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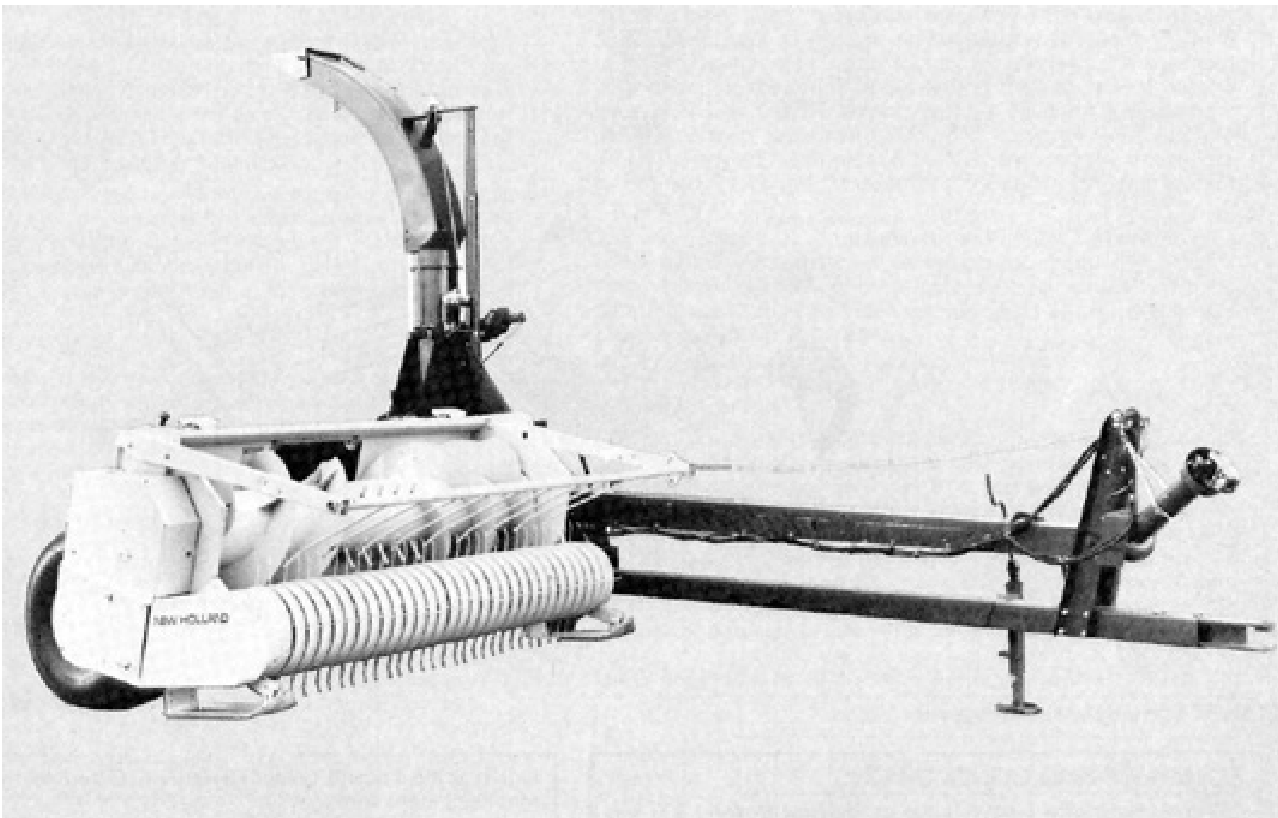
Evaluation Report 120



New Holland 890 Forage Harvester

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

NEW HOLLAND MODEL 890 FORAGE HARVESTER

MANUFACTURER:
Sperry New Holland
New Holland, Pennsylvania
U.S.A. 17557

RETAIL PRICE:
$18,447.00 (November 1979, f.o.b. Portage la Prairie, with electric remote control, electronic metal detector, 2.4 m windrow pickup and 3-row row crop head).

