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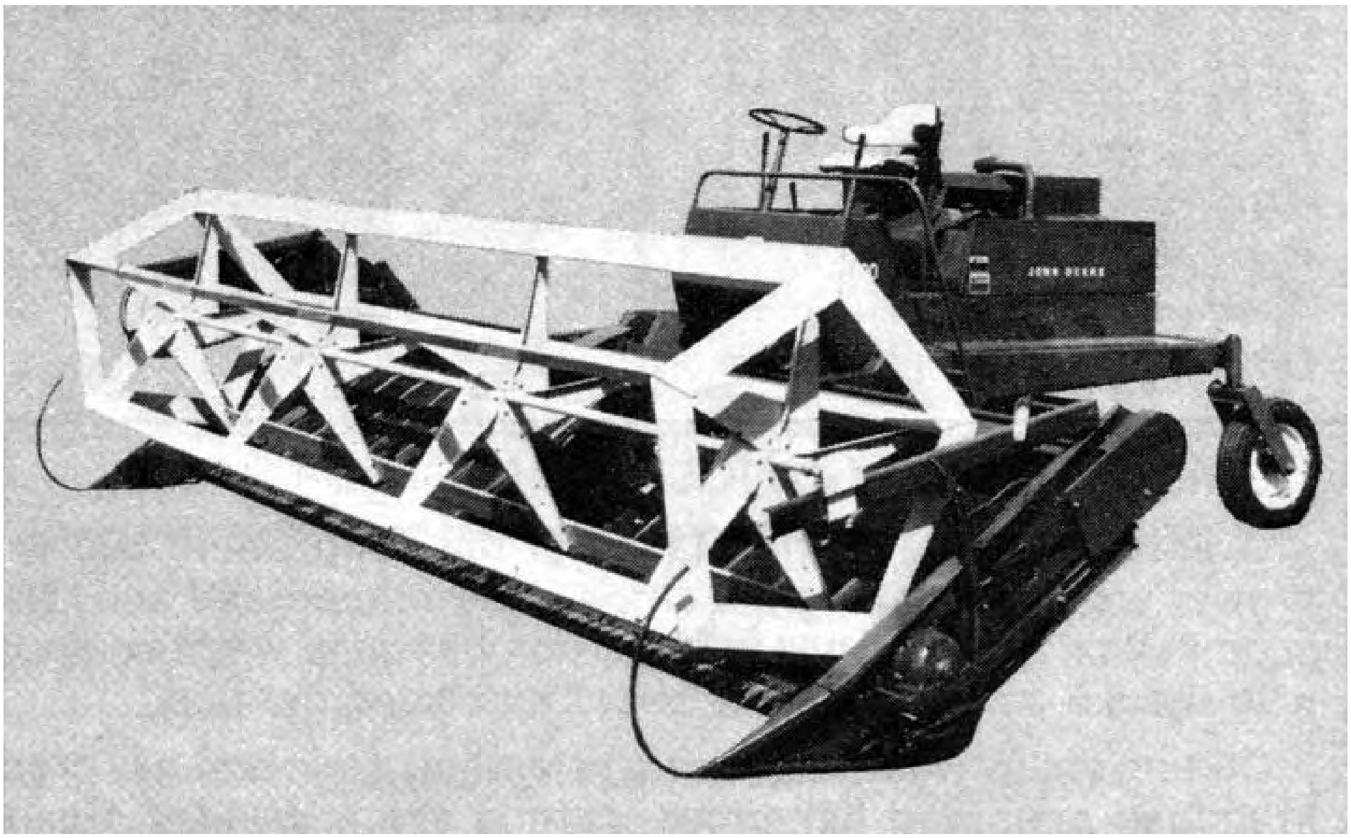
Evaluation Report 52



John Deere 800 Self-Propelled Windrower

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

JOHN DEERE 800 SELF-PROPELLED WINDROWER

MANUFACTURER:
John Deere Ottumwa Works
Ottumwa, Iowa 52501
U.S.A.

DISTRIBUTOR:
John Deere Limited
455 Park Street
Regina, Saskatchewan
S4P 3L8

RETAIL PRICE:
$10,259 (September, 1978, f.o.b. Portage la Prairie, Manitoba with 5.5 m (18 ft) draper header, header gauge shoes, skid plates and float springs).

