the cab would have made the adjustment much more convenient. It is recommended that the manufacturer consider providing a draper speed control that can be operated from the combine cab.

The controls of the Westward 7000 traction unit adjusted all header functions. The reel and header raised and lowered at an

acceptable rate. Adequate speed ranges were provided for both the reel and drapers.

Adjustments: Ease of adjustment was very good.

For initial operation, adjustments included aligning drive components on the adaptor, levelling the header, setting reel-to-cutterbar clearance, adjusting header flotation, setting header angle, and aligning and tensioning the drapers. The adjustments were easily done using common tools. When attached to the combine, the header was levelled with the adjustment provided on the combine's feeder house. Header angle was easily adjusted any where between 13° and 16° when mounted on the combine. For windrowing, the header had to be removed from the traction unit, and the rubber mounting lugs relocated to set the header angle at either 11° or 14°.

Periodic adjustment included setting minimum reel height, reel fore-and-aft position, pickup finger angle and windrow opening.

The reel position could be adjusted in 11 increments over a range of 22 in (560 mm), using common wrenches. Care was required to ensure there was adequate clearance for the rotating reel when it was moved back on the reel arms.

The finger angle adjustment for the pickup reel was easily set. The reel-to-cutterbar clearance was easily set by adjusting the reel lift stop.

The distance between the centre draper rollers had to be adjusted to suit the size of windrow desired for the crop conditions and for proper feeding onto the feeder draper when combining. The opening adjusted from 42 to 67 in (1070 to 1700 mm). The adjustment was easy, but time consuming. Setting the appropriate opening required shortening or lengthening the drapers by taking out or adding pieces of draper.

Handling: Handling characteristics were very good when mounted on the combine and good when on the windrower traction unit.

The header was easily maneuvered by the combine when straight cutting. The flotation system provided the operator with much easier header height control in uneven ground than possible with a rigid header. This reduced operator attention required especially when working in shorter crops. The header had little effect on the combine handling.

The offset header extended 20 in (0.5 m) further to the right of the feeder than to the left. Still, the standard 14 ft (4.3 m) unloading auger on the combine was not long enough to conveniently unload into a truck located at the end of the header. For any combine, the unloader would have to extend about 20 ft (6.1 m) out from the centre of the feeder in order to unload conveniently on the go.

The windrower power unit was very maneuverable. The steering was quick and the wheel base was short. As a result, although the header was easily manuevered, the combination of the header width and the traction unit response made oversteer common with less experienced operators. This also necessitated caution when encountering rough ground especially at higher speeds. About 450 lb (204 kg) of weights were added to the traction unit to counter balance the header. This was adequate for the header when using the bat reel but the traction unit would still tip forward on abrupt stops when using the pickup reel.

Transporting: As with any 30 ft (9.1 m) implement, transporting down public roadways requires extreme caution. The header can be transported on the windrower using a transporter, which tows the unit sideways. Alternately, the header can be hauled on a header trailer. This works for either the combine or windrower. Care is required in selecting the proper trailer, especially if the unit must serve both the combine and windrower. Carrying height, header angle and wheel placement are critical to enable either unit to set the header on and pick it off the trailer. As well, the hitch load must be considered so as not to overload the towing vehicle's hitch. The trailer should be equipped with brakes if transport speeds above 20 mph (32 km/h) are to be used.

The windrower traction unit should not be considered as a towing vehicle. The added weight on the rear axle could cause serious damage and unstable handling characteristics.

Care is also required when transporting the combine across rough ground with the header raised. The flotation system may allow the header to bounce excessively and damage could occur.

Visibility: Visibility was excellent.

The drapers provided a clear view of the crop as it was conveyed to the combine's feeder house. When mounted on the combine, the left side was visible, but the right end of the header was visible only when the operator leaned forward. Other combine models may provide better visibility.

Visibility for windrowing when mounted on the Westward 7000 traction unit was also excellent. Both ends of the header could be clearly viewed.

Adequate lighting was provided by both the combine and traction unit for night operation. The galvanized metal bats on the bat reel reflected light back to the operator. The pickup reel reflected less light as it was painted black.

Servicing: Ease of servicing was very good.

The daily or 10 hour service took less than 10 minutes. The operator's manual provided clear instructions and a maintenance chart for record keeping. The driveline usually had to be turned manually to access the grease fittings on the universal joints. Other service and maintenance was required for 25, 50 and 100 hour intervals, and was easily performed.

