Evaluation Report

International Harvester 620 Grain and Fertilizer Drill
INTERNATIONAL HARVESTER 620 GRAIN AND FERTILIZER DRILL

MANUFACTURER:
International Harvester Company of Canada Limited
208 Hillyard Street
Hamilton, Ontario
Canada

DISTRIBUTOR
International Harvester of Canada Limited
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RETAIL PRICE
$5,280.00 (February, 1978, f.o.b. Humboldt with 16 double disk openers on 152 mm (6 in) spacing, disk scrapers, solid press wheels, single unit hitch, fertilizer level indicator, grass seeding attachment, and rock guard attachment).

SUMMARY AND CONCLUSIONS

Overall functional performance of the International Harvester 620 was very good. Penetration and seed placement were good in a wide range of soil and trash conditions, providing the seedbed had been properly prepared. Performance of the press wheels was good; plugging occurred only in extremely wet soil. The optional rock guard attachment reduced the lodging of stones between the press wheels.

Accuracy of the seed metering system was very good in barley, wheat and oats and was fair in rapeseed. The minimum seeding rate in rapeseed was 2.6 kg/ha (2.3 lb/acre) and only a limited number of settings were within the common rapeseed seeding range. Variation in seeding rates among seed runs was insignificant when seeding large seeds such as wheat, oats and barley. The variation among the seed runs was high and slightly beyond the suggested limit when seeding rapeseed. The seeding rates in all crops were unaffected by field slope, ground speed or the level of grain in the seed box.

Overall performance of the fertilizer attachment was good. Variation of the application rates among runs was low and the application rate was not affected by field roughness, ground speed or the level in the fertilizer box. The application rate was affected by field slope and increased 34% when seeding down a 15° slope.

Performance of the grass seed attachment was fair for small seeds. As is common with such attachments, it was not suited for large, light seeds, such as brome grass or Russian wild rye grass. Such crops are usually seeded through the grain box using an agitator attachment. An agitator was not available for the International Harvester 620. The grass seed attachment performed well with rapeseed, however, it broadcasted the seed on the soil surface rather than within the furrow. Cutting the feed tubes and positioning them into the front of the optional grain seed viewing cups would enable seeding rapeseed into the opener furrow with the grass seed attachment.

Both the seed and fertilizer drive were convenient to adjust. The seed and fertilizer boxes were convenient to fill as an adequate walkway was provided. The fertilizer box was very easy to clean, but was not adequately sealed to prevent water entering the box in heavy rains. Twelve lubrication fittings required greasing.

About 22.5 kW (30 hp) of tractor power should be available for each 2440 mm (8 ft) section of drill. A 90 kW (120 hp) tractor should have sufficient power reserve to operate a multiple hook-up of four drills in most soils at speeds up to 10 km/h (6 mph).

The operator’s manual was very good. It contained detailed instructions on adjustment, repair and maintenance. The International Harvester 620 was safe to operate if normal safety precautions were followed. No serious mechanical problems occurred during functional evaluation.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Making a slower speed available for the grain drive to obtain better metering accuracy and a greater number of suitable settings for seeding small seeds such as rapeseed.
2. Supplying optional grass seed tubes or including instructions in the operator’s manual for modifying existing tubes to permit the option of placing seeds within the opener furrow when using the grass seed attachment for seeding crops such as rapeseed or mustard.
3. Supplying a slow moving vehicle sign to comply with provincial safety regulations.

THE MANUFACTURER STATES THAT

With regard to recommendation number:
1. & 2. Both of these recommendations deal with obtaining finer sowing rate graduations for seeding rapeseed. International Harvester will supply information in the Operator’s Manual, instructing the operator to purchase seed viewing cups and to modify the existing grass tubes so the grass seed attachment can sow rapeseed and mustard seed through the furrow openers. The rapeseed sowing chart for the grass seed attachment, contained in this report will also be added to the operator’s manual.
3. The mounting socket for the slow moving vehicle sign will be supplied as standard equipment.

MANUFACTURER’S ADDITIONAL COMMENTS

1. The rock guard attachment is now standard equipment on the International Harvester 620 grain drills.
2. Zero pressure press wheels are recommended for use in extremely wet, sticky soils.
3. Although a metric counter is not available a chart to convert acres to hectares has been added to the inside of the lid.
4. The failure of the press wheel gang bearing holder was due to insufficient dealer set-up instructions. This is being corrected.
5. For multiple drill hook-ups and for transporting long distances, the International Harvester 620 Endwise Transport is recommended.