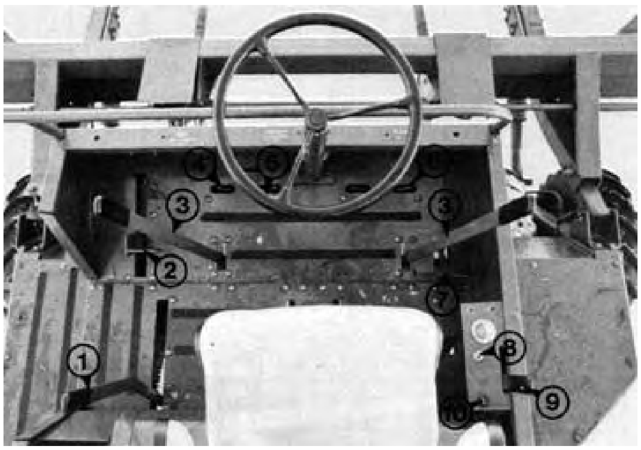


FIGURE 1. Operator's Platform, (1) Variable Speed Lever, (2) Header Engagement Clutch, (3) Directional Control Levers, (4) Reel Height Control Pedal, (5) Steering Wheel, (6) Header Height Control Pedal, (7) Parking Brake, (8) Ignition Switch, (9) Throttle, (10) Choke.

SUMMARY AND CONCLUSIONS

Overall functional performance of the John Deere 800 windrower *was good* in all grain crops, *good* in rapeseed and *fair* to *good* in flax. Performance in hay crops *was good* when equipped with the 5.5 m (18 ft) grain header and listed options.

Cutting ability *was good* in most standing grain and hay crops.

In lodged grain and flax crops, cutting ability was *fair.* Header floatation was *good.*

Windrow formation and quality varied from *fair* to *very good* depending on crop type and stand. Parallel and angled parallel swath patterns were predominant in hay and grain crops. Fantail patterns occurred in most heavy crops while herringbone patterns occurred in light crops. The header windrow opening was inadequate in very heavy crops.

Engine power was adequate. Suitable field speeds were 6.5 to 9.5 km/h (4 to 6 mph) in average grain crops and 6.5 to 9.0 km/h (4 to 5.5 mph) in average hay crops. Normal fuel consumption was 9.2 L/h (2.0 gal/hr).

Operator controls were slightly inconvenient. Handling characteristics and maneuverability were good. Adjustments were convenient.

Daily maintenance took from 25 to 30 minutes.

Visibility from the operator's platform was *very good.* Sound level at the operator's ear was about 89 db(A). No serious safety hazards were encountered when operating according to normal recommended procedures.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying the header windrow opening to reduce restriction in heavy crops.
2. Modifying the reel lift to increase maximum reel height.
3. Incorporating a speed adjustment on the draper drives.
4. Increasing the lift speed of the header and reel.
5. Modifications to reduce caster wheel shimmy at transport speeds.
6. Providing larger tires as an option for operating in soft field conditions.
7. Increasing the fuel tank capacity.
8. Using standardized symbols to identify operator controls.

Chief Engineer -- E.O. Nyborg
Senior Engineer -- J. C. Thauberger
Project Engineer -- S. T. Enns

THE MANUFACTURER STATES THAT

With regard to recommendations 1 through 8:
"The recommendations will be considered and every effort made to correct these various areas with new designs to be incorporated in future machines. There are no plans to make changes to the 800 Windrower."

GENERAL DESCRIPTION

The John Deere 800 is a self-propelled centre delivery windrower with two sets of dual traction drive wheels and two rear castor wheels. It is powered by a Chrysler Industrial six cylinder gasoline engine. The traction drive train consists of a variable speed drive belt system from the engine to a set of planetary drive cases. Roller chains are used between the planetary drives and the wheels. The header is driven through a series of two belts and a single roller chain.

Two hand levers and a trim steering wheel are used to control steering and direction of travel. The variable speed control is hand operated while the hydraulic header and reel controls are foot operated. FIGURE 1 shows the layout of the operator station and controls.

The test machine was equipped with a 5.5m (18 ft) draper-header bat reel, and optional header gauge shoes, skid plates and float springs. Several other header options and accessory attachments are available.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The JD 800 was operated in the conditions shown in TABLE 1 and 2 for 225 hours while cutting about 505 ha (1275 ac). It was evaluated in forage crops, cereal grains and oil seed crops for windrow formation, cutting ability, ease of operation and adjustment, noise level, fuel consumption, operator safety and suitability of the operator's manual.