DISTRIBUTORS:
Sperry New Holland

- Box 777
  Winnipeg, Manitoba
  R3C 2L4
- Box1907
  Regina, Saskatchewan
  S4N 2S3
- Box1616
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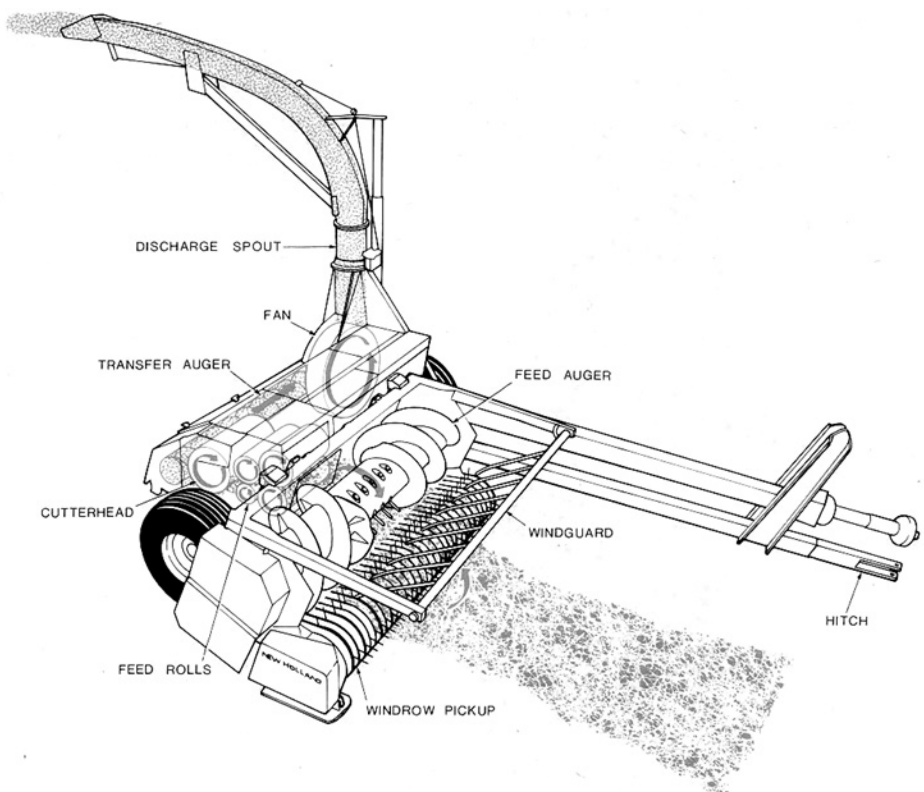

FIGURE 1. New Holland 890 Schematic.

SUMMARY AND CONCLUSIONS

Overall functional performance of the New Holland 890 was *very good.* Ease of operation and adjustment was *very good.*

Workrates ranged up to 23 t/h (25 ton/h) in standing corn, up to 36 t/h (40 ton/h) in alfalfa and up to 31 t/h (34 ton/h) in barley. Dry-weight workrates ranged up to 9 t/h (10 ton/h) in corn, up to 13 t/h (14 ton/h) in alfalfa and up to 19 t/h (21 ton/h) in barley. In windrowed crops, capacity was limited by performance of the windrow pickup, which usually limited ground speed to less than 8 km/h (5 mph). The three-row row crop head was well suited to typical prairie corn crops. Row crop head speed could be adjusted to suit ground speeds up to 13 km/h (8 mph).

The use of a 57 mm (2 inch) recutter screen reduced workrates by as much as 27%. The recutter screen significantly reduced the number of long silage particles but resulted in increased power consumption and reduced harvesting rates.

At the 6 and 9.5 mm (0.25 and 0.37 inch) length-of-cut settings, only 1% of alfalfa silage had a length greater than 100 mm (4 inch) and about 5% of corn silage had a length greater than 26 mm (1 inch).

A tractor with 110 kW (150 hp) maximum power take-off rating would have sufficient power reserve to operate the New Holland 890 in most field conditions. Power consumption was about 25% higher at the 3 mm (0.12 inch) length-of-cut setting, than at the 6 mm (0.25 inch) setting.

The electric remote controls were very convenient. The optional metal detector was effective in preventing ferrous metal objects from entering the cutterhead. Changing from the windrow pickup to the row crop head was relatively easy. Cutterhead knife sharpening and shear plate adjustment both were easy to perform.

The New Holland 890 was safe to operate if the manufacturer's safety recommendations were followed.

Only minor mechanical problems occurred during the 230 hour test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to provide adequate floatation for the three-row row crop head.
2. Providing more reliable electrical connectors for the remote control system.
3. Providing a convenient method for drive chain lubrication.

4. Improving the information in the operator's manual on adjusting and checking the smooth roll scraper clearance.

Chief Engineer E. O. Nyborg
Senior Engineer J.C. Thauberger
Project Engineer R.R. Hochstein

THE MANUFACTURER STATES THAT:

The Model 890 has been superseded by the Model 892 which has incorporated many improvements,

In answer to your specific recommendations, you will find that the new model has im proved floatation for the three-row row crop head and that the electrical connectors have been improved. The feed rolls can now be raised manually for easy adjustment of the smooth roll scraper and this point is covered clearly in the Operator's Manual.

GENERAL DESCRIPTION

The New Holland 890 (FIGURE 1) is a power take-off driven, pull-type, forage harvester with cylindrical cutterhead. It is available either with a windrow pickup or a row crop head.

The cutterhead is fed by a reversible feedroll assembly. Length of cut may be set, either by changing the feedroll drive sprockets, or by varying the number of cutterhead knives. Chopped forage is delivered from the cutterhead to the discharge fan with a transfer auger. The adjustable discharge tube and the feedroll clutch are electrically controlled from the tractor seat.

The test machine was equipped'with a 2.4 m windrow pickup as well as a three-row row crop head. It was also equipped with an optional electronic metal detector safeguard, controlling the feedroll drive. Detailed specifications are given in APPENDIX I while FIGURE 1 shows the location of the major components.

SCOPE OF TEST

The New Holland 890 was operated in the crops shown in TABLE 1 for 230 hours while harvesting about 270 ha. It was evaluated for rate of work, quality of work, power requirements, ease of operation and adjustment, operator safety, and suitability of the operator's manual.

