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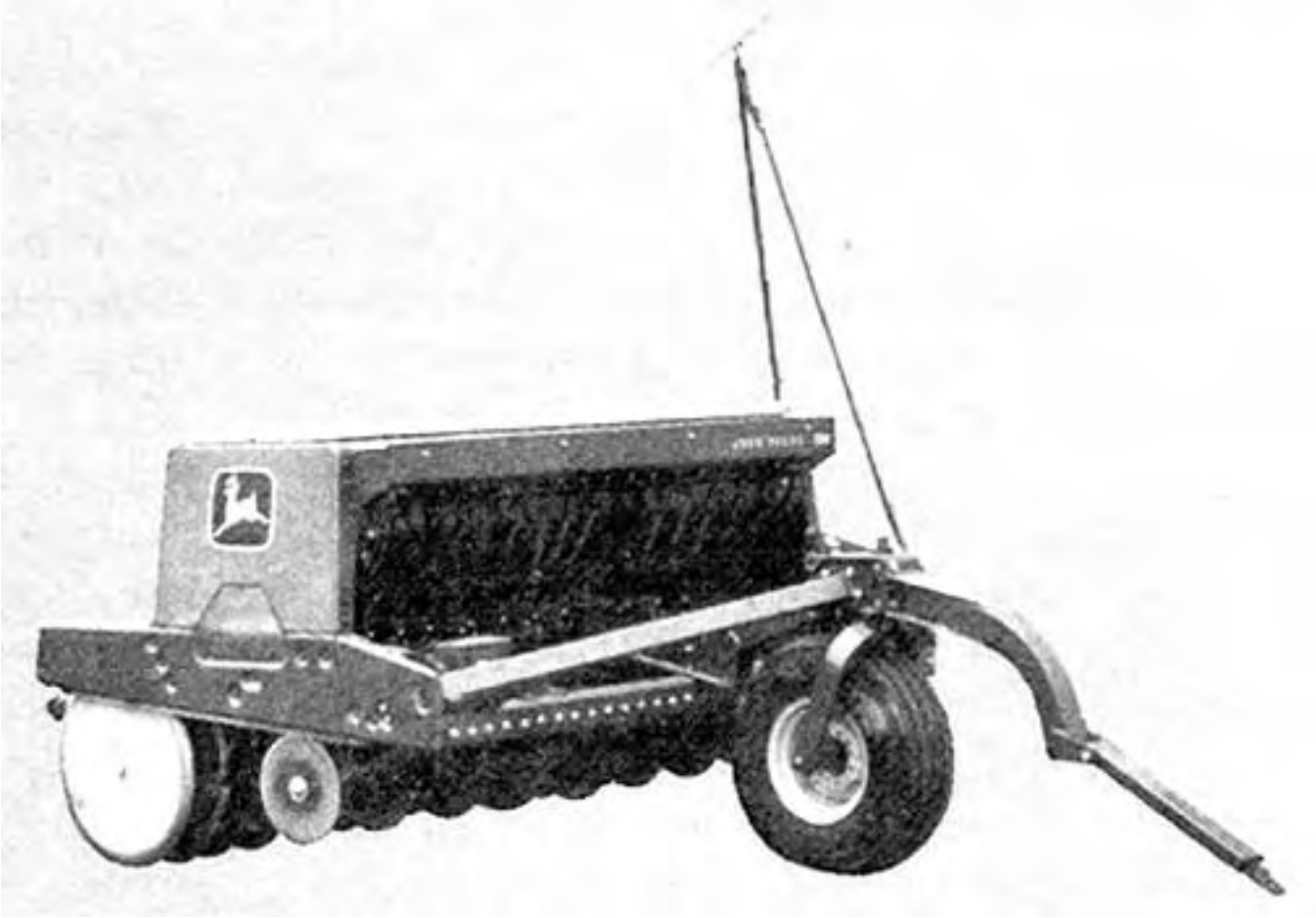
Evaluation Report 43



John Deere 9350 Grain and Fertilizer Drill

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

JOHN DEERE 9350 GRAIN AND FERTILIZER DRILL

MANUFACTURER:

John Deere Des Moines Works
Des Moines, Iowa 50306
U.S.A.

