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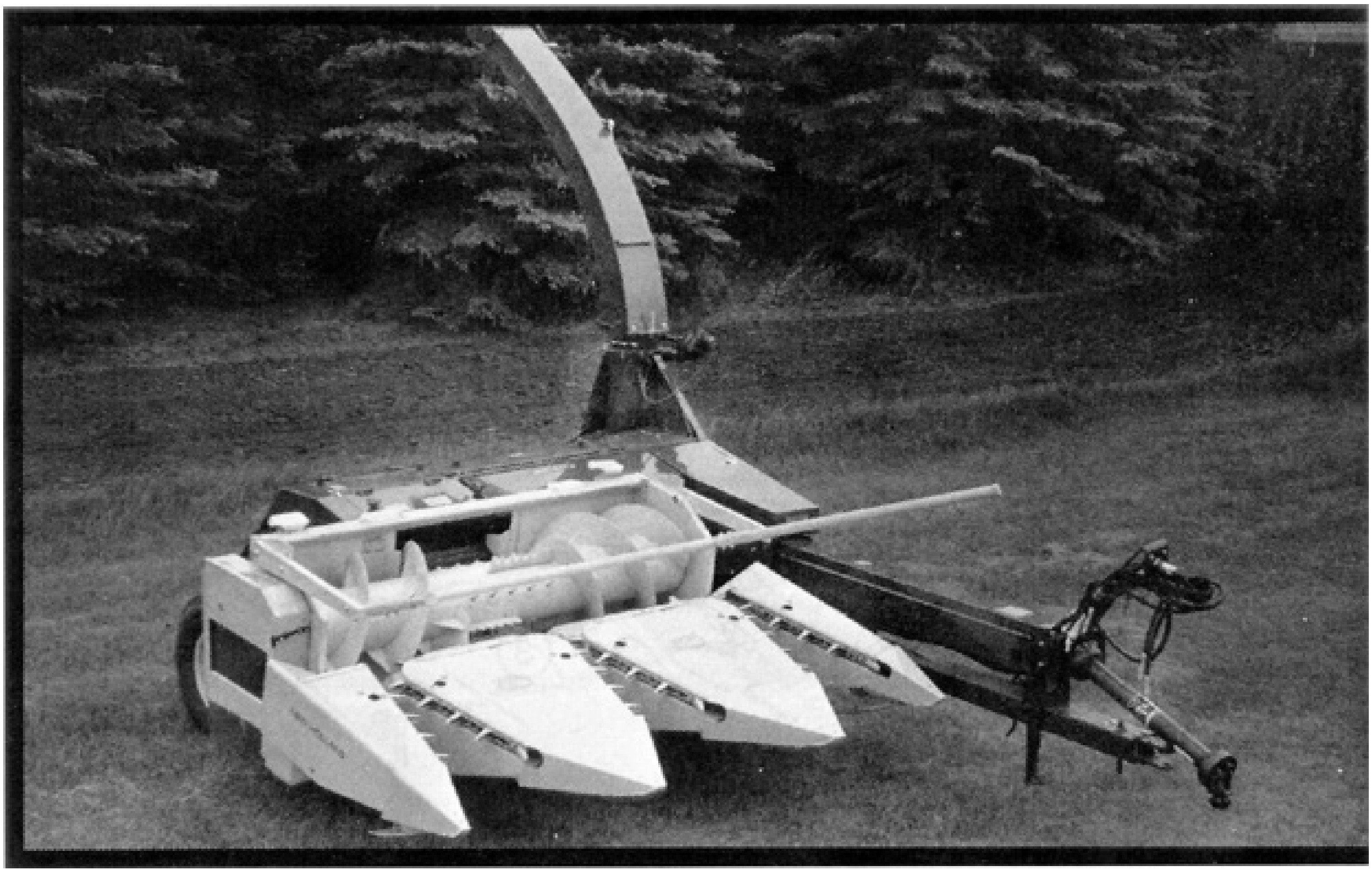
Evaluation Report 587



New Holland 900 Forage Harvester

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

NEW HOLLAND 900 FORAGE HARVESTER

MANUFACTURER:
Ford New Holland
500 Diller Drive
New Holland, Pennsylvania 17557

RETAIL PRICE:
$46,754.56 (March 1989, f.o.b. Portage la Prairie, Manitoba with electronic metal detector, pickup header, three-row row crop header, bydraulic draw pole)

DISTRIBUTOR:
New Holland of Canada Ltd.
P.O. Box 1616
Calgary, Alberta
T2P 2M7
Phone: (403) 273-6771