TABLE 1. Operating Conditions

CROP	AVERAGE YIELD (t/ha at 60% Moisture Content)	HOURS	FIELD AREA (ha)
Alfalfa	11	45	52
Grass	11	11	13
Clover	12	34	47
Green Barley	7 to 12	13	15
Corn (three-row row crop head)	20 to 32	127	143
	TOTAL	230	270

RESULTS AND DISCUSSION

RATE OF WORK

TABLE 2 presents typical workrates for the New Holland 890 in a variety of field conditions. The workrates for alfalfa and barley green feed were measured in crops yielding above 10 t/ha, which had been windrowed with 5 to 5.5 m wide windrowers, while the workrates in corn were measured in standing crops yielding more than 30 t/ha, harvested with the three-row row crop head. The reported values are for average continuous feedrates, with the harvester loaded to optimum levels, usually governed by pickup or row crop head performance. Daily workrates would be lower than those in TABLE 2, since the reported values do not include time for maintenance and unloading of wagons.

Both actual workrates and dry-weight workrates are reported in TABLE 2. The actual workrates, which include the crop moisture content, indicate the weight of forage being harvested, but should not be used for comparing performance of different forage harvesters or for assessing the effect of crop variables and machine settings. The dry-weight workrates, which indicate the weight of dry matter being harvested, provide better comparative data.

TABLE 2. Average Workrates

CROP	MOISTURE CONTENT %	LENGTH-OF-CUT SETTING (mm)	WORKRATES (t/h) ACTUAL	WORKRATES (t/h) DRY-WEIGHT
Alfalfa	70	3	28.5	8.5
	64		26.2	9.4
	50		16.8	8.4
	47		13.5	7.2
	69	6*	22.0	6.8
	64	6	36.0	13.0
	50	6	23.9	12.0
	47	6	18.2	9.7
Green Barley	40	3	22.1	13.2
		3*	18.2	11.0
		6	31.3	18.8
		6*	23.0	13.8
Corn	60	3	16.0	6.5
		6	23.0	9.2

*With 57 x 154 mm Recutter Screen

Actual workrates ranged up to 36,t/h whereas dry-weight workrates ranged only up to 18.8 t/h.

Workrates were influenced by crop moisture content, length-of-cut setting, use of a recutter screen and the type of header attachment used. An increase in the moisture content of alfalfa from 47% to 70% decreased the dry-weight workrate by about 20%. Changing the length-of-cut setting in alfalfa, from 6 mm to 3 mm, decreased the dry-weight workrate by about 30%. Using a recutter screen significantly reduced harvester workrates. In green barley, a 57 mm recutter screen reduced the dry-weight workrate by 17% at the 3 mm cut setting, and by 27% at the 6 mm cut setting.

In windrowed crops, the feedrate was limited by performance of the windrow pickup which limited ground speed to less than 7 km/h. The three-row row crop head was well suited to typical prairie crops. Gathering chain speeds could be adjusted to suit ground speeds up to 13 km/h.

QUALITY OF WORK

Uniformity of Cut:[1]

TABLE 3 presents typical particle size distributions in second-cut, full bloom alfalfa, harvested at 56% moisture content. Particie size variations are given for 3, 6 and 9.5 mm cut settings without a recutter screen, and for 6 and 9.5 mm cut settings with a 57 mm recutter screen. At the 6 mm cut setting (APPENDIX IV FIGURE 7) 8% of the silage had a length greater than 26 mm, while at the 9.5 mm cut setting 10% had a length greater than 26 mm. Using the 57 mm recutter screen significantly reduced the number of particles greater than 26 mm length.

TABLE 3. Particle Size Distribution in Alfalfa

PARTICLE LENGTH	PERCENT OF TOTAL SAMPLE WEIGHT				
	WITHOUT RECUTTER SCREEN			WITH 57 mm RECUTTER SCREEN	
	3 mm CUT SETTING	6ram CUT SETTING	9.5 mm CUT SETTING	6 mm CUT SETTING	9.5 mm CUT SETTING
Less than 4 mm	21	12 (Fig. 7a)	12	22	28
4 to 9 mm	57	40 (Fig. 7b)	37	54	46
9to 13 mm	11	(Fig. 7c)	24	15	17
13 to 26 mm	6	16 (Fig. 7d)	16	7	7
26 to 100 mm	5	8 (Fig. 7e)	10	2	2
Greater Than 100 mm	none	1 (Fig. 7f)	1	none	none

[1]For each length-of-cut setting, a forage harvester produces a range of particie lengths. Length uniformity is important for proper operation of some vertical silo unloader systems. Reduced unloading rates may result if the silage contains a significant number of particles greater than 40 mm in length. On the other hand, particle length variation has little influence on silage palatability. The importance of silage length uniformity must be individually assessed, based on the type of silage handling equipment used.

TABLE 4 presents typical particle size distributions in corn, harvested at 60% moisture content, for 3, 6, and 9.5 mm cut settings. No more than 5% of the chopped corn had a length greater than 26 mm at all three cut settings (APPENDIX IV, FIGURE 8). The smaller percentage of larger particles in corn, as compared to alfalfa, was due to the perpendicular, in-line feeding by the row-crop head.