DISTRIBUTOR:

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

RETAIL PRICE:

$5,850.00 (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, hydraulically controlled marker, grass seeding attachment, and rock guard attachment).

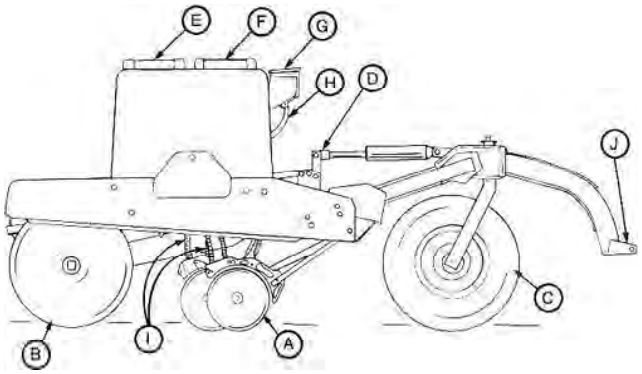


FIGURE 1. Schematic of John Deere 9350: (A) double disk openers, (B) solid press wheels, (C) castor wheel, (D) hydraulic lift, (E) fertilizer box opening, (F) grain box opening, (G) grass seed box, (H) grass seed delivery tubes, (I) fertilizer and grain delivery tubes, (J) hitch.

SUMMARY AND CONCLUSIONS

Overall functional performance of the John Deere 9350 was very good. Penetration and seed placement were good in a wide range of soil and trash conditions, providing that 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, but was poor in rapeseed. When seeding small seeds, such as rapeseed, seeding accuracy was affected by field roughness. Bouncing of the drill caused the seed flutes to move, resulting in large variations among the seed runs. The minimum seeding rate in rapeseed was 2.0 kg/ha (1.8 lbs/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. Seeding rates in all crops were unaffected by field slope, ground speed or level of grain in the seed box.

Overall performance of the fertilizer attachment was good. Variation of the application rates among runs was insignificant and the application rate was not affected by field roughness, ground speed or level in the fertilizer box. The application rate was affected by field slope and increased 44% when seeding down a 15° slope.

Performance of the grass seeding attachment was good for small seeds. As is common with such attachments, it was not suited for large, light seeds, such as bromegrass or Russian wild ryegrass. An agitator attachment (not evaluated) is available for seeding such crops through the grain box. 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 grain feed 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 the fertilizer boxes were convenient to fill as an adequate walkway was provided. The fertilizer box was simple to clean, but was not adequately sealed to prevent water entering the box in heavy rains. Only six lubrication fittings required greasing.

About 18.5 kW (25 hp) of tractor power should be available for each 2440 mm (8 ft) section of drill. A 75 kW (100 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 comprehensive instructions on adjustment, repair and maintenance. The John Deere 9350 was safe to operate if normal safety procedures were followed.

No 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. Including recommended feed gate settings in the operator's manual.
4. Indicating in the operator's manual the actual seed densities used in preparation of the calibration tables.
5. Supplying a slow moving vehicle sign to comply with provincial safety regulations.

Chief Engineer - E.O. Nyborg
Senior Engineer - L.G. Smith
Project Engineer - G.E. Frehlich

THE MANUFACTURER STATES THAT:

1. A slow speed drive bundle for 9000 series grain drills was made available in December of 1977.
2. Placement of the grass seed tubes in the grain feed cup is now possible. It is not a recommended practice for general planting of small seeds.
3. Operator's manuals shipped from factory beginning July 1977 do include recommended feed gate settings.
4. The seed densities used in the preparation of the calibration table are based on approximate accepted weights (example, 48 pounds per bushel for barley) and may vary according to different provinces. We caution all operators to calibrate according to their seed densities for precision seeding.
5. Means for mounting the bayonet bracket for positioning the SMV emblem is provided on the drill. The operator's manual clearly indicates when the emblem is to be used.