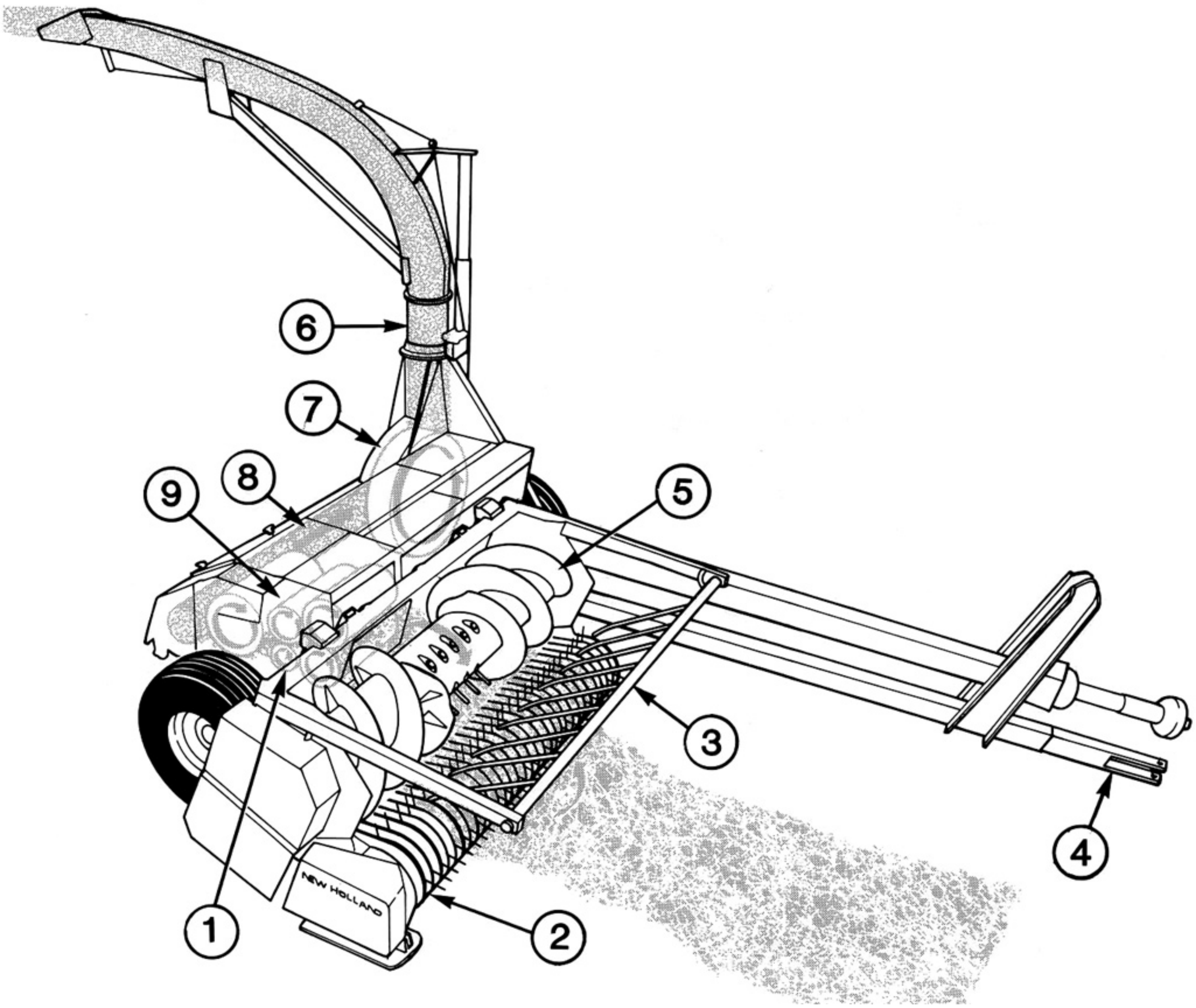


FIGURE 1. New Holland 900: (1)Feed Roils, (2) Windrow Pickup, (3) Windguard, (4) Hitch, (5) Feed Auger, (6) Discharge Spout, (7) Fan, (8) Transfer Auger, (9) Cutterhead.

SUMMARY AND CONCLUSIONS

Rate of Work:[1] Work rates ranged up to 55.6 ton/h (50.6 t/h) in alfalfa and up to 40.6 ton/h (36.9 t/h) in corn. Dry weight work rates ranged up to 25.3 ton/h (23.0 t/h) in alfalfa and 20.3 ton/h (18.5 t/h) in corn. Performance of the pick-up header was very good. Performance of the row crop header reduced harvester capacity in weed infested crops because of the gathering chain plugging.

Power Requirements: A tractor with a maximum power take-off rating of 180 hp (135 kW) would have sufficient power to operate the New Holland 900 in typical prairie crops.

Ease of Operation and Adjustment: Ease of operation was very good. The electric remote controls were convenient and easy to use. Knife sharpening, shear bar adjustment, and daily lubrication were easy.

Operator Safety: The New Holland 900 was safe to operate if the manufacturer's recommendations were followed.

Operators' Manuals: The operator's manuals were concise and clearly written.

Mechanical History: Two major and a few minor mechanical failures occurred during the test.

[1]The actual workrates, which include the moisture in the crop, indicate the total mass of crop harvested, but should not be used for comparing performance of different forage harvesters. The dry-weight workrates, which consider the mass of dry matter harvested, provide a better comparison of performance of different forage harvesters and assessment of the effect of crop variables and machine settings.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to prevent cutterhead bearing failure.
2. Modifications to provide more durable wheel spindles.
3. Modifications to prevent plugging of the row crop header especially in short or weed infested crops.