GENERAL DESCRIPTION

The International Harvester 620 is a 2438 mm (8 ft) press drill with 152 mm (6 in) spacing. It is equipped with 16 double disk openers in two rows of eight each. Seeding depth is controlled with adjustable compression springs on each opener and a hydraulic
cylinder. The divider in the combination grain and fertilizer box may be installed in two positions giving filled capacities of 568 L (15.6 bu) grain and 330 kg (728 lb) fertilizer or 458 L (12.6 bu) grain and 440 kg (970 lb) fertilizer.

Grain is metered by externally fluted feed rolls while fertilizer is metered with star-shaped traction wheels. Flexible rubber hoses deliver both the seed and fertilizer to the openers. Two gangs of 565 mm (22.3 in) diameter solid press wheels pack the soil directly behind the openers.

The test machine was equipped with rock guard attachment and grass seed attachment. Detailed specifications are given in APPENDIX I.

SCOPE OF TEST
The International Harvester 620 was operated in the conditions shown in TABLE 1 for 120 hours while seeding about 222 ha (550 ac). It was evaluated for quality of work, ease of operation, ease of adjustment, power requirements, operator safety and suitability of the operator’s manual. In addition the seed and fertilizer systems and the grass seed attachment were calibrated in the laboratory.

TABLE 1. Operating Conditions

<table>
<thead>
<tr>
<th>Crop</th>
<th>Soil</th>
<th>Stone Condition</th>
<th>Field Area</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat on summerfallow</td>
<td>Oxbow loam</td>
<td>Occasional stones</td>
<td>14</td>
<td>33</td>
</tr>
<tr>
<td>Rapedseed on summerfallow</td>
<td>Melfort silt loam</td>
<td>Stone free</td>
<td>155</td>
<td>384</td>
</tr>
<tr>
<td>Rapedseed on summerfallow</td>
<td>Naicam loam</td>
<td>Stone free</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Barley on barley stubble</td>
<td>Naicam loam</td>
<td>Stone free</td>
<td>18</td>
<td>46</td>
</tr>
<tr>
<td>Grass seed mixture &amp; barley on summerfallow</td>
<td>Oxbow loam</td>
<td>Moderately stony</td>
<td>22</td>
<td>55</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>222</td>
<td>550</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

QUALITY OF WORK
Penetration: Penetration was good in a wide variety of field conditions provided the openers (FIGURE 2) were properly adjusted and adequate pre-seeding tillage had been performed. Opener force was controlled by the position of the pressure adjusting keepers on the openers and the setting of the hydraulic lift cylinder. Opener depth was controlled by the position of the depth adjusting clips on the openers and the setting of the hydraulic lift cylinder. When these two adjustments were properly made, adequate penetration was obtained with the depth adjustment clip slightly clearing the hydraulically controlled arm. Too much clearance between the arm and the clip resulted in excessive penetration or downward motion of the disks in soft or loose soils.

FIGURE 3. Soil Surface after Seeding in Heavy Trash.


Seed Placement: In normal prairie conditions, grain is seeded into moist soil on a firm seedbed from 25 to 50 mm (1 to 2 in) deep. A firm seedbed aids in the packing of moist soil about the seed and provides a barrier to the seepage of rainfall below the seed zone. Pre-seeding tillage was the most important factor determining seed placement since the openers readily penetrated to the seedbed, but did not exert enough force to penetrate deeper.

Seeding depth was quite uniform across the drill width with slight variations resulting from field or seedbed irregularities. Seed coverage was good and was not appreciably affected by ground speed. Seed coverage was reduced in moist heavy soils due to decreased penetration and soil flow. Seed and fertilizer were placed in a 25 mm (1 in) wide band. Seeds were distributed uniformly along the row.

Soil Compaction: The press wheels followed directly behind the openers, effectively pressing the soil about the seeds. The convex rimmed press wheels were suited to dry soil providing a concentrated soil packing at the seed with minimal soil pulverization. In dry lumpy soil (FIGURE 5), a lumpy surface was retained after seeding since the openers readily penetrated to the seedbed, but did not exert enough force to penetrate deeper.

Average packing force exerted by each press wheel ranged from 490 N (110 lb) with empty seed and fertilizer boxes, to 780 N (175 lb) with full boxes. Press wheel furrow depth ranged from 40 to 65 mm (1.5 to 2.5 in) depending on soil conditions.

Seed Emergence: As with most drills, time and uniformity of seed emergence depended primarily upon seed bed preparation and soil moisture. Seed emergence was uniform in all fields with sufficient moisture reserves. In very dry fields, complete emergence occurred only after rain. FIGURES 6 and 7 illustrate emergence in fields of barley and rapeseed.