GENERAL DESCRIPTION

The John Deere 9350 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 490 L (13.6 bu) grain and 350 kg (770 lb) fertilizer or 340 L (9.5 bu) grain and 500 kg (1100 lb) fertilizer.

Grain is metered by externally fluted feed rolls while fertilizer is metered with externally ridged traction wheels. Flexible rubber hoses deliver both the seed and fertilizer to the openers. Two gangs of 660 mm (26 in) diameter solid press wheels pack the soil directly behind the openers.

The test machine was equipped with an optional hydraulically controlled marker, rock guards and grass seed attachment. Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The John Deere 9350 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

Crop	Soil	Stone Condition	Field Area		Hours
			ha	ac	
Wheat on summerfallow	Oxbow loam	Occasional stones	14	33	10
Rapeseed on summerfallow	Melfort silty clay loam	Stone free	155	384	82
Rapeseed on summerfallow	Naicam loam	Stone free	9	22	4
Barley on barley stubble	Naicam loam	Stone free	18	46	10
Barley on barley stubble	Melfort silty clay loam	Stone free	22	55	11
Grass seed mixture & barley on summerfallow	Oxbow loam	Moderately stony	4	10	3
Total			222	550	120

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 washers on the openers and the setting of the hydraulic lift cylinder. Opener depth was controlled by the position of the depth adjusting collars 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 collar slightly clearing the hydraulically controlled arm. Too much clearance between the arm and the collar resulted in excessive penetration or downward motion of the discs in soft or loose soils.

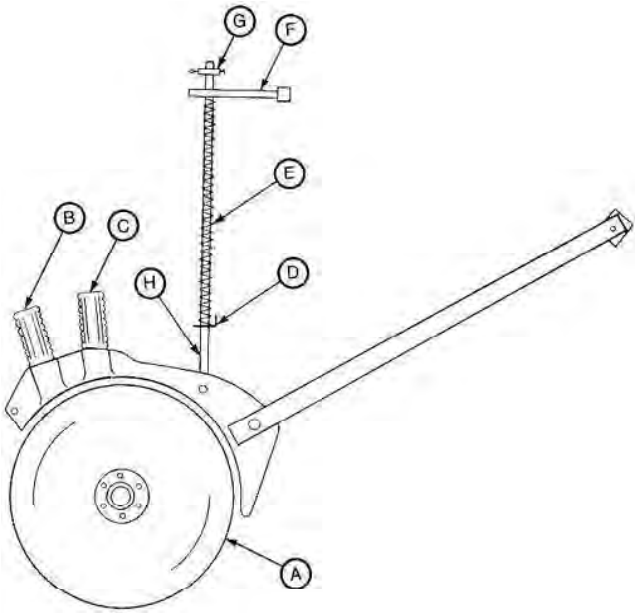


FIGURE 2. Double Disk Opener: (A) disks, (B) fertilizer tubes, (C) grain tubes, (D) pressure adjusting washer, (E) spring, (F) lift arm, (G) depth adjusting collar, (H) pressure rod.

The downward force of each opener could be adjusted from zero up to about 420 N (95 lb). An opener force of about 180 N (40 lb) was suitable for most conditions. The pressure adjusting washers on the openers running in the tractor and castor wheel tracks had to be set from one to two notches higher than on the other openers to get equal penetration in the wheel tracks.

For most fields, opener force and depth could be adequately controlled through the hydraulic lift cylinder, eliminating the need for frequent opener adjustments. Individual openers had to be adjusted only to prevent over-penetration in very soft loose soils or to achieve adequate penetration in heavy or trash covered soils. (FIGURES 3 and 4).