Station Manager: B. H. Allen

Project Engineer: C.W. Chapman

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Modifications have been made to ensure that the cutterhead bearings receive adequate lubrication at the time of manufacture. This problem occurred on a defined serial number lot of machines, and as indicated on page 6 of the PAMI report, a Service Bulletin was issued to all Ford New Holland dealers as soon as the problem was discovered.
2. The wheel spindle design has been changed to address the failure described. A Service Bulletin was issued to all Ford New Holland dealers, advising them of the corrective action to take.
3. Modifications to prevent the plugging of the row crop header in the stalkway area have been implemented. The cause of the problem was traced to the self-adjusting rotary cut off sickles binding on their mounting shafts. The bound sickles would, in turn, not properly cut fine grasses and weeds; and, in turn, allow those grasses and weeds to drag through and plug the stalkway. Improvements to the area include heat-treated sickle mounting shafts, and re-greasable sickle hubs to prevent any future binding.

GENERAL DESCRIPTION

The New Holland 900 is a power take-off driven, pull-type forage harvester. The cylindrical cutterhead is fed by a reversible feedroll assembly. The cut length may be set either by changing feedroll drive chain sprockets or varying the number of cutterhead knives. Chopped forage is delivered from the cutterhead to the discharge fan, by a transfer auger.

The test machine was equipped with a 6.3 ft (1.9 m) windrow pickup and a three-row row crop header.

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

SCOPE OF TEST

The New Holland 900 was operated in the crops shown in TABLE 1 for 215 hours while harvesting 954 ac (382 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 at 60% m.c. ton/ac	(t/ha)	Hours	ac	(ha)
Alfalfa	3.0	6.8	36	211	85
Rye	3.5	8.0	9	65	26
Oats/Millet	3.7	8.4	55	320	128
Corn	5.6	12.7	115	358	143
			215	954	382

RESULTS AND DISCUSSION

RATE OF WORK

TABLE 2 presents typical workrates for the New Holland 900 in a variety of field conditions. The workrates for alfalfa were measured in crops yielding 4.5 ton/ac (10 t/ha) which had been windrowed with a 12 ft (3.7 m) wide mower conditioner. The workrates in corn were measured in standing crops yielding 7.6 ton/ac (17 t/ha) and harvested with the three-row row crop header. The reported values are for average continuous feedrates, with the harvester loaded to optimum levels. They do not include time for maintenance and unloading wagons.

Both actual workrates and dry-weight workrates are reported in TABLE 2. The actual workrates, which include moisture in the crop, indicate the total mass of the crop harvested. These should not be used for comparing performance of different forage harvesters. The dry-weight workrates, which consider the mass of dry matter harvested, provide a better comparison of performance of different forage harvesters and assessment of the effect of crop variables and machine settings. Actual workrates ranged up to 44.4 ton/h (40.4 t/h) whereas dry-weight workrates ranged up to 25.3 ton/h (23.0 t/h).

Workrates were influenced by crop moisture content, cut length setting, use of a recutter screen and the type of header attachment used. Reducing the cut length setting from 0.375 to 0.25 in (9 to 6 mm) decreased the dry-weight workrates by 30% in alfalfa. Reducing the cut length setting from 0.44 to 0.375 in (11 to 9 mm) decreased the dry-weight workrates by 15% in corn. The performance of the three-row row crop header limited the machine capacity in corn. The pickup header permitted ground speeds up to 7.0 mph (11 km/h).

TABLE 2. Average Work Rates

Crop	Moisture Content %	Cutlength Setting in	(mm)	Workrates ton/h (t/h) Actual	Dry Weight
Alfalfa	42.9	0.25	(6)	31.3 (28.4)	17.8 (16.2)
	45.7	0.25	(6)	35.2 (32.0)	19.0 (17.3)
	61.2	0.25	(6)	55.6 (50.6)	21.7 (19.7)
	42.9	0.375	(9)	44.4 (40.4)	25.3 (23.0)
Corn	50.0	0.375	(9)	34.6 (31.4)	17.3 (15.7)
		0.44	(11)	40.6 (36.9)	20.3 (18.5)

QUALITY OF WORK

Uniformity of Cut:[2] FIGURE 2 presents typical particle length distributions in second-cut, one half bloom alfalfa, harvested at 47% moisture content. Particle length variations are given for 0.25 and 0.375 in (6 and 9 mm) cut settings, with and without the use of a slotted hole, progressive size recutter screen. At a 0.25 in (6 mm) setting, only 7% of the silage had a length greater than 1.0 in (25 mm), while at the 0.375 in. (9 mm) setting, 12% had a length greater than 1.0 in (25 mm). The slotted hole recutter screen greatly decreased the percentage of longer particles at each cut length setting.

FIGURE 3 presents typical particle length distributions in corn, harvested at 50% moisture content, for 0.375 and 0.44 in (9 and 11 mm) settings (APPENDIX III, FIGURE 7). None of the chopped corn had a length greater than 1 in (25 mm) at both 0.25 in and 0.44 in (9 and 11 mm) settings. The smaller percentage of longer particles in corn, compared to alfalfa, was due to perpendicular feeding of the row crop header.

Windrow Pickup Losses: Pickup losses were insignificant at speeds up to 7.0 mph (11 km/h), provided that the windrows were not severely wind-scattered.

Three-row Row Crop Header Losses: Losses from the row crop header were insignificant at speeds below 7.5 mph (12 km/h) provided care was taken to keep the divider points centred between the rows.