Metering Accuracy: The grain, fertilizer and optional grass...
seed metering systems (FIGURE 8) were calibrated in the laboratory using a standard procedure and compared with the manufacturer’s calibrations. Since the actual application rates for certain settings depend on factors such as size, density and moisture content of seeds and fertilizer particles, it is not possible for a manufacturer to present charts to include all the variations of seed and fertilizer used. Field calibration checks may be necessary for seed and fertilizer with properties differing from those indicated in the manufacturer’s tables. Research has shown, however, that small variations in seed or fertilizer application rates will not significantly affect grain crop yields.

Field slope or ground speed did not affect the seeding rate for either large or small seeds.

Grain Metering System: FIGURES 9 to 12 show calibration curves obtained by PAMI and the manufacturer for the International Harvester 620 in wheat, barley, oats and rapeseed using the slow speed grain drive. When using the fast speed drive, seed rates for each setting must be doubled. The differences between the calibration curves of PAMI and the manufacturer are probably due to different seed size, density and moisture content. The seed densities (bushel weights) used by PAMI and the manufacturer are indicated on the curves.

Level of seed in the grain box, field roughness and variation in

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1PAMI T773, Detailed Test Procedure for Grain Drills.

The coefficient of variation (CV) is commonly used to describe

2The coefficient of variation (CV) is the standard deviation of application rates from individual seed cups expressed as a percent of the mean application rate.
the variation of application rate among individual seed cups. An accepted variation for grain or fertilizer application is a CV value not greater than 15%. If the CV is less than 15%, seeding is acceptable whereas if the CV is much greater than 15%, the variation among individual seed cups is excessive.

For wheat, oats and barley, seeding was quite uniform. For example when seeding wheat at 78.5 kg/ha (70.0 lb/ac) the CV was only 6.5%. However, when seeding rapeseed at a rate of 14.6 kg/ha (13.0 lbs/ac) the CV was 16.8%. This CV value for rapeseed was high and above the suggested 15% limit.

It is therefore recommended that the manufacturer consider supplying an optional extra slow speed drive for use with small seeds such as rapeseed. This would extend the range of seed rate settings available for small seeds and should increase seeding uniformity.

**Fertilizer Metering System:** The operator's manual presented a fertilizer calibration table for fertilizer with a density of 1040 kg/m³ (65 lb/ft³). FIGURE 13 shows PAMI calibration results for 23-23-0 fertilizer with a density of 990 kg/m³ (61 lb/ft³) when using the slow speed drive. Comparisons with the manufacturer’s calibrations on the same figure indicate a slight difference between the two graphs. This difference is probably due to the variation in the size and density of fertilizer used in the two calibrations. Application rates for the high speed drive range from about 145 to 695 kg/ha (130 to 620 lb/ac).

Fertilizer distribution across the width of the drill was quite uniform. For example, when distributing 23-23-0 fertilizer at a rate of 56 kg/ha (50 lb/ac), the coefficient of variation among individual feed cups was 9%.

The fertilizer application rate was not affected by the level of fertilizer in the box, ground speed or field vibrations. It was, however, significantly affected by field slope. FIGURE 14 shows the variation in fertilizer application rates obtained when fertilizing uphill, downhill and on level ground with the fertilizer selection lever at setpoint ten while applying 23-23-0 fertilizer. The application rate varied from 44 kg/ha (39 lb/ac) while seeding up a 15° slope to 75 kg/ha (67 lb/ac) while seeding down a 15° slope. The application rate on level ground was 56 kg/ha (50 lb/ac).

**Grass Seed Attachment:** As is common with most drills, the grass seed attachment is designed only for small seeds, which cannot be suitably seeded through the grain box. It is not intended for large seeds such as bromegrass or Russian wild ryegrass. Such grasses can be seeded through the grain box by mixing with the seed heavier material such as cracked grain. A grain agitator was not available to aid in the seeding of the light grasses through the main box.

FIGURE 15 shows the grass seed attachment calibration for alfalfa while FIGURE 16 shows calibration for rapeseed, both with the low speed drive. For the high speed drive, seeding rates for each setting have to be doubled.

Seeding rates were not significantly affected by level of seed in the box, ground speed or field vibration. The grass seed attachment was only slightly more suitable for seeding rapeseed than was
The fertilizer box was very easy to clean. The bottom of the fertilizer gates on each of the seed cups could be opened to aid in cleaning. Air was needed for thorough cleaning of the grain box. The feed and that the fertilizer has not caked. Checking before operation to ensure that the feed shaft is free to turn is forced to stand out in the rain, the fertilizer attachment must be checked. If the drill rains, water entered the fertilizer box mainly at both ends. If the drill viewing cups to the openers. Moisture: The optional rock guards effectively prevented plugging of the press wheels with mud when seeding through small pot holes or wet depressions. In extremely wet soil, they were only partially effective and occasional press wheel plugging occurred, necessitating cleaning with a bar. Soil clung to the press wheels in moist seeding conditions however seed was never seen clinging to the press wheels.