FIGURE 3. Soil Surface after Seeding in Heavy Trash.

FIGURE 4. Soil Surface after Seeding in Light 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 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 6), a lumpy surface was retained after seeding.

FIGURE 5. Soil Surface after Seeding Loose Summerfallow.

Average packing force exerted by each press wheel ranged from 580 N (130 lb) with empty seed and fertilizer boxes, to 735 N (165 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 7 and 8 illustrate emergence in fields of barley and rapeseed.

FIGURE 6. Soil Surface after Seeding Dry Lumpy Summerfallow. (Left: Unseeded, Right: Seeded)

FIGURE 7. Barley Emergence after 17 Days.

FIGURE 8. Rapeseed Emergence after 18 Days.

Metering Accuracy: The grain, fertilizer and optional grass seed metering systems (FIGURE 9) were calibrated in the laboratory using a standard procedure[1] 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, however, shown that small variations in seed or fertilizer application rates will not significantly affect grain crop yields.

Grain Metering System: FIGURES 10 to 13 show calibration curves obtained by PAMI and the manufacturer from the John Deere 9350 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 densities. The seed densities (bushel weights) used by PAMI in the calibration are indicated on the curves. The seed densities used by the manufacturer are not given in the operator's manual and it is therefore recommended that they be included to permit an operator to compare seed densities to determine when field calibrations are necessary.

Level of seed in the grain box, variation in field slope or ground speed did not affect the seeding rate for either large or small seeds. Field roughness did not appreciably affect the seeding rate for large seeds such as wheat, oats, or barley, but severely affected the seeding rate for small seeds such as rapeseed. Field vibration caused the feed rolls to move on the feed shaft. The small amount of free travel of individual feed rolls on the feed shaft was sufficient to cause large variations among seed cups when metering small seeds.

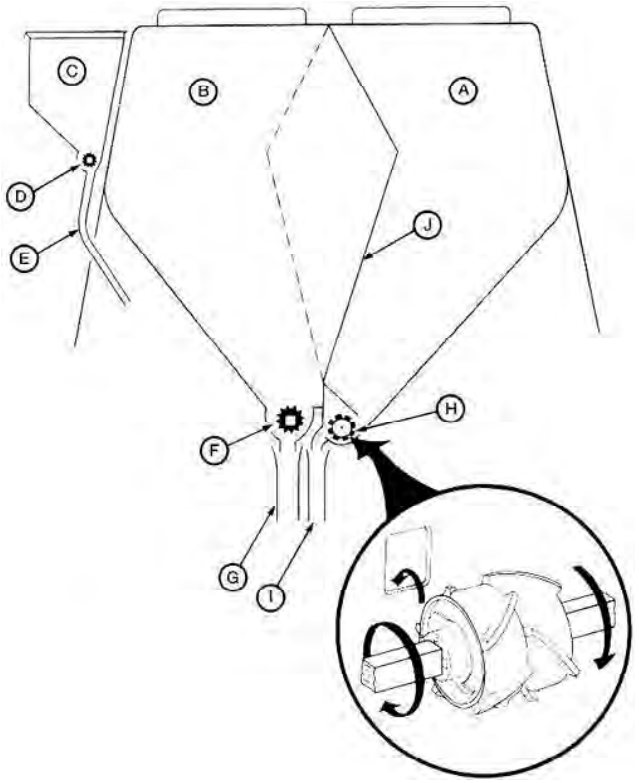


FIGURE 9. Grain, Fertilizer and Optional Grass Seed Metering Systems: (A) fertilizer box, (B) grain box, (C) grass seed box, (D) externally fluted feed roll, (E) grass seed tube, (F) externally fluted feed roll, (G) grain tube, (H) externally ridged traction wheels, (I) fertilizer tube, (J) two-position box partition.