TABLE 1. Operating Conditions

Crop	Soil Texture	Hours	Field Area	
			ha	ac
Alfalfa	Loam	18	49	120
Bromegrass	Loam	3	5	12
Bromegrass/Alfalfa	Loam	20	57	140
Mixed Hay	Loam	6	11	27
Slough Grass	Loam	4	5	12
Fall Rye	Sandy Loam	11	31	76
Barley	Sandy Loam to Clay Loam	36	88	216
Wheat	Loam to Sandy Loam	52	115	283
Oats	Loam to Sandy Loam	17	25	95
Rapeseed	Loam to Silty Loam	14	35	87
Buckwheat	Sandy Loam to Heavy Clay	31	63	155
Flax	Loam to Clay Loam	13	21	51
Total		225	505	1275

TABLE 2. Operation in Stony Fields

Field Condition	Hours	Field Area	
		ha	ac
Stone Free	201	450	1140
Moderately Stony	24	55	135
Total	225	505	1275

RESULTS AND DISCUSSION
WINDROW FORMATION

Windrow Types: Windrows may be classified into four general patterns (FIGURE 2) although many combinations and variations exist. The JD 800 produced parallel and angled parallel windrows in most hay and grain crops. Herringbone windrows occurred in very light crops while fantail windrows occurred in heavy crops.

TABLE 3 describes the types of windrows produced by the JD 800 in various crops while FIGURES 3 to 12 illustrate typical windrows.

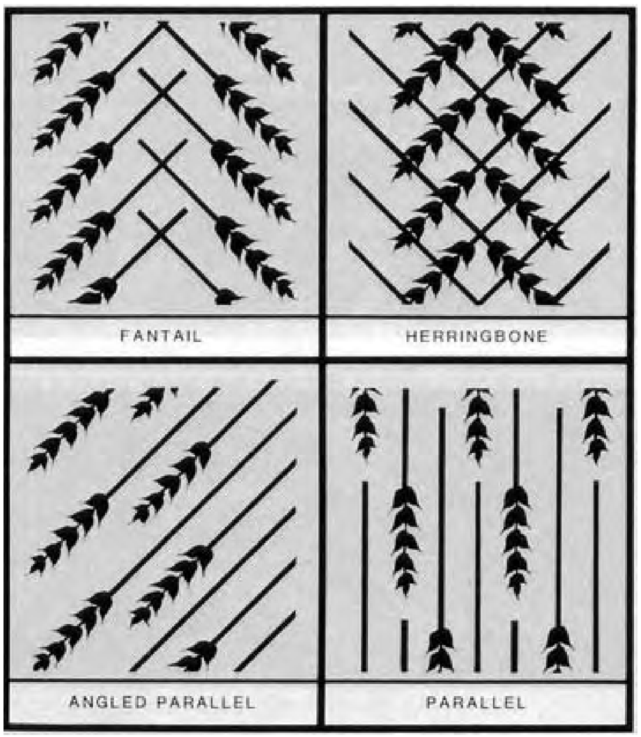


FIGURE 2. Windrow Types.

Leaning Crops: The direction of cut was important when windrowing lodged or leaning grain crops. Cutting in the direction of crop lean usually resulted in parallel windrows while cutting at an angle to the direction of lean generally resulted in angled parallel windrows.

FIGURE 3. Alfalfa (4.5 t/ha).

FIGURE 4. Brome and Alfalfa (2.8 t/ha).

FIGURE 5. Slough Grass (Heavy).

TABLE 3. Windrow Formations in Various Crops.