However, plugging of the lower gathering chains and cutting discs reduced harvester performance, especially in short or weed infested crops.

[2]For each cut length setting, a forage harvesterproduces a range of particle lengths. Although variation in particle length has little effect on silage palatability, the performance of some silage unloading equipment may be adversely affected if a significant quantity of material is longer than 1.5 in (40 mm). FIGURE 2 and 3 show material length distribution at various cut length settings, with and without recutter screens. A narrow curve with a high peak indicates uniform particle length distribution. The average material length is about that at the peak of the curve. Forage with a wide range of particle lengths has a wide curve with a low peak.

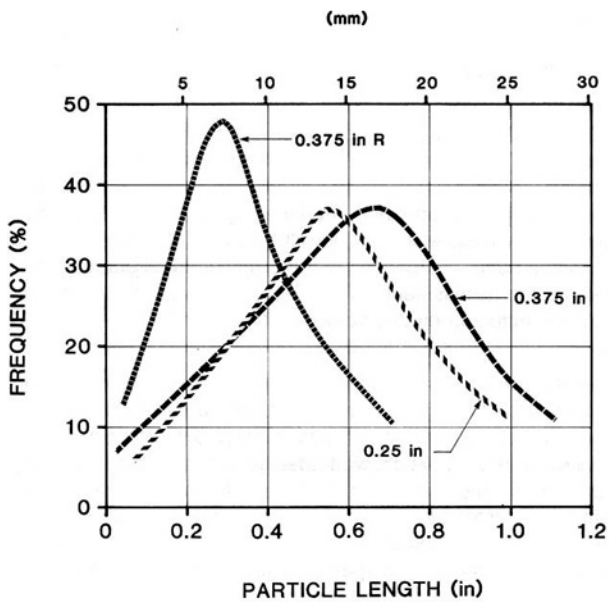


FIGURE 2. Particle Length Distribution in Alfalfa (R: with slotted hole progressive size recutter screen.)

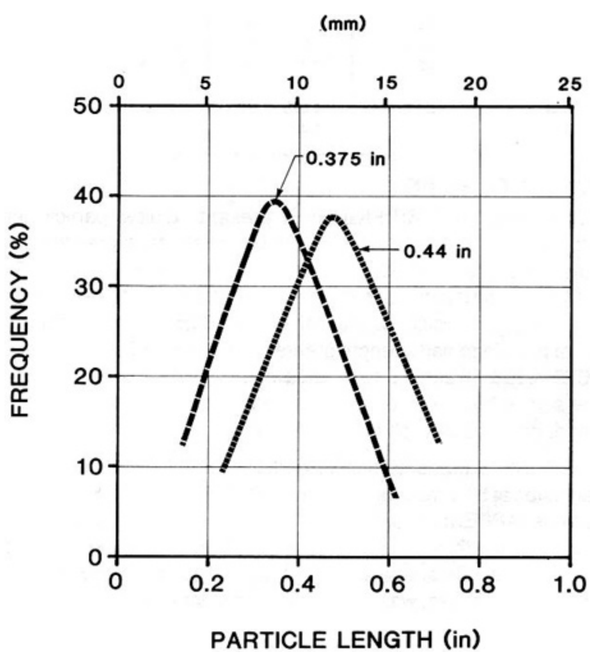


FIGURE 3. Particle Length Distribution in Corn

POWER REQUIREMENTS

Tractor Size: The peak power take-off requirement, at maximum workrate, was about 180 hp (135 kW) in alfalfa and 150 hp (110 kW) in corn. Corresponding average power requirements were about 150 hp (110 kW) and 120 hp (90 kW) respectively.

Power requirements increased with shorter cut settings, higher moisture contents and use of a recutter screen. For example, reducing the cut setting from 0.375 to 0.25 in (9 to 6 mm) while harvesting 42% moisture alfalfa yielding 4.5 ton/ac (10 t/ha), increased average power by 18 hp (13.5 kW). An increase of 10% moisture content in alfalfa increased the power requirements 7.0 hp (5.3 kW). The use of a slotted hole recutter screen increased average power 42.0 hp (31.5 kW) in alfalfa.

Total drawbar power requirement on firm, level fields was about 24 hp (18 kW) at 8 mph (13 km/h). This included the draft of the forage harvester and a dump wagon with a 3.3 ton (3 t) load. In soft, hilly fields, drawbar power requirements could be as great as 34 hp (25 kW).

A tractor with a 180 hp (135 kW) maximum power take-off rating should have sufficient power to operate the New Holland 900 at optimum workrates, in most field conditions.

Specific Capacity: FIGURE 4 shows the specific capacity of the New Holland 900. 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 shown in FIGURE 4, a 10% increase in crop moisture content increased the specific capacity by about 10% in alfalfa. Changing cut length settings from 0.375 to 0.25 in (9 to 6 mm) reduced specific capacity by about 35%. The use of a slotted hole recutter screen reduced specific capacity by 60% at a 0.375 in (9 mm) cut setting.

In corn, specific capacity was 0.237 ton/hp-h (0.285 t/kW-h) at 50% moisture content.

