

# Evaluation Report

685



## Macdon 5000 Mower Conditioner

A Co-operative Program Between



# MACDON 5000 MOWER CONDITIONER

## MANUFACTURER AND DISTRIBUTOR:

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## RETAIL PRICE:

\$23,506.00 (f.o.b. Portage la Prairie, MB, October 1991) Available options were: Skid Shoes - \$145.00, Tall Crop Divider - \$99.00, High Usage Parts Kit- \$510.00, Reel Bat Kit -\$271.00, 1000 rpm Pump -\$130.00.

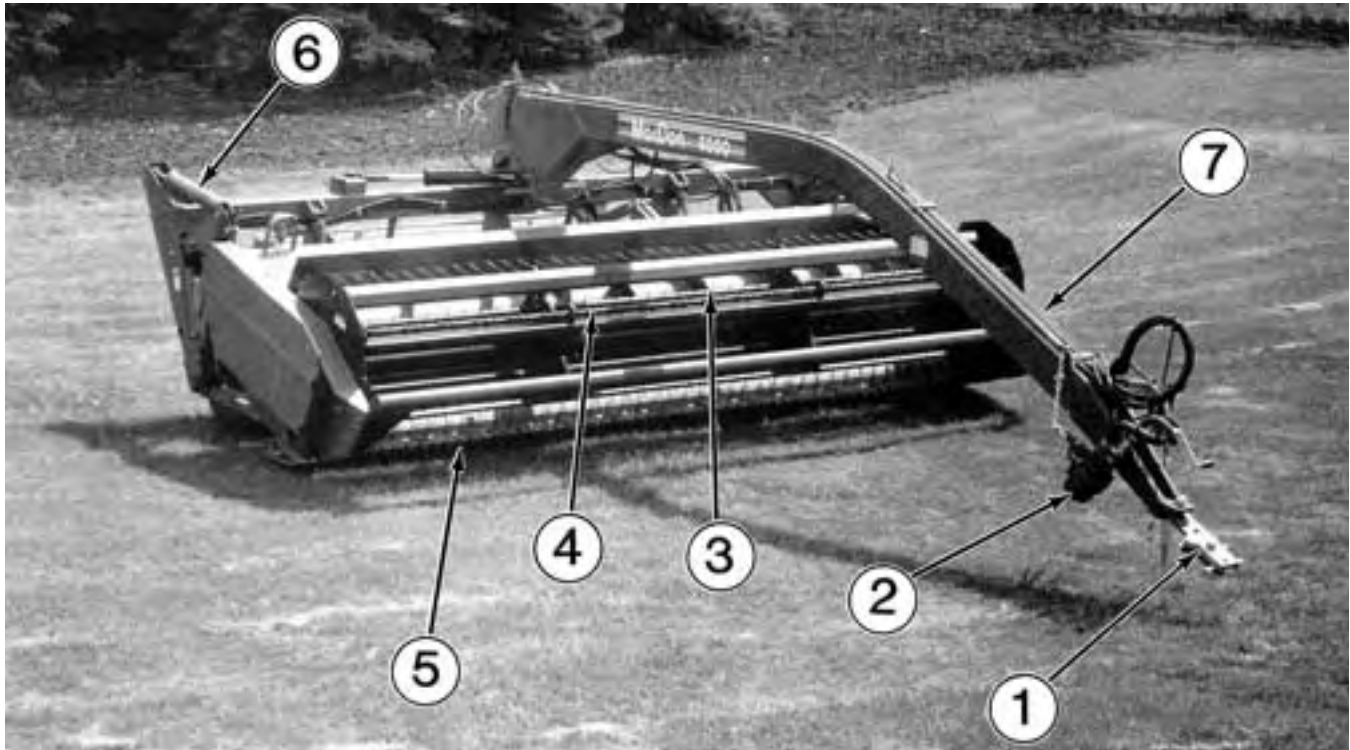


FIGURE 1. MacDon 5000 Mower Conditioner: (1) Drawbar Extension, (2) Hydraulic Motor, (3) Feed Auger, (4) Reel, (5) Cutter Bar, (6) Floatation Springs, (7) Hitch Tongue.