Crop	Range		Cut Crop Length		Speed		Windrow Type	Figure Number
	t/ha	bu/ac (t/ac)	mm	in	km/h	mph		
Alfalfa	4.75 - 5.5	(1.75 - 2.0)	500 - 600	20 - 26	8.0 - 10.5	5 - 6.5	Fantail where heavy, angled parallel where lighter	3
Bromegrass	2.0 - 2.75	(0.75 - 1.0)	500	20	8.0 - 9.5	5 - 6	Mixed pattern, angled parallel where lighter	
Bromegrass/Alfalfa	2.0 - 4.75	(0.75 - 1.75)	500 - 750	20 - 30	7.0 - 11.0	4.5 - 7	Fantail where heavy, angled parallel where medium to light	4
Slough Grass	1.5 - 4.0	(0.50 - 1.50)	650 - 1000	26 - 40	3.0 - 6.5	2 - 4	Parallel and angled parallel	5
Wheat	1.0 - 3.0	15 - 35	250 - 750	10 - 30	3.0 - 9.5	2 - 6	Angle parallelwhere heavy, herringbone where lighter	6
Barley	1.5 - 3.5	25 - 55	200 - 900	8 - 36	5.5 - 10.5	3.5 - 6.5	Parallel and angle parallel	7, 8
Oats	3.0 - 3.5	75 - 80	850	34	7.0 - 9.5	4.5 - 6	Angle parallel, herringbone where lighter	
Rye	1.0 - 4.0	15 - 50	600 - 900	24 - 36	5.0 - 9.5	3 - 6	Parallel and angle parallel, some fantail where heavy	9, 10
Rapeseed	1.5 - 2.5	20 - 35	650 -1100	26 - 44	5.0 - 9.5	3 - 6	Parallel pattern, fantail where heavy	11
Flax	1.0 - 1.5	13 - 18	500 - 650	20 - 26	4.0 - 8.0	2.5 - 5	Parallel pattern	12
Buckwheat	1.0 - 1.5	15 - 20	850 - 950	34 - 38	6.5 - 8.0	4 - 5	Parallel pattern	

FIGURE 6. Wheat (3.0 t/ha).

FIGURE 7. Barley (2.0 t/ha).

FIGURE 8. Barley (3.0 t/ha).

FIGURE 9. Fall Rye (1.0 t/ha).

FIGURE 10. Fall Rye (2.2 t/ha).

FIGURE 11. Rapeseed (2.0 t/ha).

FIGURE 12. Flax (1.0 t/ha).

Uniformity: Windrows were uniform in most crops. In light short hay crops, hay sometimes collected on the cutterbar resulting in slight bunching. Some bunching also occurred in badly lodged crops due to the variation in crop flow on the drapers. In flax, bunching usually occurred at speeds above 8 km/h (5.0 mph).

Draper Speed: Draper speed was not adjustable. At recommended engine speed, the draper speed was about 130 m/min (430 ft/min). It is recommended that the manufacturer consider incorporation of a speed adjustment on the draper drives to aid in adjustment of windrow formation.

Header Angle: The header angle on the JD 800 was not adjustable. In lowered position, the header angle was 30 degrees.

Forward Speed: The forward speed had a significant effect on windrow formation in many tall, heavy crops. The restricted header opening caused bunching and windrow distortion at high cutting speeds. In some tough crops, speed was limited by cutterbar performance rather than by restriction at the windrow opening.

Windrow Opening: Windrow opening clearance was inadequate in tall or heavy crops of hay, rapeseed, buckwheat or flax. Crop bunching, while passing through the header opening, frequently restricted travel speed although plugging rarely occurred. In very tall crops, the windrow often had a tendency to twist as it passed through the header opening.

In short, heavy crops the inside drive wheels occasionally ran over the outer fringes of the windrow. This also occurred with the rear castor wheels in tall heavy crops. It is recommended that the manufacturer modify the windrow opening to reduce restriction in heavy crops.

CUTTING ABILITY

Cutterbar: All testing was carried out with over-serrated knife sections. Cutting ability of the JD 800 windrower was good in most hay and grain crops. In heavy slough grass, heavily lodged grain or slightly damp flax, cutting ability was fair. Cutterbar hammering occurred occasionally in heavy or damp crops but no mechanical problems resulted. Plugging of the cutterbar occurred in excessively heavy or damp slough grass, heavily lodged crops and damp flax. In lodged crops, it was best to travel in the direction of the crop lean.

Stubble: The types of stubble formed by a windrower may be divided into three types: ideal, undulating and irregular as shown in FIGURE 13. The JD 800 generally produced ideal stubble in all grain crops up to 9.5 km/h (6 mph) provided that the knife and guards were in good condition. In flax and partially lodged rapeseed or buckwheat, ideal stubble was formed at speeds up to 7.0 km/h (4.5 mph). Higher speeds resulted in irregular stubble. Undulating stubble was formed only on fairly rough fields.