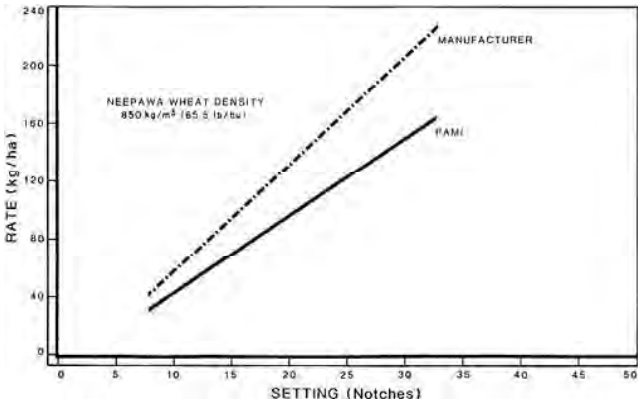


FIGURE 10. Wheat Calibration.

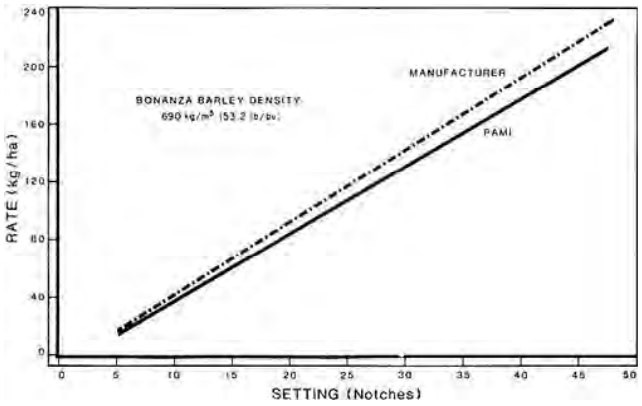


FIGURE 11. Barley Calibration.

The coefficient of variation (CV)[2] is commonly used to describe the variation of application rate among individual seed cups. An

[1]*PAMI T773, Detailed Test Procedure for Grain Drills.*

accepted variation for grain or fertilizer application is a CV value not greater than 15%. If the CV is less than 15%, seeding is quite uniform whereas if the CV is much greater than 15%, the variation among individual seed cups is excessive.

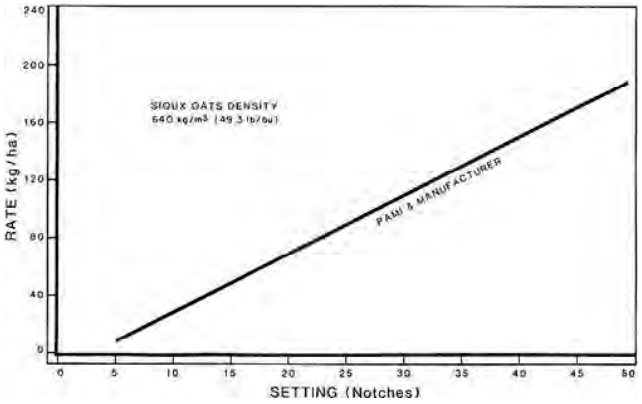


FIGURE 12. Oats Calibration.

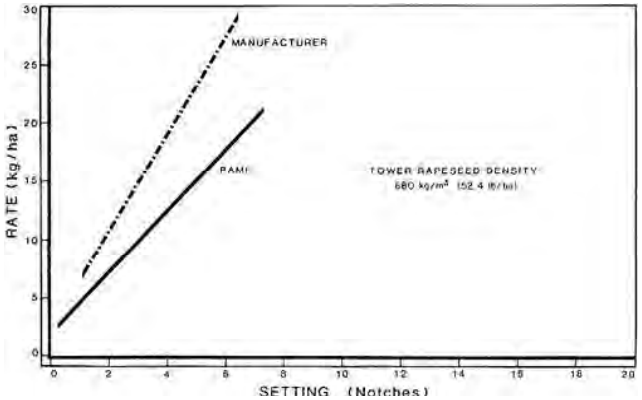


FIGURE 13. Rapeseed Calibration of the Main Grain Box.