POWER REQUIREMENTS

Average power requirement of the MacDon Harvest Header when combining at 3 mph (4.8 km/h) in a 50 bu/ac (3.4 t/ha) wheat crop was less than 20 hp (14.9 kW). During the test, the combine and traction unit easily supplied the required power.

OPERATOR SAFETY

Normal safety precautions were required while operating the MacDon Harvest Header. The operator's manual emphasized operator safety, and should be read prior to machine operation. Warning decals were mounted on the header to point out precautions for safe operation. Adequate shields were provided. Safety locks were provided for the reel when in a raised position. Header lift locks were provided on the Westward 7000 power unit and on the combine.

When mounted on the combine, the draper speed control was located on the header adaptor. Frequent adjustment was not required, however, the operator had to leave the operator station to adjust draper speed. It was convenient to leave the header running to allow the operator to visually judge the change in draper speed. Although the manufacturer discourages this practice, operators are likely to do it. Some combines automatically stop the header when the operator leaves the cab. This would make it impossible for one person to change and observe the draper speed at the same time but may encourage the use of a second person. A draper speed control within the cab would make the adjustment more convenient and much safer. A recommendation has been made.

The operator's manual provided useful information for transporting the header when driving the combine or traction unit. Warning lights were provided at each end of the header. However, the safe transport of the header is the responsibility of the operator. The operator should contact provincial authorities for the laws governing the safe transport of wide equipment.

The overall header width was too wide to allow safe travel on roadways when driving the combine or power unit with the header attached. If the header is placed on a trailer for transporting, the trailer must have sufficient load carrying capacity, and its wheels must be located so the hitch weight does not over load the towing vehicle. The trailer should also be equipped with electric brakes when transporting at speeds above 20 mph (32 km/h).

OPERATOR'S MANUAL

The operator's manuals were very good.

Separate manuals were provided for the header and pickup reel. The manuals contained much useful information that was easy to follow and well illustrated. It is essential that the operator read the manuals and follow the instructions for safe and reliable use of the machine.

MECHANICAL HISTORY

TABLE 2 outlines the mechanical history of the MacDon Harvest Header during 118 hours of field operation while harvesting and windrowing 1675 ac (670 ha) of crop. The intent of this test was to evaluate functional performance. Extended durability testing was not conducted.

TABLE 2. Mechanical History

Item	Operating Hours	Field Area ac	(ha)
- The left draper was tom at the connector slat after	74	1155	(462)
- The left adaptor drive shaft wrapped with flax staw at	108 - 118	1620	(653)
- 3 knife sections were replaced	During the test		
- 1 knife guard was replaced During the test	During the test		

Drapers: The left draper was torn at the connector slat. This was caused by the connector slat catching on the lower draper guide. The draper was shortened slightly and reconnected.

Knife Sections: Three knife sections were replaced during the test. One knife section was sheared off at the rivets and not recovered from the field. In order for the knife to stop when an object is caught on the cutterbar, the knife drive belt must slip. Over tightening the drive belt could result in more severe damage.

Left Adaptor Drive: The left adaptor drive shaft wrapped with flax straw. This only occurred when the header passed over either dropped straw or encountered longer straw, which had been pulled around by the drapers. A guard or deflector would eliminate the wrapping. It is recommended the manufacturer consider supplying a guard or deflector for the left adaptor drive shaft.