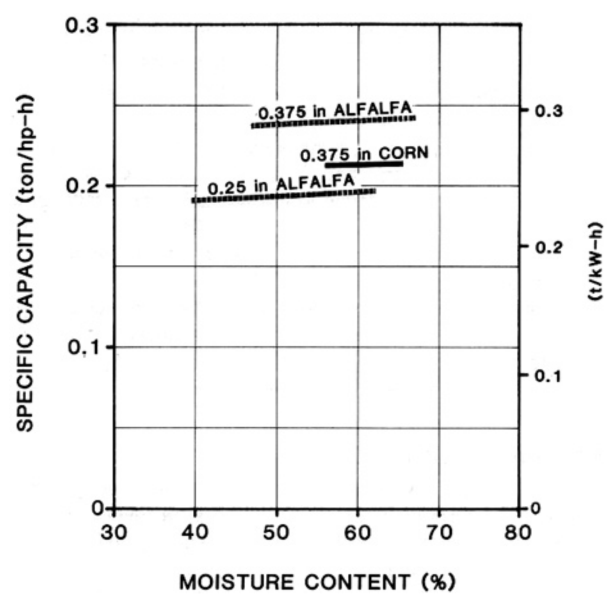


FIGURE 4. Specific Capacity.

EASE OF OPERATION AND ADJUSTMENT

Hitching: Ease of hitching was very good. The New Holland 900 was equipped with an equal angle hitch which attached to the tractor drawbar, extending it 8 in (200 mm). The driveshaft height was not adjustable. The New Holland 900 was equipped with a 1000 rpm power take-off drive.

Remote Controls: Ease of operation of the remote controls was very good. The New Holland 900 was equipped with electric remote controls for adjusting discharge spout direction, deflector cap angle, and the forward/reverse feedroll clutch. The electric control console, which mounted in the tractor cab, controlled the individual electric actuators.

The controls were effective and convenient to use.

Electronic Metal Detector: Operation of the metal detector was very good. 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 cutterhead or "hardware disease" in cattle. If metal objects were detected, the system automatically locked and disengaged the feedroll drive, and signaled the operator with an audible alarm from the tractor mounted control box. The detection system response was quick and effective, stopping the feedrolls and catching ferrous metal objects before they entered the cutterhead.

Windrow Pickup: Performance of the windrow pickup was very good. The pickup header had excellent feeding characteristics in most crops. Pickup losses were insignificant at speeds up to 7.5 mph (12 km/h). Only one windrow pickup speed was possible. Adjustable skid shoes made it possible to match pickup height to field and windrow conditions.

Three-row Row Crop Header: Performance of the row crop header was fair. The three-row row crop header (FIGURE 5) was equipped with lower gripping chains, upper gathering chains and rotary sickles which operated at a row spacing of 38 in (960 mm).

Four header chain speeds were possible by changing header drive sprockets. This matched gathering chain speed to ground speed up to 9 mph (14 km/h).

.The lower gathering chains plugged several times during the test in short corn and weed infested crops. Adjustments to the header did not alleviate the problems. It is recommended the manufacturer consider modifications to prevent row crop header plugging.

In crops taller than 5 ft (1.5 m) the header performance was very good.

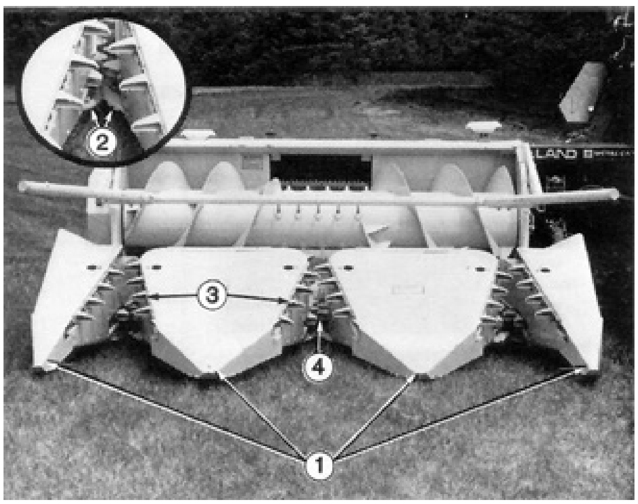


FIGURE 5. Three-row Row Crop Header: (1) Divider Points, (2) Rotary Sickle, (3) Upper Gathering Chains, (4) Lower Gathering Chains.

Feedrolls: Performance of the feedrolls was very good. The feedrolls were very aggressive in all crops. Occasional plugging occurred in bunchy windrows. Unplugging was possible from the tractor seat by reversing the feed roll drive. The upper feed roll was protected with a jump clutch.

Access to the cutterhead and shear bolts were very good.

Discharge Spout: The lift and reach of the discharge spout could be adjusted by adding or removing pipe sections as shown in FIGURE 6 or by tilting the spout at its base. The extension used for testing was a 24 in (600 mm) horizontal. Several other extensions were available. The dimensions in FIGURE 6 were determined at the maximum ground clearance setting of the adjustable axle, which could be positioned to give discharge heights 3 in (75 mm) and 6 in (150 mm) lower than those shown. Tilting the spout would give discharge heights 6 in (150 mm) higher or lower than those shown.

The forage discharge direction was controlled by spout rotation and deflector cap angle, which were operated by the remote controls. The range of adjustments was adequate for operation with wagons and trucks.