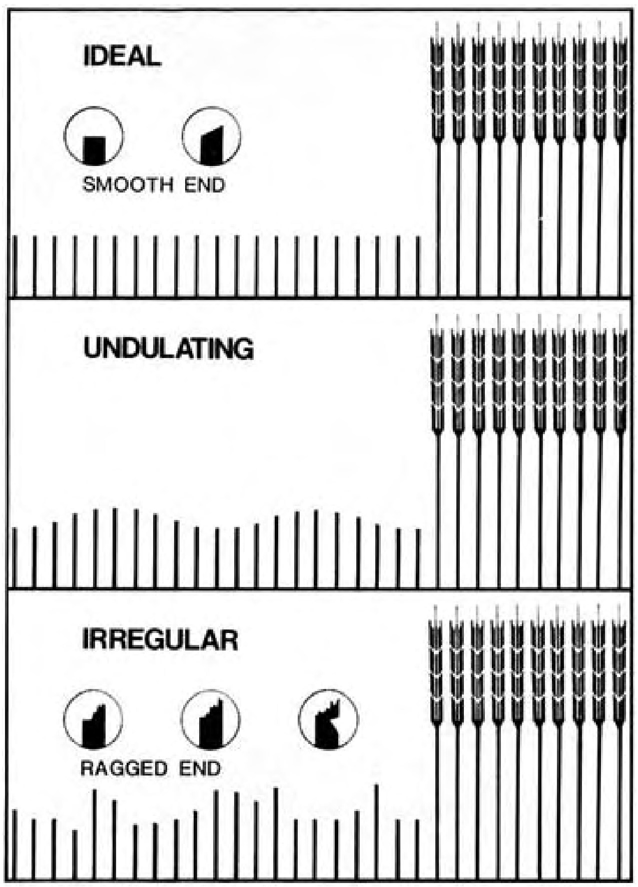


FIGURE 13. Types of Stubble.

In hay crops, the stubble formed was generally ideal provided that forward speed was matched to crop condition. Excessive speed in tough or damp hay crops resulted in irregular stubble.

Dividers: In average straight standing grain and hay crops, divider performance was satisfactory. Hairpinning on the divider, at the reel lift cylinders, occurred frequently when cutting tall leaning grain crops or heavy rapeseed. Divider performance in rapeseed was improved by straightening the divider rod loops as shown in FIGURE 14. The dividers then functioned by pushing the crop down during separation. This path of pushed down material was about 115 mm (4.5 in.) wide and could best be retrieved by cutting in the opposite direction on the next pass.

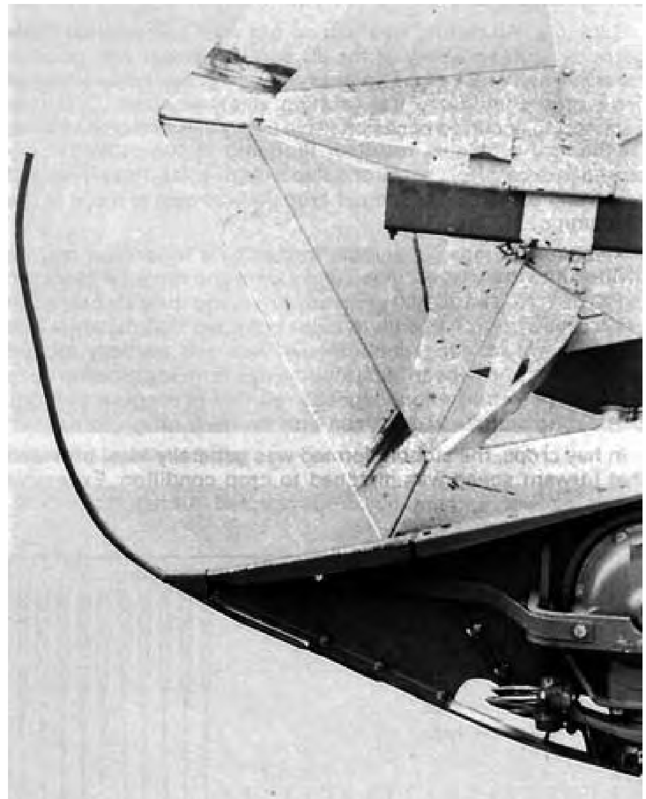


FIGURE 14. Modified Divider Rod for Rapeseed.