### SUMMARY

**Rate of Work:** The average continuous ground speed for the MacDon 5000 was 5.5 mph (8.8 km/h). Average continuous work rate was 8.2 ac/h (3.3 ha/h). **Quality of Work:** The performance of the MacDon 5000 mower conditioner in all crops tested was very good. The single knife cutterbar was very good cutting alfalfa, native grasses, timothy and clover. Performance of the conditioning rolls was very good in all crops tested and windrow formation was very good. Floatation was very good and was easily set to match field conditions. Leaf loss was minimal.

**Ease of Operation and Adjustment:** Ease of hitching was good if the windrower was used with different tractors. If used with the same tractor all of the time, hitching was very good. Ease of operating the hydraulic controls, and lubricating were all very good. The MacDon 5000 was easy to operate and took little operator practice.

Daily servicing took one person about 15 minutes. Ease of transporting was very good.

Ease of adjustments of the MacDon 5000 was good. Most adjustments were simple but had to be performed manually on the ground. Ease of setting components to suit field conditions was very good. Setting was usually quick and required only a little fine tuning.

**Power Requirements:** The manufacturer recommends a tractor of at least 75 hp (56 kW) with dual remote hydraulic outlets and a PTO shaft capable of 540 rpm or 1000 rpm.

**Operator Safety:** The MacDon 5000 was safe to operate if normal safety precautions were followed. The MacDon 5000 complied with all applicable ASAE standards for safety.

**Operator's Manual:** The operator's manual was excellent. It contained accurate and useful information.

**Mechanical History:** Only a few mechanical problems

occurred during the 138 hour test time. The header tilt bracket separated from the main frame. The wobble box and pitman arm were replaced.

### RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. An addition to the operator's manual that would list and outline potential hitching problems with some tractors.
2. A modification to the wobble box bracket that would allow a socket wrench to be used to apply torque to the jam nut on the output shaft of the wobble box.

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### THE MANUFACTURER STATES THAT

With regards to the recommendations:

1. The mounting holes in the drawbar extension conform to the ASAE standard for tractor drawbars and fits most popular tractors. If the tractor drawbar is not standard, the need to drill a different hole is obvious.
2. The shoe under the wobble box output shaft has been changed to provide clearance for a socket wrench.

### Manufacturer's Additional Comments

To facilitate cutterbar maintenance, sickle sections are now bolted to the sickle bar.

## GENERAL DESCRIPTION

The MacDon 5000 mower conditioner is designed to cut, condition, and windrow hay and forage crops. It is a pull-type trailing machine with a centre mounted tongue that allows operation on both sides of the towing tractor. The unit is capable of cutting swaths up to 14.3 ft (4.3 m) wide in a single pass.

The MacDon 5000 is hydraulically powered and derives its 540 rpm (1000 rpm optional) rotary power from the power take-off shaft mounted hydraulic pump connected to a hydraulic motor mounted on the header frame. Power is then transmitted mechanically to the four component drives on the header; the reel, auger, knife, and conditioning rolls. The MacDon 5000 has a single 14.3 ft (4.3 m) cutterbar that utilizes forged guards and over serrated knife sections. The knives are mounted to the cutterbar with rivets.

The reel is supplied with 5 bat bars and tine tubes. The reel is adjustable for fore and aft movement as well as for height and rotational speed. The tine bars are controlled by a cam track located on the right hand side of the header.

The MacDon 5000 has a single progressive pitch feed auger, which feeds the crop into the dual steel conditioning rolls. The conditioning rolls mesh together in a helical design and are arranged within the header one on top of the other.

Sheet metal panels at the rear of the header are adjustable for forming windrows of desired height and width.

The windrower is supported by pneumatic rubber floatation tires and the header floatation weight is controlled by two large tension springs arranged one per side.

The height of the machine is hydraulically adjustable to permit ease of conversion from field to transport position. It utilizes mechanical transport locks.

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 APPENDIX I of this report. The manufacturer may have built different configurations of this machine before or after 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 5000 was operated in the crops shown in TABLE 1 for 138 hours while cutting and conditioning about 654 acres (265 ha). It was evaluated for rate of work, quality of work, ease of operation and adjustment, power requirements, operator safety, and suitability of the operator's manual. In addition, mechanical problems were monitored throughout the test.

TABLE 1. Operating Conditions

Crop	Hours	Equivalent Field Area	
		ac	ha
Alfalfa	81	394	160
Timothy & Brome	12	65	26
Native Grasses	31	120	49
Green Feed (Oats)	14	75	30
Total	138	654	265

## RESULTS AND DISCUSSION

### RATE OF WORK

The rate of work was dependent upon field roughness, soil moisture, crop density, machine width and operator experience. The average continuous ground speed was 5.5 mph (8.8 km/h) and the average continuous workrate was 8.2 ac/h (3.3 ha/h). The MacDon 5000 was capable of cutting and conditioning at speeds up to 6.5 mph (10.4 km/h). Average daily work rates are lower than continuous work rates because continuous rates do not account for time lost due to turning and other field irregularities.