Recutter Screen: Ease of installation and adjustment of the recutter screen was good. An oval hole, progressive size recutter screen was used for about 5 hours of field testing. The recutter screen was effective, provided a close tolerance was maintained between the cutterbar knives and the screen.

The clearance was adjusted with eyebolts at the rear of the screen. The screen seated against adjustable stops which were bolted to the side sheets of the harvester.

Initial installation of the stops and other hardware took approximately 2 hours. Installation of the screen took an experienced operator 30 minutes. Removal of the screen took about 10 minutes.

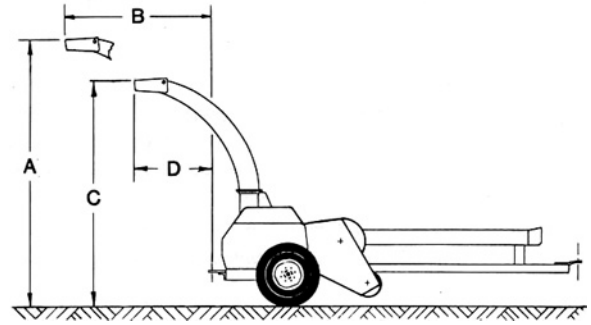


FIGURE 6. Discharge Spout Dimensions: (a) Lift with Extension 10.8 ft (3.3 m), (b) Reach with Extension 5.4ft (1.6 m), (c) Lift 10.7 in (3.2 m), (d) Reach 3.4ft (1.0 m).

Knife Sharpening: Ease of operation of the knife sharpener and adjustment of the shearplate clearance were very good. The New Holland 900 was equipped with a cylindrical sharpening stone and a reversing cutter head drive for knife sharpening. To reverse the cutterhead, the cutterhead driveshaft was moved to an alternate input shaft. This operation was easy.

A ratchet mechanism automatically lowered the stone to contact the knives while a lever mechanism was used to draw the stone across the cutterhead.

Shearplate clearance was easily adjusted with two bolts, while the cutterhead was slowly rotating in reverse rotation. The average period between knife sharpening was about 10 hours. During the 215 hour test, the knives incurred about 0.44 in (11 mm) of wear due mainly to sharpening.

One edge of the reversible shearplate was worn and was reversed at 165 hours to provide a new shearing edge.

Cut Length: Ease of adjustment of the cut length was very good. The length of cut could be adjusted either by adding or removing cutterhead knives or by changing the feed roll drive sprockets. Changing the sprockets was the easier method and provided a more uniform cut. The sprockets provided 0.19,0.25, 0.375 and 0.44 in (5,6,9 and 11 mm) cut length settings. It was necessary to break the drive chain only when using the 0.44 in (11 mm) cut length setting. Changing or reversing sprockets took only a few minutes.

Exchanging Header Attachments: Ease of exchanging header attachments was very good. The same feed auger base was used with either the windrow pickup drum or the row crop header. 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.

When using the row crop header it was necessary to install a secondary header floatation spring.

Transporting: Ease of transporting was very good. The drawpole could be placed in four positions. The extreme right position was used when transporting with either header. The extreme left position was used with both headers during field testing.

The New Holland 900 was easy to maneuver and towed well in transport position. Ground clearance was adequate and there was ample hitch clearance for turning sharp corners. Three hitch positions were provided for towing a wagon.

The hydraulic drawpole made changing from field position to transport position easy. It could also be used to steer the harvester during field operation, provided the drawpole locking pin was retracted. This was often convenient in row crops.

Lubrication: Ease of lubrication was very good. The New Holland 900 had 51 pressure grease fittings of which 31 required lubrication at 10 hour intervals. In addition, the main unit had 5 drive chains, 3 gear boxes and two wheel bearings.

The three-row row crop header had 19 pressure grease fittings, 3 drive chains, and 12 gathering chains. The pick-up header had one drive chain. Complete daily lubrication could be completed in 20 minutes.

OPERATOR SAFETY

Safety of the New Holland 900 was very good. The New Holland 900 was safe to operate and service, as long as common sense was used and the manufacturer's safety recommendations were followed. A comprehensive safety section was included in the operators' manuals.

Protective shields were opened easily for service.

The New Holland 900 was equipped with a slow moving vehicle sign bracket.

OPERATORS' MANUALS

The operators' manuals were excellent.

The operators' manuals were concise and clearly written, containing much useful information on operation, adjustment, servicing and safety.

MECHANICAL HISTORY

TABLE 3 outlines the mechanical history of the New Holland 900 during 215 hours of operation while harvesting 596 ac (239 ha) of windrowed crop and 358 ac (1 43 ha) of corn. The intent of the test was evaluation of functional performance. An extended durability test was not conducted.

TABLE 3. Mechanical History

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA ac	(ha)
The metal detector locking nuts loosened and were tightened at:	12	70	(28)
A snap ring on the header drive shaft failed and was replaced at:	104	616	(247)
The main cutter head bearings failed and were replaced at:	108	621	(249)
The right wheel spindle broke and was replaced at:	111	626	(250)
The left wheel spindle broke and was replaced at:	215	895	(358)

DISCUSSION OF MECHANICAL PROBLEMS

Cutterhead Bearings: The main cutterhead bearings failed after 108 hours of operation. A service bulletin from the manufacturer indicated improper lubrication at the time of manufacturing. It is recommended the manufacturer consider modifications to prevent cutterhead bearing failure.