For wheat, oats, and barley, seeding was very uniform. For example when seeding wheat at 95 kg/ha (85 lb/ac) the CV was only 2%. When seeding rapeseed at notch number 3, the mean seeding rate was 10 kg/ha (9 lb/ac) with a CV of only 5% when the drill had just been set. When the drill was bounced, corresponding to normal field vibrations, the feed rolls moved toward a closed position reducing the mean seeding rate by 59% to 4.1 kg/ha (3.7 lb/ac) and increasing the CV to 57%. FIGURE 14 shows rapeseed seeding uniformity just after the drill was set while FIGURE 15 shows uniformity of seeding after the feed rolls had moved on the seed shaft due to field vibration.

It is recommended that the manufacturer consider supplying an optional extra slow speed feed 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 1041 kg/m³ (65 lb/ft³). Also included was a table of correction factors for fertilizers with different densities. TABLE 2 shows PAMI calibration results for 23-23-0 fertilizer with a density of 990 kg/m³ (61 lb/ft³) when using the low speed drive. These results agree closely with those in the operator's manual when the suggested correction factors are applied. Application rates for the high speed drive vary from about 80 to 320 kg/ha (70 to 285 lb/ac).

Fertilizer distribution across the width of the drill was very uniform. For example, when distributing 23-23-0 fertilizer at a rate of 36 kg/ha (32 lb/ac), the coefficient of variation among individual feed cups was only 7%.

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 16 shows the variation in fertilizer application rates when seeding uphill, downhill and on level ground with the fertilizer drive set at gear B5 while applying 23-23-0 fertilizer. The application rate varied from 43 kg/ha (39 lb/ac) while seeding up a 15° slope to 70 kg/ha (63 lb/ac) while seeding down a 15° slope. The application rate on level ground was 49 kg/ha (44 lb/ac).

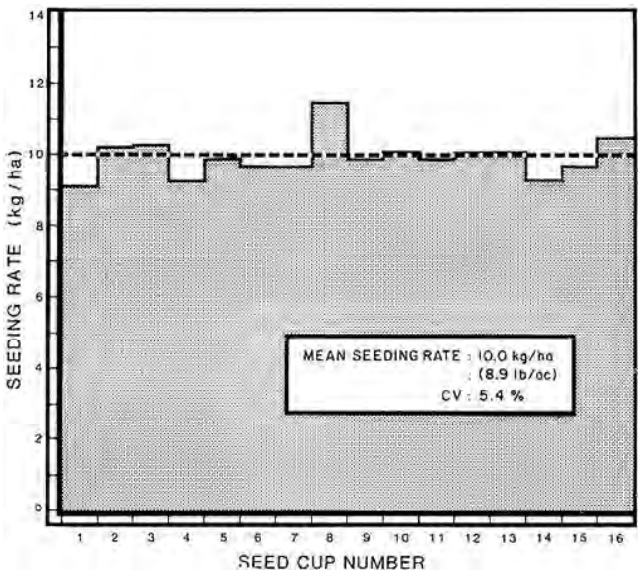


FIGURE 14. Variation in Rapeseed Seeding Rates for Individual Seed Cups Immediately after Setting the Grain Box Seed Shaft at Notch Number 3.