### QUALITY OF WORK

**Windrow Formation:** The MacDon 5000 produced very good windrows in all crops tested. When the windrow forming shields were adjusted to their narrowest settings, the forming shields produced a clean edged windrow that easily served as guide for the tractor wheel for the succeeding row. When the shields were spread further

apart, wider flatter windrows resulted.

Windrows up to 7.5 ft (2.3 m) wide or as narrow as 2.5 ft (0.76 m) could be achieved. The MacDon 5000 allowed six settings within this range.

The centre delivery discharge allowed a continuous windrow to be formed around corners. It was easy to adjust the windrow width to accommodate the pickups of balers subsequently used.

**Cutterbar Performance:** Cutting ability of the single cutterbar was very good if the forward ground speed of the windrower was kept below 6.5 mph (10.4 km/h). Speeds in excess of 6.5 mph (10.4 km/h) produced ragged uneven stubble. The MacDon 5000 was very effective cutting native grasses, due to the high cyclic rate of the knife. Damp and fine stemmed crops did not adversely affect cutting ability. If the knife was passed repeatedly through a damp mole hill or gopher mound, it would eventually plug. The MacDon 5000 produced ideal stubble in most crops. In areas that were trampled or lodged, stubble height was controlled by the individually adjustable skid shoes beneath the header.

**Floatation:** Two large tension springs provided very good floatation. Two adjustable skid shoes were located on the header underside. The skid shoes provided cutterbar height adjustments of up to 4 in (100 mm).

**Conditioner Performance:** Conditioner performance was very good. The MacDon 5000 was equipped with two counter rotating conditioning rolls. The two 7.8 ft (2.3 m) long rolls meshed together in a spiral design. The rolls were arranged within the header one on top of the other. Both 10 in (250 mm) diameter rolls were constructed of steel. As the crop passed through the conditioning rolls, the stems were crushed or broken allowing moisture evaporation.

The difference in drying or curing time between a conditioned crop and an unconditioned crop is shown in FIGURE 2. The tests were carried out in the same crop on the same days in parallel windrows. Other conditions that affect curing time are stubble height, ambient temperature and wind velocity. Generally, the advantage of a conditioned crop is one-half to one-day advance baling.

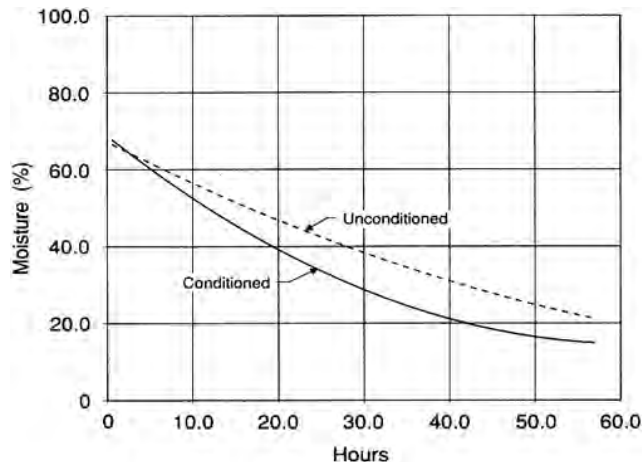


FIGURE 2. Conditioner Performance.

**Leaf Loss:** Leaf loss was minimal and was considered very good on the MacDon 5000. Very few loose leaves were observed on the ground after passing through the conditioner.

### EASE OF OPERATION AND ADJUSTMENT

**Hitching:** Ease of hitching was good. The MacDon was supplied with a drawbar extension that had to be bolted to the tractor drawbar before the mower conditioner could be attached. On some older tractors the holes would not align and new holes had to be drilled to accommodate the hitch extension. Once the extension was attached to the drawbar, the windrower hitch was lowered onto the hitch extension pin (FIGURE 3).

A suitable sized cotter pin through the drawbar extension pin locked the windrower in position. The hitch jack was raised, removed from the hitch and stored on the underside of the swing tongue.