Wheel Spindles: The right and left wheel spindles failed at 111 and 21 5 hours respectively. It is recommended the manufacturer consider providing more durable wheel spindles.

APPENDIX I

SPECIFICATIONS

MAKE:	New Holland
MODEL:	900
SERIAL NO.:	769753
OVERALL DIMENSIONS:	
- height (discharge spout removed)	5.3 ft (1.6 m)
- length	18.7 ft (5.7 m)
- width	
- without attachments	10.5 ft (3.2 m)
- with windrow pickup	11.5 ft (3.5 m)
- with three-row row crop header	12.8 ft (3.9 m)
- ground clearance	(adjustable)
WINDROW PICKUP:	
model	919W3
serial number	778667
type	Floating cylindrical drum
height adjustment	Adjustable skid shoes
working width	6.3 ft (1.9 m)
overall width	7.9 ft (2.4 m)
tooth spacing	2.75 in (70 mm)
number of tooth bars	4
pickup speed	90 or 110 rpm
auger diameter	25 in (630 mm)
auger length	7.0 ft (2.1 m)
auger speed	50, 60, 66, 86, 93 rpm
THREE-ROW ROW CROP HEADER:	
model	939-R3
serial number	748984
distance between rows	38 in (950 mm)
type of cutter	Rotary disk
cutter speed	145 rpm
type of stalk gatherer	Chain (upper and lower)
gathering chain/ground synchronization speed:	
- upper	1.6,1.8, 2.0 mph (2.5, 2.8, 3.3 km/h)
- lower	1.7,1.9, 2.3 mph (2.8, 3.0, 3.6 km/h)
FEEDROLL ASSEMBLY:	
- throat opening	22x6.5 in (560x160 mm)
- roll width	21 in (530 mm)
- front roll diameter	
- upper	11 in (280 mm)
- lower	9 in (230 mm)
- rear roll diameter	
- upper	7 in (180 mm)
- lower	5 in (130 mm)
- front roll speed	
- upper	87 rpm
- lower	108 rpm
- rear roll speed	
- upper	153 rpm
- lower	201 rpm
CUTTERHEAD:	
- type	Cylindrical
- number of knives	12
- width	23 in (580 mm)
- diameter	21 in (530 mm)
- speed	848 rpm
RECUTTER SCREEN:	
- width	24 in (610 mm)
- arc length	24 in (610 mm)
- opening size	Progressive size 1.2x5 in to 3.2x5 in (30x130 mm to 30x130 mm)
KNIFE SHARPENER:	
- type	Cylindrical stone
- size (diameter)	2 in (50 mm)
CONVEYING ASSEMBLY:	
Transfer Auger	
- diameter	10 in (250 mm)
-length	76 in (1930 mm)
- speed	575 rpm
Fan	
- diameter	31 in (775 mm)
- blade width	9 in (230 mm)
- discharge spout (diameter)	9.5 in (240 mm)
- speed	720, 1000 rpm

TIRES:
-Two, 31x13.5 - 15, 6 ply implement

WEIGHTS:

	Field Position With Pickup Header	With Row Crop Header
- left wheels	2072 lb (942 kg)	1800 lb (818 kg)
- right wheels	27851b (1266kg)	35291b (1604kg)
- hitch	651 lb (296 kg)	1091 lb (496 kg)
TOTAL:	5508 tb (2504 kg)	6420 lb (2918 kg)

LUBRICATION:

Main Unit:

- grease fittings	51 (31 @ 10 hrs, 19 @ 50 hrs, 1 @ 100 hrs)
- chains	5 (5 @ 10 hrs)
- wheel bearings	2 (annually)
- gear boxes	3 (annually)

Windrow Pickup

- chains	1 (1 @ 10 hrs)

Three-row Row Crop Header

- grease fittings	19 (18 @ 10 hours, 1 @ 50 hours)
- chains (drive)	3 (3 @ 10 hours)

OPTIONAL EQUIPMENT:

auxiliary header lift spring
tandem wheel axles
spout extensions
driveline
hydraulic controls
recutter screens
stationery feeder attachment

APPENDIX II

MACHINE RATINGS

The following rating scale is used in the PAMI Evaluation Reports:

excellent	fair
very good	poor
good	unsatisfactory

APPENDIX III

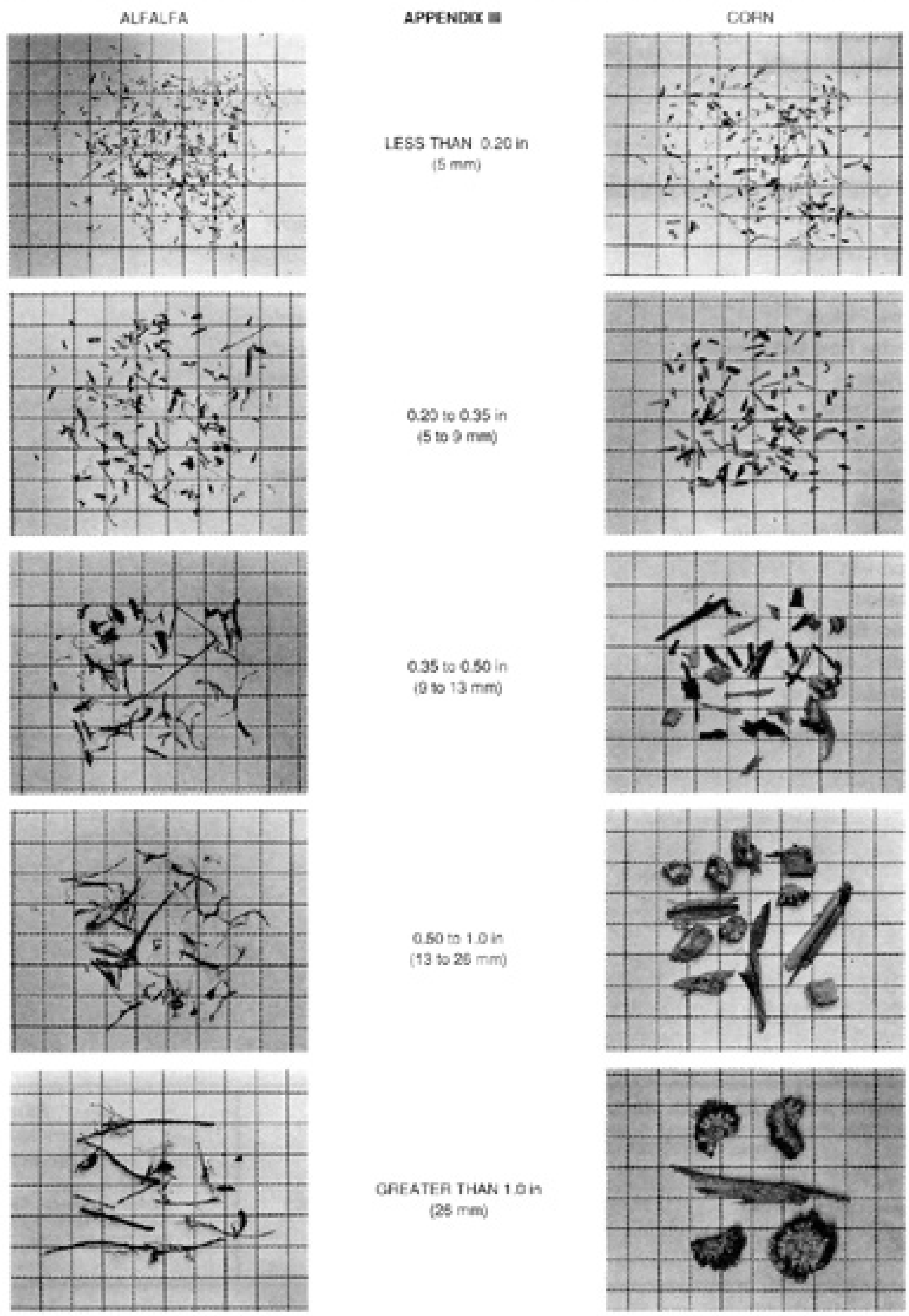


FIGURE 7. Distribution of Particle Lengths (0.80 in [20 mm] grid)

SUMMARY CHART

NEW HOLLAND 900 FORAGE HARVESTER

RETAIL PRICE	$46,754.56 (March 1989, f.o.b. Portage la Prairie, Manitoba with electronic metal detector, pickup header, three-row row crop header, hydraulic draw pole)
RATE OF WORK	Maximum 55.6 ton/h (50.6 t/h) in alfalfa. Maximum 40.6 ton/h (36.9 t/h) in corn.
QUALITY OF WORK	
Uniformity of Cut	7% greater than 1 in (25 mm) at 0.25 in (6 mm) setting in alfalfa. 0% greater than 1 in (25 mm) at 0.375 in (9 mm) setting in corn.
Windrow Pickup Losses	Minimal
Three-row Row Crop Header Losses	Minimal
TRACTOR LOSSES	
Power Requirements	180 hp (135 kW)
Specific Capacity	0.190 to 0.240 ton/hp-h (0.230 to 0.290 t/kW-h) in alfalfa. 0.237 ton/hp-h (0.285 t/kW-h) in corn.
EASE OF OPERATION AND ADJUSTMENT	
Hitching	**Very Good**; equal angle hitch
Remote Controls	**Very Good**; effective and convenient
Electronic Metal Detector	**Very Good**; effective
Windrow Pickup	**Very Good**; adjustable height
Three-row Row Crop Header	**Fair**; some plugging occurred
Feed Roils	**Very Good**; adequate adjustments
Recutter Screen	**Good**; adjustments required for optimum performance
Knife Sharpening	**Very Good**; easy to use
Shearplate Clearance	**Very Good**; 2 bolt adjustment
Cut Length	**Very Good**; easy to adjust
Exchanging Attachments	**Very Good**; 2 men 30 minutes
Transporting	**Very Good**
Lubrication	**Very Good**; 30 minutes
Operator Safety	**Very Good**; if manufacturer's recommendations were followed.
Operators' Manuals	Excellent; concise and clearly written.
Mechanical History	3 mechanical failures

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