TABLE 4. Particle Distribution in Corn

PARTICLE LENGTH	PERCENT OF TOTAL SAMPLE WEIGHT		
	3 mm CUT SETTING	6 mm CUT SETTING	9.5 mm CUT SETTING
Less than 5 m m	19	13 (Fig. 8a)	8
5 to 7 mm	19	15 (Fig. 8b)	11
7 to 9 mm	27	30 (Fig. 8c)	25
9 to 13 mm	20	25 (Fig. 8d)	27
13 to 26 mm	10	12 (Fig. 8e)	25
Greater than 26 mm	5	5 (Fig, 8f)	4

Windrow Pickup Losses: Pickup losses were insignificant at speeds up to 7 km/h, provided that the windrow was not severely wind-scattered. The wide pickup was effective in picking moderately scattered windrows and negotiating corners.

Row Crop Head Losses: Losses from the three-row row crop head were insignificant at speeds below 9 km/h. Crop conditions did not warrant greater speeds. Precise centering of the row crop head directly upon corn rows, to maintain picking losses at a minimum, was not essential. The upper gathering chain in effect widened the allowable stalk entrance to almost twice that of a conventional, single chain, stalk-gathering system.

POWER REQUIREMENTS

Tractor Size: Peak power take-off input at maximum workrate was about 110 kW in alfalfa and 90 kW in corn. Corresponding average power requirements were about 75 and 70 kW, respectively.

Power requirements increased with shorter cut settings and with higher moisture contents. For example, when harvesting 11 t/ha alfalfa, at 50% moisture content (at a dry-weight workrate of 10 t/h), changing the length-of-cut setting from 6 to 3 mm in-. creased the power take-off input by 16 kW. At the same dry-weight workrate, in the same field conditions, 20% higher crop moisture content increased power consumption only marginally.

Total drawbar power requirements on firm, level fields, at 6 km/h were about 12 kW. This included the draft of the forage harvester and a dump wagon with a 3 t load. In soft, hilly fields, drawbar requirements were as great as 20 kW. A tractor with 110 kW maximum power take-off rating should have sufficient power reserve to operate the New Holland 890, at optimum workrates, in most field conditions.

Specific Capacity:[2] FIGURE 2 shows the specific capacity of the New Holland 890 in alfalfa at 3 and 6 mm cut settings. Specific capacity is a measure of how efficiently a machine operates. A high specific capacity indicates efficient energy use while a low specific capacity indicates less efficient operation.

As seen in FIGURE 2, a 20% increase in crop moisture content affected the specific capacity only marginally. Changing from 6 to 3 mm cut setting reduced specific capacity by about 23%.

In corn at 60% moisture content, specific capacities were 0.13 t/kW-h at 3 mm cut setting and 0.16 t/kW-h at 6 mm cut setting. In green barley at 40% moisture content, specific capacities were 0.25 t/kW-h at 3 mm cut setting end 0.32 t/kW-h at 6 mm cut setting. In the same barley field, the use of a 57 x 154 mm recutter screen caused a 28% decrease in specific capacity at 3 mm cut setting and a 34% decrease at 6 mm cut setting.

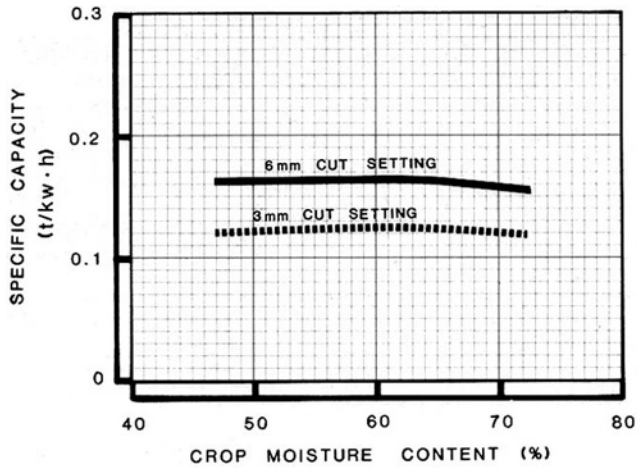

FIGURE 2. Specific Capacity in Alfalfa (based on dry-weight workrates).

EASE OF OPERATION AND ADJUSTMENT

Hitching: The New Holland 890 was equipped with a fixed clevis hitch. To adjust drawpole height, the hitch clevis could be reversed. Adjustment was ample for all tractors used during field testing. The manufacturer recommends that the tractor drawbar be from 330 to 430 mm above the ground.

Electric Remote Controls: The New Holland 890 was equipped with three electric controls for adjusting discharge spout angle and spout deflector position and for operating the forward and reverse feedroll clutch. The control console could be mounted at a convenient location on the tractor and was powered by the tractor electrical system. The controls were effective and convenient to use. The electrical connectors used in the remote control harness came apart frequently during operation resulting in erratic behaviour. It is recommended that the manufacturer use more reliable connectors.

Electronic Metal Detector: The test machine was equipped with an optional electronic metal detector. The metal detector was mounted in the front lower feedroll and scanned incoming forage for the presence of metal objects which might result in damage to the cutterhead or "hardware disease" in cattle. If metal objects were detected, the system automatically locked and disengaged the feedroll drive, and signalled the operator with an audible alarm from the tractor mounted control box. The detection system response was quick and effective, stopping the feedroll and catching ferrous metal objects before they entered the cutterhead.