The PTO driven hydraulic pump was placed on the greased power-shaft of the tractor, and its anti-torque lever was adjusted to bear against the drawbar and was chained in position. On some makes of tractors the drawbar roller interfered with the hydraulic

pump and required time consuming relocation. It is recommended that the manufacturer consider an addition to the operator's manual that would list and outline potential hitching problems with some tractors. Hook-up was completed with the attachment of four hydraulic hoses to the remote hydraulic couplers of the tractor and proper attachment of the safety chain.

In general, if the tractor was compatible with the hitch extension and hydraulic pump, hitching was easy and took one person about 10 minutes.



FIGURE 3. Hitch Extension.

**Hydraulic Controls:** Ease of operating the hydraulic controls was very good. The MacDon 5000 responded well to hydraulic inputs from the tractor. Tractor flow control adjustments were sometimes required on the circuit, which controlled the speed of the swing tongue. The MacDon was equipped with two separate hydraulic control circuits.

Mower height was controlled by double acting cylinders attached to each of the ground wheels. These cylinders also lifted the MacDon high enough to allow placement or removal of the safety locks. Movement of the header was easy and required only the fore and aft movement of the appropriate hydraulic lever.

The second hydraulic circuit was used to power the double acting cylinder, which swung the tongue from side to side.

Swinging the header from one side of the tractor to the other was easy and required only the fore and aft movement of the appropriate lever.

**Transporting:** Ease of transporting was good. The MacDon 5000 was prepared for transport by centralizing the centre pivot tongue and locking the header perpendicular to the tongue by moving the transport latch rod to its lower position. The windrower was raised to its full maximum height and the transport locks were placed on the wheel cylinder rams and pinned in place. The cylinder locks ensured the header could not be lowered to the ground while in transport.

The 15.4 ft (4.7 m) overall width was not convenient when traversing bridges or meeting oncoming traffic on narrow roadways. Caution had to be exercised when meeting traffic or obstacles. The MacDon 5000 towed well at 30 mph (50 km/h) and had sufficient ground clearance over high crowned roads. The manufacturer places strong emphasis on safety and recommends that travel speed should not exceed 20 mph (30 km/h). The floatation tires provided very good support over damp ground and met the requirements of the Tire and Rim Association for the weight of the machine.

**Lubrication:** Ease of lubrication was very good. The tongue of the MacDon 5000 also served as the hydraulic fluid reservoir. Checking the level of the hydraulic fluid was easy and consisted of parking the windrower on a level area, and checking the level of the

fluid in the sight glass provided on the hitch pivot. Several sealed bearings were used throughout the machine and therefore did not require additional lubrication. There were, however, seven pressure fittings that required grease every ten hours and fifteen pressure fittings that required grease every fifty hours.

In addition, there were several locations that required external applications of SAE 30 motor oil. The operator's manual illustrated where and when lubrication was required. Normal daily lubrication took about 15 minutes to complete. All grease pressure nipples were easy to get at with the exception of those within universal joints.

**Field Operation:** Ease of field operation was very good. The MacDon 5000 was placed in field position by raising the header to its maximum height and removing and storing the wheel transport locks. The tongue lock was released by raising the latch rod to its upper position. The tongue was moved to the field position, the header was lowered to the ground, the PTO engaged and the windrower advanced into the crop to initiate cutting, conditioning and windrowing.

Once cutting began, a visual inspection of the results determined what adjustments had to be made. Usually adjustments to the header floatation had to be made to be compatible with ground contours.

Due to the design and location of the hitch tongue cutting on both sides of the tractor was possible. Moving the windrower from one side of the tractor to the other was simple. Steering around corners and obstacles required a little operator practice.

**Adjustments:** Ease of adjustment was good. No adjustments were possible from the tractor seat. All adjustments, including the lean bar, cutterbar, roll gap, reel speed and position, floatation and windrow forming were carried out manually on the machine.

The lean bar was adjustable for height only and was difficult for one person to accomplish. The cutterbar angle was easily adjusted and once set for a particular crop, did not require readjustment.

The skid shoes controlled the height at which the mower conditioner cut and were adjustable for height. Adjustments for reel speed were simple and allowed reel speed to be increased from 53 to 66 rpm by repositioning the drive pulleys. An optional pulley was available that would produce a reel speed of 60 rpm. The reel position was adjustable and allowed horizontal and vertical repositioning of the reel. Reel position adjustments were required for some types of crop conditions.