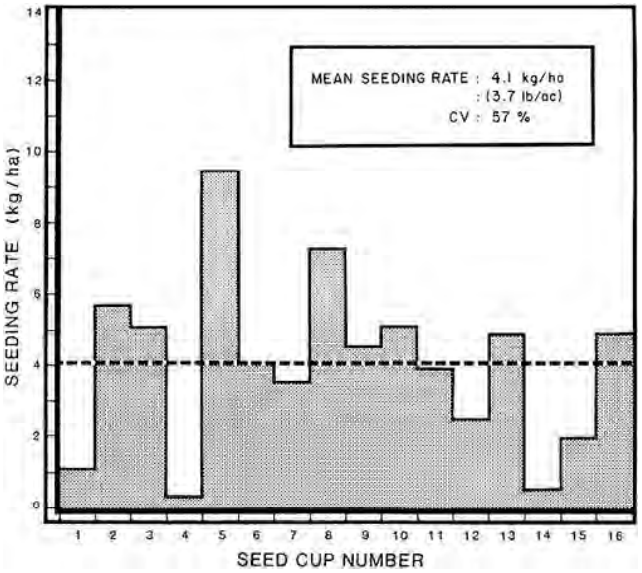


FIGURE 15. Variation in Rapeseed Seeding Rate for Individual Seed Cups, with the Grain Box Seed Shaft Set at Notch Number 3, after Shifting of the Feed rolls due to Field Vibration.

TABLE 2. Fertilizer Application Rates at Various Gearbox Settings with Slow Speed Drive when Applying 23-23-0 Fertilizer with a Density of 990 kg/m³ (61 lb/ft³)

Setting	Application Rate		Setting	Application Rate	
	kg/ha	lb/ac		kg/ha	lb/ac
A1	22.6	20.1	B5	48.9	43.6
B1	23.5	20.9	C4	49.4	44.4
A2	28.6	25.5	D3	50.5	45.0
C1	28.9	25.8	E2	53.7	47.9
B2	30.9	27.5	C5	57.2	51.0
A3	32.1	28.6	D4	57.4	51.2
D1	34.7	30.9	E3	64.3	57.3
C2	35.9	32.0	D5	68.7	61.2
B3	37.0	33.0	E4	71.9	64.1
A4	37.7	33.6	E5	86.4	77.0
C3, A5, B4, D2, E1	42.6	38.0			

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 light seeds such as bromegrass or Russian wild ryegrass. Such grasses can be seeded through the grain box with the addition of the grain agitator attachment or by mixing with the seed heavier

[2]The coefficient of variation (CV) is the standard deviation of application rates from individual seed cups expressed as a percent of the mean application rate.

material such as cracked grain.

FIGURE 17 shows grass seed attachment calibration for alfalfa while FIGURE 18 shows calibration for rapeseed, both with the low speed feed drive. For the high speed drive, seeding rates for each setting have to be doubled.

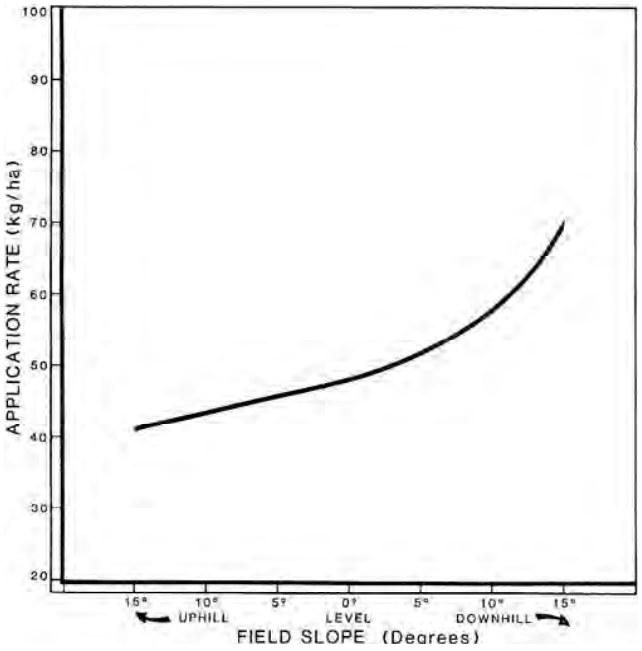


FIGURE 16. Variation in Fertilizer Application Rate with Change in Field Slope While Applying 23-23-0 Fertilizer at B5 Gearbox Setting.