Windrow Pickup: The pickup attachment (FIGURE 1) had excellent feeding characteristics in most crops. Pickup losses usually were insignificant at speeds below 7 km/h. Adjustable skid feet made it possible to match pickup height to field and windrow conditions. Wrapping around the feed auger or bunching in front of the feedroll seldom occurred provided that the feed auger speed was adjusted to suit feedroll speed. Three feed auger speeds were possible by adjusting the feed auger drive.

Three-Row Row Crop Head: The row crop head (FIGURE 3) was equipped with lower gripping chains as well as upper gathering chains. Feeding was positive and aggressive at forward speeds up to 9 km/h. Gathering chain speed was adjustable, facilitating optimum loading of the cutterhead in typical prairie corn yields.

The divider noses were rigidly mounted to the row-crop head, however the complete head was supported by floatation springs and equipped with skid shoes. Floatation was adequate only in firm soil. In softer soil, the skid shoes dragged severely. The operator's manual recommended that the floatation springs be adjusted so that lifting force at the skid shoes be no more than 220 N. It was impossible to achieve this adjustment with the three-row row crop head. When the floatation springs were set at maximum tension, lifting force at the skid shoes was about 1000 N.

It is recommended that the manufacturer consider modifications to improve row crop head floatation.

[2]Since *the specific capacities presented in FIGURE 2 are based on dry-weight workrates, direct comparison to specific capacities of equipment such as balers is not accurate. Baled hay normally has a moisture content of about 20% and is not refined to the same degree as silage.*

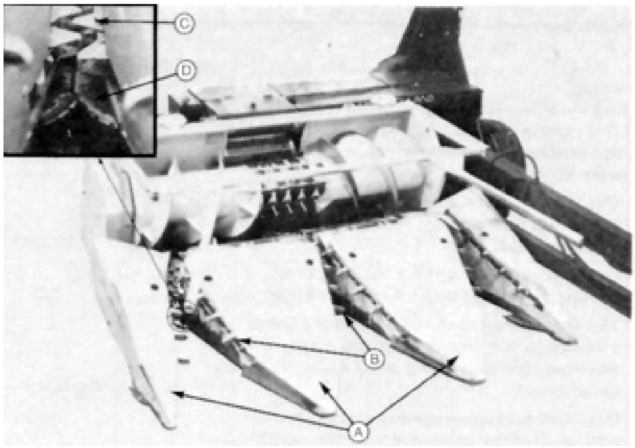

FIGURE 3. Three-Row Row Crop Head: (A) Divider Noses, (B) Upper Gathering Chains, (C) Lower Gripping Chains, (D) Serrated Cutting Discs.

Overall stalk gathering performance was very good. For proper performance, maximum side drift from the row had to be less than 300 mm, requiring a comfortable degree of operator vigilance to maintain good performance.

Feedrolls: The feedrolls were aggressive in most crops. Occasional plugging occurred in bunchy windrows at high feedrates. Unplugging of the feedrolls was easily performed, from the tractor seat, by reversing the feedroll drive. The reversing feedroll clutch control was positive and effective. If severe plugging should occur, it was easily remedied in 5 to 10 minutes by releasIng tension on the feedroll pressure springs with a wrench and then reversing the feedrolls.

The smooth, rear, lower feedroll was equipped with an adjustahie scraper. Correct scraper clearance was extremely difficult to judge and the operator's manual did not suggest a method alternate to using a feeler gauge. It is recommended that the manufacturer provide better information in the operator's manual on the adjustment of the smooth roll scraper.

Cutterhead Plugging: Cutterhead plugging occurred only infrequently. A plugged cutterhead usually resulted in the shear bolts shearing. This was usually due to engaging the power take-off clutch too quickly or failing to allow all forage to pass through the harvester before disengaging power take-off clutch. Access to shear bolts was excellent.

Discharge Spout: The height and reach of the discharge spout could be adjusted by adding or removing pipe sections, as shown in FIGURE 4. The dimensions in FIGURE 4 are for the adjustable axle set for maximum ground clearance. The axle could be positioned to give discharge spout heights 75 and 150 mm lower than those shown in the figure.

The discharge direction and the discharge angle of the forage was controlled from the tractor seat with the electric remote controls. Both adjustments were simple and convenient. Maximum rotation of the discharge spout with remote controls was 75°.

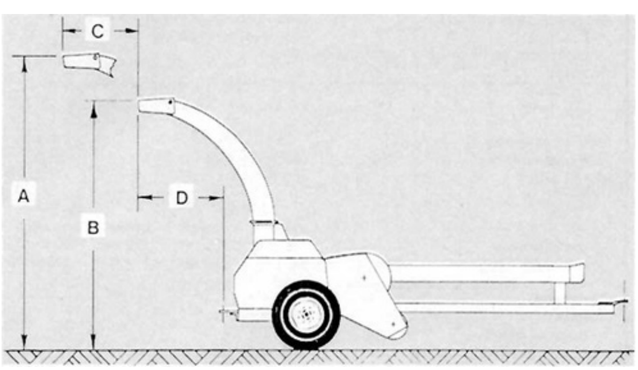

FIGURE 4. Discharge Spout Dimensions: (A) Lift, with vertical extension -- 3375 mm; (B) Lift --3000 mm; (C) Reach Extension -- 1200 mm; (D) Reach -- 650 mm.