APPENDIX I
SPECIFICATIONS

MAKE:	MacDon
MODEL:	Harvest Header
SERIAL NUMBER:	76826
MANUFACTURER:	MacDon Industries Ltd. 680 Moray Street Winnipeg, Manitoba R3J 3S3
CUTTERBAR:	
-- width of cut (divider points)	30.6 ft (9.3 m)
-- effective cut (inside dividers)	29.8 ft (9.1 m)
-- minimum cutting height	2 in (50 mm)
-- guard spacing	3 in (75 mm)
-- length of knife section (over-serrated)	3 in (75 mm)
-- full depth	3.2 in (75 mm)
-- cutting length	1.8 in (46 mm)
-- knife stroke	3 in (75 mm)
-- knife speed	675 cycles/min (on traction unit) 550 cycles/min (on combine)
PLATFORM:	
-- number of drapers	2
-- draper width	41.5 in (1054 mm)
-- draper length	varies with windrow opening
-- draper material	rubberized polyester with rubber slats
-- draper speed range	
- on traction unit	570 ft/min (2.9 m/s)
- on combine	610 ft/min (3.1 m/s)
-- angle (fully lowered)	
- on traction unit	11 or 140 below horizontal
- on combine	15 to 180 below horizontal
-- width of windrow opening	41 to 67 in (1041 to 1702 mm)
-- height of windrow opening	37 in (940 mm)
-- stabilizer wheel size	6.70 - 15 4 ply
-- feeder auger	
- length	77 in (1956 mm)
- outside diameter	18 in (457 mm)
ADAPTOR:	
-- feeder draper(size varies with combine used)	
- width	60 in (1524 mm)
- length	46 in (1168 mm)
-- drive type	mechanical
-- speed	560 f/min (2.8 m/s)
-- flotation system	includes 2 leaf springs and 2 coil springs
BAT REEL:	
-- number of bats	5
-- diameter	54 in (1370 mm)
-- number of arms per bat	10
-- maximum height above cutterbar	29.5 in (750 mm)
-- fore-and-aft adjustment range	22 in (560 mm)
-- speed range	0 to 50 rpm (on traction unit)
PICKUP REEL:	
-- number of bats	5
-- number of arms per bat	5
-- maximum height above cutterbar	27.5 in (699 mm)
-- fore-and-aft adjustment range	22 in (560 mm)
-- finger type	plastic
-- finger spacing	4.5 in (114 mm)
-- finger angle adjustment	at cam assemblies at each end of reel
OVERALL DIMENSIONS:	
-- width	30.8 ft (9.4 m)
-- length	8.3 ft (2.5 m)
-- maximum height	6.3 ft (1.92 m)
WEIGHTS:	
-- platform (without reel)	2495 lb (1132 kg)
-- adaptor	1115 lb (506 kg)
-- bat reel	215 lb (98 kg)
-- pickup reel	775 lb (352 kg)

OPTIONS AND ATTACHMENTS:

-- header available in 25, 30, or 36 ft (7.6, 9.1, or 11 m) widths
-- gage wheels are standard on 36 ft (11 m) model, and optional on the 30 ft (9.1 m) model only
-- skid shoes
-- pickup reel

APPENDIX II
MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

SUMMARY CHART

MACDON HARVEST HEADER

RETAIL PRICE	$24,398.00 [March, 1991, f.o.b. Humboldt, Sask., 30 ft (9.1 m) size c/w adaptor to fit John Deere 7720 combine, pickup reel, bat reel, gauge wheels, and skid shoes].
RATE OF WORK	
Windrowing	
Average Speed	5 to 7 mph (8 to 11 km/h)
Average Workrate	17 to 24 ac/h (6.8 to 9.6 ha/h)
Combining depended on combine capacity	
Average Speed	3 to 4 mph (4.8 to 6.4 km/h) on the combine used
QUALITY OF WORK	
Dividing	**Good;** divided most crops, cutting back-and-forth across field reduced losses
Header Flotation	**Very Good;** followed ground contour well, bounced over most rocks
Cutting	**Very Good;** knife had adequate power for all test conditions
Crop Handling	**Very Good;** handled most crops and conditions
Windrow Quality	**Very Good;** most windrows uniform with parallel configuration
EASE OF OPERATION AND ADJUSTMENT	
Installation	**Very Good;** when attaching to the combine **Good;** when attaching to the traction unit, installing mounting pins was often difficult
Controls	**Very Good;** most provided by the combine or traction unit
Adjustments	**Very Good;** most adjustments were quick and easy
Handling	**Very Good;** when mounted on the combine **Good;** when mounted on the traction unit, gauge wheel did not clear high windrows
Transporting	a header trailer or windrower transporter was required due to wide width
Visibility	**Excellent;** crop easily viewed, the pickup reel reflected less light back to the operator at night
Servicing	**Very Good;** daily service took less than 10 minutes
POWER REQUIREMENTS	Less than 20 hp (14.9 kW) in a 50 bu/ac (2.4 t/ha) wheat crop, traction unit and combine easily provided the power.
OPERATOR SAFETY	adequate shields provided; draper speed control required leaving the combine cab.
OPERATOR'S MANUAL	**Very Good;** very useful and well illustrated
MECHANICAL HISTORY	very few minor failures

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