When travelling against the crop lean in extremely heavy, green, matted rapeseed, build-up of crop material around the divider rod caused one end of the header to pull sideways.

Reel: Reel performance was adequate in most crops. More adjustment was required to increase the reel height. In tall grain crops, such as rye, the reel could not be raised high enough to prevent stalks from hairpinning on the reel bats and being carried around over the top of the reel. It is recommended that the manufacturer consider modification to increase the maximum reel lift height. Reel drive belt slippage was not a problem.

Reel speed was variable from 35 to 65 rpm by adjusting the belt drive pulley or by changing the drive chain sprocket. For optimum performance it is best to have a reel index* from 1.1 to 1.2.

On the JD 800 an optimum reel index was obtained at forward speeds ranging from 7.5 to 15 km/h (4.7 to 9.5 mph). Operation outside this speed range was also possible in many crops.

Table Floatation: The John Deere 800 was equipped with optional platform float springs. Performance of the header floatation system was good. Floatation was achieved through an arrangement of two compression springs positioned around the header lift cylinders. (FIGURE 15) To adjust the degree of floatation, the amount of load carried by each spring could be easily changed by moving a single clamp.

The header followed contours well when cutting hay. In damp soil conditions there was a tendency for the header ends to skid on the ground and cause the windrower to pivot slightly. On slopes, limited end-to-end floatation also caused one end of the header to skid occasionally.

EASE OF OPERATION

Steering: Directional control and maneuverability of the JD 800 were good. Two steering levers were used to make sharp turns and rapid manoeuvres. Pulling backward on these levers also engaged the reversing bands on the drive cases for backing the windrower. This required a pulling force of 120 to 140 N (26 to 30 lb) on each lever. A trim steering wheel was provided for making gradual steering adjustments in the field or for road travel. The steering wheel worked satisfactorily but lacked smooth response.

**Reel index is defined as the ratio of reel tip speed to travel speed.*

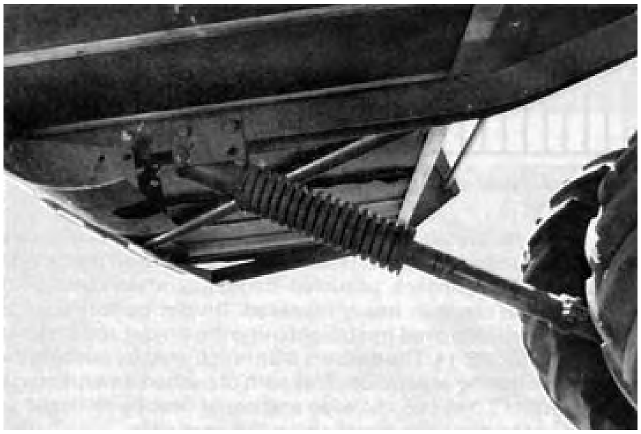


FIGURE 15. Header Float Springs.

Speed Control: Speed variation from 0 to 14.5 km/h (0 to 9 mph) was possible with the variable drive belt speed control lever. Speed control was constant over all ground slope conditions. A force of about 100 N (22 lb) was needed to move the speed control lever.

Braking: A mechanical foot controlled parking brake was provided. The pedal location was inconvenient but its use was seldom required.

Header Controls: The header drive was engaged by a foot pedal. Positioning of this control behind the left steering lever was awkward. The hydraulically operated reel and header lifts were controlled using foot pedals, which required a side to side motion of the foot. The actions of both of these were satisfactory after operators became familiar with them. Slightly faster reel and header lift speeds would have improved control in conditions where plugging was a problem or at the ends of windrows when cutting back and forth. It is recommended that the manufacturer consider increasing the reel and header lift speeds. Control positioning was satisfactory with the exception of the platform drive and parking brake control pedals. The parking brake was positioned behind the right steering lever. The hydraulic header and reel lift controls were positioned on either side of the steering column so that each was activated by a different foot. No standardized symbols were used to identify controls.

Soft and Muddy Fields: In soft or muddy fields the dual drive wheels frequently plugged with mud resulting in reduced traction. The small tire size and lack of clearance compounded the problem. Once plugged, restricted space made it difficult to clean the mud from the wheels (FIGURE 16). The rear castors also tended to build up with mud readily. It is recommended that the manufacturer consider supplying larger tires as an option for soft field conditions.