RecutterScreen: A 57 x 154 mm slotted opening recutter screen was used for about 50 hours of field testing. The recutter screen performed well, provided close clearance was maintained between the screen and the cutterhead knives. The clearance was set by adjusting crescent plates at the sides of the cutterhead housing. If the clearance was not properly adjusted after knife sharpening, forage collected on the screen cutting edges, significantly decreasing the workrate. The long arc length of the recutter screen made it difficult to set the screen clearance, especially after several red uctions of cutterhead diameter due to knife sharpenings.

Removal or installation of the recutter screen was easy. It took an experienced operator about 10 minutes to install and adjust the screen, and about 5 minutes to remove it.

Knife Sharpening: The New Holland 890 was equipped with a rotating cylindrical sharpening stone (FIGURE 5) and a reversing cutterhead drive for knife sharpening. To reverse the cutterhead, the cutterhead drive line was reconnected to the sharpener drive shaft. A conventional quick-connect coupler, similar to that used on a power take-off shaft, made reversing of the cutterhead d rive easy.

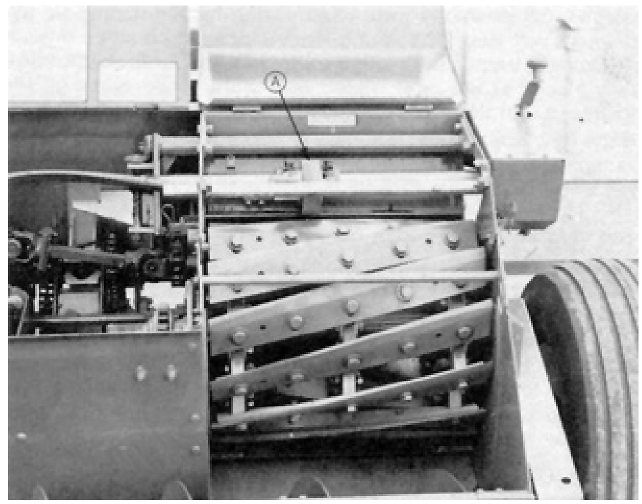

FIGURE 5. Cutterhead Knife Sharpening: (A) Cylindrical Stone.

Shear plate clearance was adjusted by loosening four bolts on the shear plate ends. There was ample room on both ends for adjusting the shear plate. A large, easily opened, hinged shield that swung well away, gave excellent access to the cutterhead and feedroll drives. It took an experienced operator about 25 minutes to sharpen the cutterhead knives and adjust the shear plate.

The average period, between knife sharpenings, was about 20 hours. During the 230 hour test period, the knives incurred about 2.5 mm of wear, primarily due to the number of sharpenings needed. One shearing edge of the reversible shear plate was worn significantly after 210 hours of operation, necessitating reversal.

During testing, it was not necessary to reset the cutterhead knives. These were each held in place with five bolts. There were no set screws provided to aid .in adjustment.

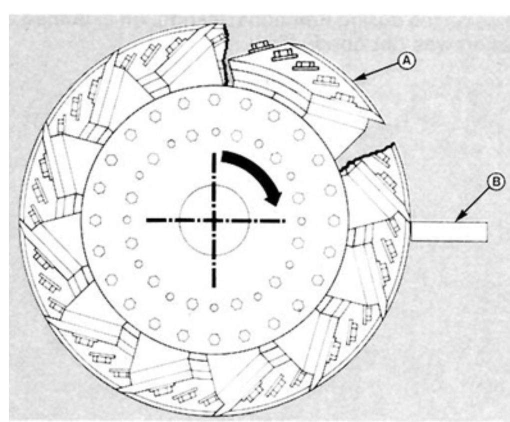

FIGURE 6. Cutterhead Assembly: (A) Knife, (B) Shear Plate.

Adjusting the Length of Cut: The length of cut could be changed either by adding or removing cutterhead knives (FIGURE 6) or by changing the feedroll speed by repositioning the triple feedroll drive sprocket assembly. Repositioning the triple sprocket assembly was the easier method. Adjusting length of cut with the triple sliding sprocket was easy, as a spring-loaded ball locked the sprocket into one of three detentes on the splined drive shaft. This adjustment took one man about 5 minutes. With twelve cutterhead knives, 3, 6, and 9 mm cut settings were possible. Longer lengths of cut could be obtained by removing cutterhead knives.

Exchanging Header Attachments: The same feed auger base was used with either the windrow pickup drum or the row crop head. Two bolts held the attachments in place. It was necessary to exchange one drive sprocket, since the pickup and row-crop attachments used different size drive chains.

Removing either header attachment took one man about 30 minutes. Mounting either of the attachments took two men about 30 minutes.

Transporting: The drawpole could be placed in transport position or in five different operating positions. Only the transport and extreme left positions were used during testing. Drawpole adjustment was easy. The spring-loaded lock pin could be retracted, from the tractor seat, with the attached line. A block, appropriately placed at the right wheel, was useful when swinging the drawpole with the tractor.