Adjustments for auger speed and position were not possible. The stripper bars that prevent crop from winding around the auger were easily adjusted for position.

The conditioning rolls were not adjustable for pressure or rotational speed. Gap adjustments that controlled the amount of space between the rolls were easily accomplished. Roll timing adjustments were accurate and easy to complete if the instructions in the operator's manual were followed. The rolls separated when the header was raised to the full up position for power through unplugging.

Floatation of the header was easily adjustable to suit field conditions and were completed by one person in about 10 minutes. **Field Setting:** Ease of setting components to suit field conditions was very good. Once familiar with the machine's performance, setting was usually quick and required only a little fine tuning. The mower conditioner was easily converted from transport position into field position and consisted of releasing and removing the transport locks.

Usually floatation adjustments were required to suit field conditions and occasionally the cutterbar angle had to be adjusted to suit the crop in which the machine was operated.

The conditioner roll gap usually required adjustment when changing from one crop type to another. Native grasses, brome, timothy and fescue type crops required a smaller gap than legume type crops.

The forming shields were easily adjustable to make windrow width compatible with the baler pickup. Windrow shield adjustments were easy.

**Maintenance:** Ease of maintaining the MacDon was good. It was time consuming to replace a knife section in the field. The machine was easily cleaned and inspected for broken or damaged parts.

**POWER REQUIREMENTS**

Average and peak PTO power for the MacDon 5000 were 13.4 and 22.8 hp (10.0 and 17.1 kW) respectively. Average drawbar pull at 5 mph (8 km/h) was 436 lb (1939 N) for a crop yielding 1.7 ton/ac (3.8 t/ha).

PAMI used a variety of tractors throughout the evaluation, which ranged from 75 hp (56 kW) to 140 hp (105 kW). Tractors required at least two remote hydraulic outlets capable of supplying 1750 psi (12.1 MPa) and a PTO shaft capable of 540 rpm (1000 rpm optional).

**OPERATOR SAFETY**

Safety on the MacDon 5000 was very good if normal safety precautions were followed. The test machine was supplied with lights, which provided warning and running lights while the machine was in transport mode.

The test machine complied with all ASAE Standards for safety. All pulleys, sprockets, universal joints and shafts were adequately guarded and labelled.

The MacDon 5000 was equipped with a slow moving vehicle sign and safety chain for the hitch.

**OPERATOR'S MANUAL**

The operator's manual was excellent and contained useful information on specifications, serial numbers, checklists, safety, general information, lubrication, operation, maintenance, adjustments, storage and trouble shooting. The manual was well written and illustrated, while all information contained was factual and accurate.

**MECHANICAL HISTORY**

The mechanical history of the MacDon 5000 is outlined in TABLE 2. The intent of this evaluation was the functional performance of the machine and an extended durability evaluation was not conducted.

TABLE 2. Mechanical History

Item	Hours	Equivalent Area	
		ac	(ha)
Header tilt bracket separated from the main frame and was repaired at:	55	262	(106)
Knife broke due to loose pitman arm. Pitman arm replaced and knife repaired at:	60	282	(114)
Wobble box output splines worn from loose pitman arm. Wobble box and pitman arm were replaced at:	67	314	(127)
Wobble box drive belt broke and was replaced at:	115	559	(226)
Auger drive chain seized and was replaced at:	122	594	(240)

**DISCUSSION OF MECHANICAL HISTORY**

**Header Tilt Bracket:** At 55 hours the header lift bracket weld failed and the bracket separated from the main frame. The bracket was straightened, rewelded and the problem did not recur (FIGURE 4).



FIGURE 4. Broken Header Tilt Bracket.

**Cutterbar:** At 60 hours the cutterbar broke due to a loose pitman arm. The knife bar was welded, the cutterbar reassembled and replaced in the windrower.

**Wobble Box:** At 67 hours the knife bar, and wobble box assembly were replaced. During wobble box replacement it was determined that insufficient torque was applied to the jam nut due to a lack of access room on the output shaft of the wobble box. It is recommended that the manufacturer consider a modification to the wobble box bracket that would allow a socket wrench to be used

to apply torque to the jam nut on the output shaft of the wobble box. After replacement of the knife box and wobble box assembly (FIGURE 5) the problem did not recur.



FIGURE 5. Wobble Box Assembly.