FIGURE 16. Mud Build-up Around Drive Wheels.

Transporting: Maximum forward speed was about 14.5 km/h (9 mph). Towing the windrower with the drive wheels on the ground was not recommended by the manufacturer, but if required, the intermediate drive chains had to be removed and speeds kept below 16 km/h (10 mph). When loaded on a windrower transporter, castor wheel shimmy limited speeds to less than 25 km/h (15 mph) on most roads. It is recommended that the manufacturer consider modifications to reduce castor wheel shimmy during transport.

Adjustments: The reel speed was adjusted by varying the number of shims inserted between the two halves of the drive belt pulley. In addition, a double sprocket was provided which could be reversed to obtain additional speed range. The reel lift was adjusted by repositioning the lower cylinder pivot in a series of holes. Horizontal repositioning was easily accomplished by loosening a single adjusting screw at each end of the reel and sliding the reel to a new position. Drive belt tension was not affected by reel position.

Servicing: Daily lubrication of the JD 800 took from 25 to 30 minutes. A grease gun with a flexible hose was required for a number of grease fittings, which were not easily accessible. Safety shields made access to two fittings difficult.

NOISE LEVEL

Total noise at operator ear level was about 89 db(A) when operating on flat fields at normal speed in average wheat crops.

POWER AND FUEL CONSUMPTION

The engine on the JD 800 had adequate power for all conditions encountered. Average fuel consumption was about 9.2 L/h (2.0 gal/hr). Fuel consumption would be greater in extreme conditions. The 65.5 L (14.4 gal) fuel tank permitted about 7.5 hours of operation between fillings. This was inconvenient during the extended working hours normally experienced during harvesting. It is recommended that the manufacturer consider increasing fuel tank capacity.

OPERATOR SAFETY

The centre of gravity was located above and behind the main drive wheels. Stability was satisfactory even when operating on steep slopes over rough ground.

Access to the operator's platform was safe and convenient. The JD 800 was equipped with a slow moving vehicle sign. Flashing safety lights were available as an option for road transport.

Starting the machine in motion required the movement of three different controls. Both steering control levers and the left hand variable speed control lever had to be moved ahead. A safety switch in the speed control lever ensured that the machine could not be started without being in neutral. A few hours of operation was generally required before a new operator could smoothly coordinate the sequence of all control movements.

No safety hazards were apparent, if recommended safety procedures were followed during servicing and operation. Drives were adequately shielded and the windrower was stable on slopes and rough terrain.

OPERATOR'S MANUAL

The operator's manual contained much useful information on operation, adjustment and servicing. It was clear and well written.

DURABILITY RESULTS

TABLE 4 outlines the mechanical history of the JD 800 windrower during 225 hours of operation while windrowing about 505 ha (1275 ac). The intent of the test was evaluation of functional performance. The following failures represent those, which occurred during functional testing. An extended durability evaluation was not conducted.

TABLE 4. Mechanical History

Item	Operating Hours	Equivalent ha	Equivalent ac
– The reel drive chain jumped off the rear sprocket bending the support bracket. The bracket was straightened and a bearing replaced at	35	91	(225)
– The left ground drive shaft, intermediate sprocket and bearing were replaced at	52	128	(315)
– The engine condensor was replaced at	52	128	(315)
– The variable speed drive pulley had to be disassembled and realigned at	75	186	(406)

DISCUSSION OF MECHANICAL PROBLEMS

The cause for the reel drive chain jumping off the sprocket may have been due to insufficient chain tension, misalignment of sprockets or excessive play in the larger sprocket. As the chain came off the small sprocket, it wrapped itself around the drive shaft, causing the shaft to flex and the bearing support bracket to bend.

Failure of the left ground drive resulted from the intermediate driven sprocket shifting inward, away from its retaining gib key. It then turned on the shaft damaging the sprocket, shaft, bearing and key. It is believed that the gib key was not properly driven in during assembly, allowing the sprocket to loosen.

The inner half of the engine variable drive sheave moved inward about 25 mm (1 in) contacting the engine timing gear and causing the variable speed linkage to go out of adjustment. It is believed the cap screw holding the engine sheave wedge lock was not adequately secured during assembly.