The New Holland 890 was easy to maneuver and towed well in transport position. Ground clearance was adequate and there was ample hitch clearance for turning sharp corners. A hitch was provided at the rear of the harvester for towing the wagon in line with the harvester when in transport position.

Lubrication: The New Holland 890 had 39 pressure grease fittings with an additional 19 fittings on the row-crop head. Thirty-three required daily lubrication, taking about 15 minutes. Complete lubrication of all other weekly and seasonal fittings took an additional 10 minutes.

Access to the drive chains for oiling was inconvenient. It is recommended that convenient access for lubricating of drive chains be provided.

OPERATOR SAFETY

A comprehensive safety section was included in the operator's manual. The New Holland 890 was safe to operate and service, as long as common sense was used and the manufacturer's safety recommendations were followed.

Shielding on the New Holland 890 gave good operator protection from all moving parts. One hinged shield provided excellent access to all the major component drives. All shields, over points requiring frequent service, were hinged.

OPERATOR'S MANUAL

The operator's manual was concise and clearly written, containing much useful information on operation, adjustment, servicing and safety. Further information should be included in the operator's manual on how to adjust the smooth feedroll scraper.

DURABILITY RESULTS

TABLE 5 outlines the mechanical history of the New Holland 890 during 230 hours of operating while harvesting about 127 ha of hay and 143 ha of corn. 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 5. Mechanical History

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA (ha)
The plastic control knob extensions on the three electric remote control switches were all broken at	20	24
The feedroll drive idler sprocket slipped on its hub bearing, necessitating sprocket realignment at	195, 220	232, 258
Lower support mount for the header lift hydraulic cylinder broke and was-welded at	202	240
The rope connecting the electrical control actuator to the discharge angle actuator wore out due to rubbing on the discharge spout brace	twice during test	
Electrical connectors in the electric remote control harness came apart during operation	many times during test	
The metal detector feedrott drive-stop pawt connecting link was worn requiring replacement at	end of test	

DISCUSSION OF MECHANICAL PROBLEMS

Remote Electric Controls: Operation of the remote electrical control assembly was sometimes troublesome because of connector problems in the wiring.

APPENDIX I

SPECIFICATIONS

Make:	New Holland			
Model:	890			
Serial No.:	345953			
Overall Dimensions:				
-- height (discharge spout removed)	1700 mm			
-- length	5480 mm			
-- width				
-- without attachments	3140 mm			
-- with windrow pickup	3600 mm			
-- with three-row row crop head	3730 mm			
-- ground clearance	255, 330, and 405 mm (adjustable)			
Windrow Pickup:				
-- serial no.	338773			
-- type	floating cylindrical drum with spring teeth			
-- height adjustment	adjustable skid feet			
-- working width	1950 mm			
-- overall width	2385 mm			
-- tooth spacing	67 mm			
-- number of tooth bars	4			
-- pickup speed	84 rpm			
-- tooth tip speed	8.4 km/h			
-- tooth type	steel wire			
-- tooth length	105 mm			
-- auger diameter	615 mm			
-- auger length	2085 mm			
-- auger speed	65, 74, 84, and 93 rpm (adjustable)			
Three-Row Row Crop Head:				
-- distance between rows	910, 960, or 1010 mm (adjustable)			
-- type of cutter	serrated discs			
-- cutter speed	150 rpm			
-- type of stalk gatherer	lower stalk gripping chain with upper gathering chain			
-- gathering chain ground synchronization speed				
-- upper	2.5. 2.8. and 3,3 km/h (adjustable)			
-- lower	28, 3.0. and 3.6 km/h (adjustable)			
Feedroll Assembly:				
-- throat opening	560 x 125 mm			
-- roll width	560 mm			
	FRONT		REAR	
	Upper	Lower	Upper	Lower
-- roll diameter	280 mm	220 mm	140 mm	97 mm
-- roll speed (at 6 mm cut setting)	94 rpm	120 rpm	174 rpm	260 rpm
Cutterhead:				
-- type	cylindrical			
-- number of knives	12			
-- width	570 mm			
-- diameter	460 mm			
-- speed	830 rpm			
Recutter Screen:				
-- width	590 mm			
-- arc length	550 mm			
-- opening size	57 x 154 mm angled slots			

Knife Sharpener:		
--type	rotating cylindrical stone	
-- size		
-- diameter	120 mm	
-- width	40 mm	
Conveying Assembly:		
-- transfer auger		
-- diameter	250 mm	
-- length	1860 mm	
-- speed	555 rpm	
-- fan		
-- diameter	780 mm	
-- blade width	170 mm	
-- discharge spout diameter	230 mm	
-- speed	500 rpm	
Tires::	two, 31 x 13.5. 6-ply	
Wheel Tread:	2 830 mm	
Weight:	WITH WINDROW PICKUP	WITH THREE-ROW ROW CROP HEAD
-- left wheel	846 kg	755 kg
-- right wheel	1190 kg	1513 kg
-- hitch	204 kg	359 kg
TOTAL	2240 kg	2627 kg
Servicing:		
-- main unit		
-- grease fittings	37. daily: 7. every 25 h	
-- chains	6, daily	
-- wheel bearings	2, yearly	
-- gear box6s	2 yearly	
-- windrow pickup		
-- grease fittings	4. daily	
-- chains	2, daily	
-- three-row row crop head		
-- grease fittings	19, daily	
-- chains	14, daily	