Disk Scrapers: The International Harvester 620 was equipped with adjustable spring loaded inner scrapers. If properly adjusted the scrapers effectively prevented mud accumulation on the disks without excessive disk wear. The disks turned freely in all soils.

Feed Gates: The grain box seed cups were equipped with adjustable feed gates. The gates could be set in three operating positions and in a fully open position for cleaning the seed cups.

Filling: The 330 mm (13 in) wide metal walkway and the large wide opening lid made filling of the grain and fertilizer boxes on level fields with average soil moisture was about 4495 N (1010 lb) while average draft was about 4140 N (930 lb). When considering variation in soil and field conditions, about 22.5 kW (30 hp) of tractor power should be available for each 2.44 m (8 ft) section of drill. In other words a 90 kW (120 hp) tractor should have sufficient power reserve to operate a multiple hook-up of four drills in most soils at 10 km/hr (6 mph).

OPERATOR’S MANUAL
The operator’s manual was simple, concise, and well illustrated, presenting much useful information on operation and maintenance. The operator’s manual did not include metric calibration charts for the grain and fertilizer box or the grass seed attachment. Metric calibration charts were attached to the inside of the drill lid.

DURABILITY RESULTS
The International Harvester 620 was operated for 120 hours while seeding about 222 ha (550 ac). The intent of the test was evaluation of functional performance and an extended durability evaluation was not conducted. TABLE 2 outlines the mechanical problems that did occur during the functional testing.

<table>
<thead>
<tr>
<th>Item</th>
<th>Field Area</th>
<th>Hours</th>
<th>Item</th>
<th>Field Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A bearing holder on one of the press wheel gangs was broken and replaced.</td>
<td>105</td>
<td>220</td>
<td>(540)</td>
<td></td>
</tr>
<tr>
<td>Several discs came loose and were tightened.</td>
<td>End of Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The positioning lever on one of the feedcup gates broke and was replaced during Laboratory Tests</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION OF MECHANICAL PROBLEMS
Bearing Holder on Press Wheels: Mud buildup on the press wheels pulled a loose bolt from one of the press wheel gangs bearing holder freeing the one end. Resulting twist of the gang fractured the second bearing holder.
APPENDIX I

SPECIFICATIONS

MAKE: International Harvester Grain and Fertilizer Drill
MODEL: 620
SERIAL NO.: 620 CI 211

OVERALL DIMENSION:
-- height 1485 mm (58.5 in)
-- length 4140 mm (163 in)
-- width 2550 mm (100.5 in)
-- effective seeding width 2438 mm (96 in)
-- transport ground clearance 76 mm (3 in)

SEED METERING SYSTEM:
-- type externally fluted feed rolls
-- drive chain and gear from press wheels
-- adjustment lever controlling feed roll protrusion
-- transfer to openers convoluted rubber hose
-- options seed viewing cups

FERTILIZER METERING SYSTEM:
-- type star-shaped feed wheels rotating on a vertical shaft
-- drive chain and gear drive from press wheels
-- adjustment lever controlling feed inlet size
-- transfer to openers convoluted rubber hose

GRASS SEED ATTACHMENT: (OPTIONAL)
-- type externally fluted feed rolls
-- drive chain from grain box feed shaft
-- adjustment lever controlling feed roll protrusion
-- seed transfer rubber tubes broadcasting behind the openers

OPENERS:
-- type double disk
-- disk diameter 356 mm (14 in)
-- number of openers 16
-- opener spacing 150 mm (6 in)
-- number of rows 2
-- distance between rows 140 mm (5.5 in)
-- options 180 mm (7 in) opener spacing, outer disk scrapers

PRESS WHEELS:
-- type solid with convex rim
-- diameter 565 mm (22.25 in)
-- number 16
-- spacing 150 mm (6 in)
-- number of gangs 2
-- options 76 x 510 mm (3 x 20 in) shielded with rubber tire and 57 x 510 mm (2.25 x 20 in) shielded with convex rim

CASTOR WHEELS:
-- number 1
-- tire size 7.60 x 15, 4-ply

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

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) = 2.47 acres (ac)
1 kilometre/hour (km/h) = 0.62 miles/hr (mph)
1 metre (m) = 1000 millimetres (mm) = 39.37 inches (in)
1 kilowatt (kW) = 1.34 horsepower (hp)
1 kilogram (kg) = 2.2 pounds (lb)
1 newton (N) = 0.22 pounds force (lb)
1 litre (L) = 0.028 bushels (bu)
1 kilogram/hectare (kg/ha) = 0.9 pounds/acre (lb/ac)