**Drive Belt:** At 115 hours the wobble box drive belt failed. The belt was replaced and no further problem occurred.

APPENDIX I SPECIFICATIONS		
<b>MAKE:</b>	MacDon	
<b>MODEL:</b>	5000 power tongue windrower	
<b>SERIAL NUMBER:</b>	77812	
<b>OVERALL DIMENSIONS:</b>	<u>Transport Position</u>	<u>Field Position</u>
-- length	22.2 ft (6.8 m)	16.3 ft (5.0 m)
-- width	15.4 ft (4.7 m)	21.3 ft (6.5 m)
-- height	6.2 ft (1.9 m)	6.2 ft (1.9 m)
<b>DRIVES:</b>	Hydraulic	
-- main drive	Mechanical	
-- secondary drives		
<b>HEADER:</b>		
-- effective width of cut	14.3 ft (4.32 m)	
-- range of cutting height	2.0 to 21 in (50 to 530 mm)	
-- guard range	6.00 to 11.50 from horizontal	
-- guard type	Twin forged steel	
-- guard spacing	3 in (75 mm)	
-- knife speed	1450 strokes per minute	
-- knife section type	Over serrated	
-- length of knife bar	14.4 ft (4.4 m)	
<b>REEL:</b>		
-- number of bats	5	
-- diameter	22.0 in (560 mm)	
-- number of tines/bat	42	
-- bat teeth spacing	4 in (100 mm)	
-- reel speed range	53 or 66 rpm (60 rpm pulley optional)	
<b>AUGER:</b>		
-- speed	230 rpm	
-- length	14 ft (4.3 m)	
-- outside diameter	22.0 in (559 mm)	
-- inside diameter	12.0 in (305 mm)	
-- flighting pitch	Variable from outside to inside	
<b>CONDITIONING ROLLS:</b>		
-- number of rolls	2	
-- length	7.7 ft (2.36 m)	
-- roll construction	Steel	
-- roll diameter		
-upper	10.0 in (254 mm)	
-lower	10.0 in (254 mm)	
-- roll speed	750 rpm	
-- roll pressure	Factory set (not adjustable)	
<b>WEIGHT:</b>		
-- left wheel	2528 lb (1146 kg)	
-- right wheel	2442 lb (1107 kg)	
-- hitch	726 lb (329 kg)	
Total	5696 lb (2582 kg)	
<b>TIRES:</b>	2, 31 x 13.5 - 15 NHS, 8-ply Terra-Rib	
<b>DRIVES:</b>		
-- number of chain drives	3	
-- number of belt drives	2	

**HYDRAULIC CONTROLS:**

- header lift
- pivot tongue

Two, double acting cylinders  
One, double acting cylinders

**APPENDIX II  
MACHINE RATINGS**

The following rating scale is used in PAMI Evaluation Reports:

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

## SUMMARY CHART MACDON 5000 MOWER CONDITIONER

<b>RETAIL PRICE:</b>	\$23,506 (October 1991, fob Portage la Prairie, MB)
<b>RATE OF WORK:</b>	Average continuous speed was 5.5 mph (8.8 km/h) Average continuous workrate was 8.2 ac/h (3.3 ha/h)
<b>QUALITY OF WORK:</b>	
Windrow Formation	<b>Very Good;</b> fully adjustable
Cutterbar Performance	<b>Very Good;</b> cut all crops effectively
Floatation	<b>Very Good;</b> easy to set
Conditioner Performance	<b>Very Good;</b> effective on all crops
Leaf Loss	<b>Very Good;</b> minimal
<b>EASE OF OPERATION AND ADJUSTMENT:</b>	
Hitching	<b>Good;</b> after drawbar extension installation hitching took about 10 minutes
Hydraulic Controls	<b>Very Good;</b> responded well to hydraulic inputs
Transporting	<b>Very Good;</b> width required extreme caution
Lubrication	<b>Very Good;</b> easy to lubricate
Field Operation	<b>Very Good;</b> easy to operate
Adjustments	<b>Good;</b> easy and fast
Field Setting	<b>Very Good;</b> small amount of fine tuning required
Maintenance	<b>Good;</b> difficult to change sections in the field
<b>POWER REQUIREMENTS</b>	75 hp (56 kW) was sufficient
<b>OPERATOR SAFETY</b>	<b>Very Good;</b> conformed with ASAE standards for safety
<b>OPERATOR'S MANUAL</b>	<b>Excellent;</b> contained useful information
<b>MECHANICAL HISTORY</b>	Only a few problems throughout the test period



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