Optional Equipment:
- -- two-row snapper head 760 mm and 960 mm row spacing
- -- recutter screens, screens, sizes 75 and 57 mm slotted. 32, 25, 29 and 13 mm round openings
- -- spout extensions, horizontal -- 1200, 2400 mm: vertical -- 380 mm
- -- automatic wagon hitch
- -- 150 mm axle extension

APPENDIX II

MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

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

APPENDIX III

METRIC UNITS

tn 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)	062 mile hour (mph)
1000 millimetres (mm) 1 metre (m)	39.37 ,riches (in)
1 kilowatt (kW)	1.34 horsepower (hp)
1 kilogram (kg)	220 pounds mass (lb)
1 tonne (t)	22046 pounds mass (lb)
1 newton (N)	022 pounds force (lb)
1 tonne hour (t h)	1.10 ton hour (ton h)
1 tonne kilowatt hour (t/kW-h)	0.82 ton horsepower hour (ton/hp-h)

DISTRIBUTION OF PARTICLE LENGTHS

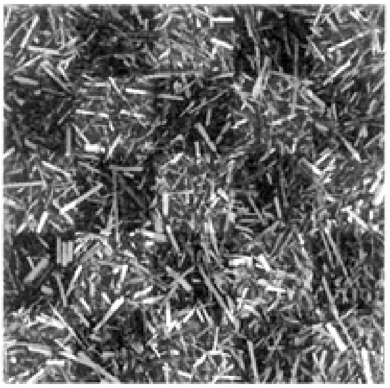
FIGURE 7a
Less than 4 mm

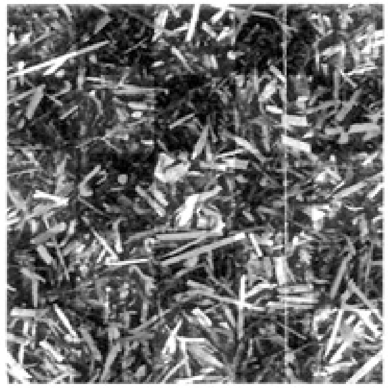
FIGURE 7b
4 to 9 mm

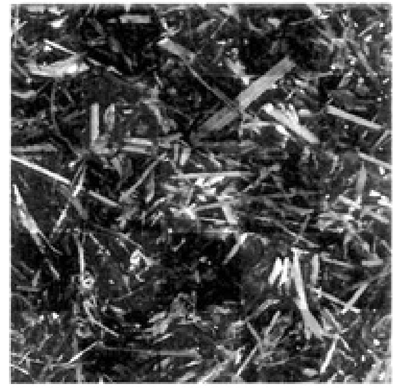
FIGURE 7c
9 to 13 mm

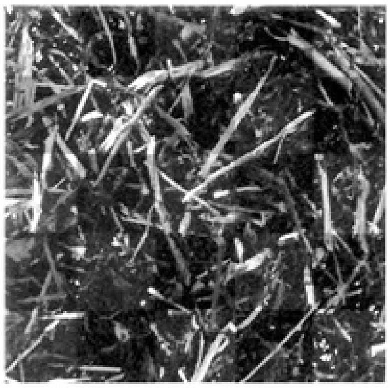
FIGURE 7d
13 to 26 mm


FIGURE 7e
26 to 100 mm

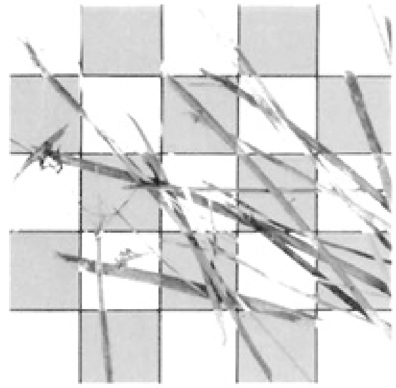
FIGURE 7f
Greater than 100 mm

FIGURE 7. Typical Distribution of Particle Lengths in Alfalfa (20 mm grid)

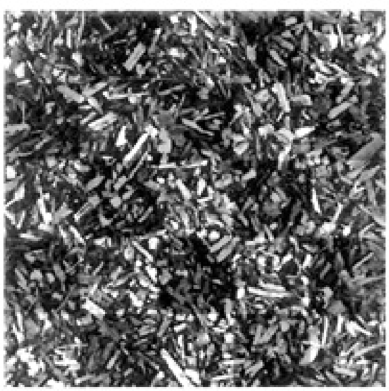
FIGURE 8a
less than 5 mm


FIGURE 8b
5 to 7 mm


FIGURE 8c
7 to 9 mm


FIGURE 8d
9 to 13 mm


FIGURE 8e
13 to 26 mm


FIGURE 8f
Greater than 26 mm

FIGURE 8. Typical Distribution of Particle Lengths in Corn (20 mm grid)

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