APPENDIX I
SPECIFICATIONS

Model:	John Deere 800
Serial No.:	340012
Cutter Bar:	
-- width of cut (divider points)	5385 mm (212 in)
-- effective cut (inside divider)	5400 mm (213 in)
-- range of cutting height	-100 to 710 mm (-4.0 to 28 in)
-- guard spcing	76 mm (3 in)
-- length of knife section (overserrated)	76 mm (3 in)
-- knife stroke	76.mm (3 in)
-- knife speed	560 cycles/min
Header:	
-- header angle	
- fully raised	9.6°
- fully lowered	30.6°
-- number of drapers	2
-- width of drapers	2100 mm (82.6 in)
-- draper speed	2.2 m/s (430 ft/min)
-- draper roller diameter	54 mm (2.1 in)
-- height of windrow opening	794 mm (31.3 in)
-- width of windrow opening	
- between rollers	940 mm (37 in)
- between windboards	858 mm (33.8 in)
-- raising time of header	2.2 sec
-- lowering time of header	2,4 sec
Reel:	
-- number of bats	5
-- number of reel arms per bat	4
-- diameter	685 mm (27 in)
-- speed range	35 to 65 rpm
-- range of adjustment	
- fore-and-aft	229 mm (9 in)
- height above cutterbar	0 to 566 mm (0 to 22.3 in)
-- raising time	1.0 sec
-- lowering time	3.0 sec
Ground Drive:	
-- type	variable pitch belt to planetary drive case to final drive chain
-- speed control	hand lever
-- range of forward speed	0 to 14.5 km/h (0 to 9 mph)
-- range of reverse speed	0 to 14.5 km/h (0 to 9 mph)
Steering:	hand levers with steering wheel for trim steering
Brakes:	foot operated parking brake
Hydraulic System:	
-- table and reel lift	Cessna hydraulic pumps, belt driven from engine
No. of Chain Drives:	8
No. of V-belts:	
-- single V	5
-- double V	2
No. of Pressure Lubrication Points:	37
No. of Pre-lubricated Bearings:	9
Engine:	
-- make	Chrysler Industrial
-- model	HB225.6 cylinder
-- no load speed	2400 rpm
-- power	55 hp (41 kW) manufacturer’s rating
-- fuel tank capacity	68 L (14.4 gal)
Machine Dimensions:	
-- wheel tread	
- outside duals	2410 mm (95 in)
- castor wheels	1994 mm (78.5 in)
-- wheel base	24150 mm (97 in)
-- overall width	5766 mm (227 in)
-- overall length	5220 mm (206 in)
-- overall height	2096 mm (83 in)
Tire Size:	
-- drive wheels	4 - 7.50 x 16, 4-ply rating
-- castor wheels	2 - 5.90 x 15, 4-ply rating
Weight as Tested (header raised):	
-- right drive wheel	860 kg (1892 lb)
-- left drive wheel	946 kg (2081 lb)
-- castor wheels	300 kg (660 lb)
-- TOTAL	2106 kg (4633 lb)
Centre of Gravity (header raised):	
-- height above ground	900 mm (35.5 in)
-- distance behind drive wheels	350 mm (14 in)
-- distance left of right outside drive wheel	1315 mm (52 in)

Options and Attachments Available:
hay conditioner, pickup reel, header float springs, header gauge shoes, header skid plates, field light attachment, engine air pre-cleaner

APPENDIX II
MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports

a) excellent	d) fair
b) very good	a) poor
c) good	f) unsatlstactory

APPENDIX III
METRIC UNITS

In keeping with the Canadian metric conversion program, this report has been prepared in SI units For comparative purposes, the following conversions may be used:

1 hectare (ha)	= 247 acres (ac)
1 kilometre/hour (km/h)	= 0.62 miles/hour (mph)
1 tonne (t)	= 2204.6 pounds (lb)
1 tonne/hectare (t/ha)	= 0.45 ton/acre (ton/ac)
1 metre (m) = 1000 millimeters (mm)	= 39.37 inches (in)
1 kilowatt (kW)	= 1.34 horsepower (hp)
1 kilogram (kg)	= 2.2 pounds (lb)
1 Litre/hour (L/h)	= 0.22 Imperial gallons/hour (gal/h)
1 newton (N)	= 0.22 pounds force (lb)

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