Evaluation Report

New Holland 890 Forage Harvester
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).

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.

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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The Model 890 has been superseded by the Model 892, which has incorporated many improvements.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 fi nd that the new model has improved 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 electronically 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>
<thead>
<tr>
<th>Crop</th>
<th>Average Yield</th>
<th>Hours</th>
<th>Field Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>11</td>
<td>45</td>
<td>52</td>
</tr>
<tr>
<td>Grass</td>
<td>11</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Clover</td>
<td>12</td>
<td>34</td>
<td>47</td>
</tr>
<tr>
<td>Green Barley</td>
<td>7 to 12</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Corn (three row crop head)</td>
<td>20 to 35</td>
<td>127</td>
<td>143</td>
</tr>
<tr>
<td>Total</td>
<td>230</td>
<td>270</td>
<td></td>
</tr>
</tbody>
</table>

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.

TABLE 2. Average Workrates

<table>
<thead>
<tr>
<th>Crop</th>
<th>Moisture Content</th>
<th>Length-of-Cut Setting</th>
<th>Workrates</th>
<th>Actual</th>
<th>Dry Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>mm</td>
<td>t/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alfalfa</td>
<td>70</td>
<td>3</td>
<td>28.5</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>3</td>
<td>26.2</td>
<td>9.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>3</td>
<td>16.8</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>47</td>
<td>3</td>
<td>13.5</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>69</td>
<td>6</td>
<td>22.0</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>6</td>
<td>36.0</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>6</td>
<td>23.9</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>47</td>
<td>6</td>
<td>18.2</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td>Green Barley</td>
<td>40</td>
<td>3</td>
<td>22.1</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3*</td>
<td>3</td>
<td>18.2</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>3</td>
<td>31.3</td>
<td>18.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6*</td>
<td>3</td>
<td>23.0</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>60</td>
<td>3</td>
<td>16.0</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>3</td>
<td>23.0</td>
<td>9.2</td>
<td></td>
</tr>
</tbody>
</table>

*With 57 x 154 mm Recutter Screen

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.

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: TABLE 3 presents typical particle size distributions in second-crop, full bloom alfalfa, harvested at 56% moisture content. Particle 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 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, inline feeding by the row-crop head.

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 increased 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:** 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 and 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.

**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 amply 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.
It is recommended that the manufacturer consider modiﬁcations to the skid shoes was about 1000 N. Maintaining good performance was important, with a maximum side drift from the row. Three feed auger speeds were adjusted to suit feedroll speed. Three feed auger speeds were 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 ﬂotation springs and equipped with skid shoes. Flotation was adequate only in ﬁrm soil. In softer soil, the skid shoes dragged severely. The operator’s manual recommended that the ﬂotation 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 ﬂotation 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 ﬂotation. 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 adjustable 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°.

Recutter Screen: 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 reductions 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 driveline was reconnected to the sharpener drive shaft. A conventional quick-connect coupler, similar to that used on a power
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

<table>
<thead>
<tr>
<th>Item</th>
<th>Operating Hours</th>
<th>Equivalent Field Area ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>The plastic control knob extensions on the three electric remote control switches were all broken</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>The feedroll drive sprocket slipped on its hub bearing, necessitating sprocket realignment</td>
<td>195, 220</td>
<td>232, 258</td>
</tr>
<tr>
<td>Lower support mount for the header lift hydraulic cylinder broke and was welded</td>
<td>202</td>
<td>240</td>
</tr>
<tr>
<td>The rope connecting the electrical control actuator to the discharge angle actuator was cut due to rubbing on the discharge spout brace twice</td>
<td>during test</td>
<td>during test</td>
</tr>
<tr>
<td>Electrical connectors in the electric remote control harness came apart during operation many times</td>
<td>during test</td>
<td>during test</td>
</tr>
<tr>
<td>The metal detector feedroll drive-step pawl connecting link was worn requiring replacement</td>
<td>end of test</td>
<td>end of test</td>
</tr>
</tbody>
</table>

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 window 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
- 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 615 mm
- auger diameter 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
- 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
- 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
- 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
- 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: 2830 mm

Weight:
- With Window Pickup
  - left wheel 846 kg
  - right wheel 1190 kg
  - hitch 204 kg
  - TOTAL 2240 kg
- With Three-Row Row Crop Head
  - left wheel 755 kg
  - right wheel 1513 kg
  - hitch 369 kg
  - TOTAL 2627 kg

Servicing:
- main unit
  - grease fittings 37, daily; 7, every 25 h
  - chains 6, daily
  - wheel bearings 2, yearly
  - gear boxes 2, yearly
- window 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

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APPENDIX II

MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:
(a) excellent  (d) fair
(b) very good  (e) poor
(c) good  (f) unsatisfactory

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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) = 2.5 acres (ac)
1 kilometre/hour (km/h) = 0.6 mile/hour (mph)
1 metre (m) = 3.3 feet (ft)
1 millimetre (mm) = 0.04 inches (in)
1 kilowatt (kW) = 1.3 horsepower (hp)
1 kilogram (kg) = 2.2 pounds mass (lb)
1 newton (N) = 0.2 pounds force (lb)
1 tonne/hour (t/h) = 1.1 ton/hour (ton/h)
1 tonne/kilowatt hour (t/kW-h) = 0.8 ton/horsepower hour (ton/hp-h)
APPENDIX IV

Distribution of Particule Lengths

Figure 7. Typical Distribution of Particule Lengths in Alfalfa (20mm grid)

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 8. Typical Distribution of Particule Lengths in Corn (20mm 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