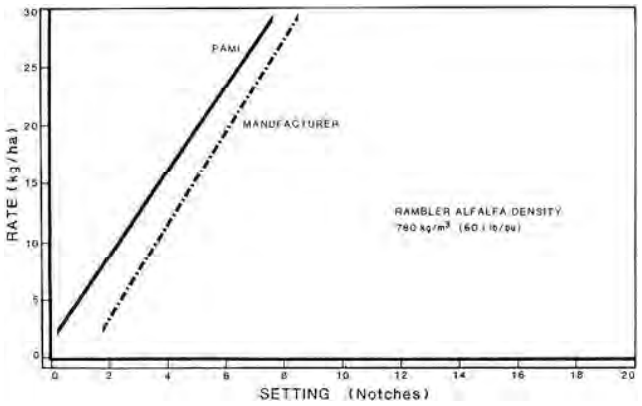


FIGURE 17. Alfalfa Calibration for the Grass Seed Attachment.

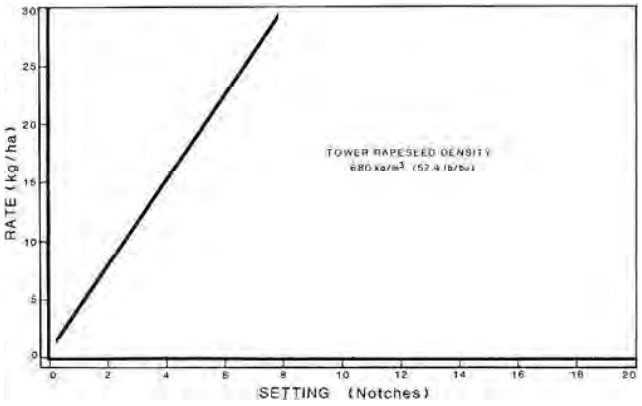


FIGURE 18. Rapeseed Calibration for the Grass Seed Attachment.

Seeding rates were not significantly affected by level of seed in the box, ground speed or field vibration. The grass seed attachment was much more suitable for seeding rapeseed than was the grain box. The accuracy of the grass seeding attachment was much higher with better rate control and lower adjustment sensitivity. The coefficient of variation among seed cups, when seeding rapeseed through the grass seed attachment was only 6% at a seeding rate of 12 kg/ha (10.7 lb/ac) and only 5% at a seeding rate of 17 kg/ha (15 lb/ac).

The grass seed attachment broadcasted the seed on top of the soil directly behind the openers. For rapeseed, it may be more suitable to cut the seed tubes and insert them into the front of the grain box seed cups to permit seeding within the opener furrow.

EASE OF OPERATION

Wet Fields: The optional rock guards effectively prevented mud from plugging the press wheels when seeding through small pot holes or wet depressions. In extremely wet sticky soil, they were only partially effective and occasional press wheel plugging occurred, requiring cleaning with a bar. Soil clung to the press wheels in moist seeding conditions, however, seed was never seen clinging to the press wheels.

Stony Fields: No problems occurred in stony conditions, however, only a small portion of the test was conducted in stony fields (TABLE 1). Overall trip clearance was about 250 mm (10 in) for both the rear and front openers. Opener force at maximum clearance was about 430 N (95 lb). The optional rock guard attachment effectively prevented stones from lodging between the press wheels.

Disk Scrapers: The John Deere 9350 was equipped with adjustable spring loaded disk scrapers. The scrapers effectively prevented mud accumulation on the disks. 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. The operator's manual did not indicate suggested feed gate settings for various seed sizes. It is recommended that suggested feed gate settings be included in the operator's manual.

Marker Attachment: The optional hydraulic marker attachment was effective and convenient to use. The single disk could be adjusted to leave a suitably visible mark, while the length could be adjusted to suit multiple hook-ups of up to three drills.

Filling: The 570 mm (22 in) wide metal walkway at the rear of the drill made filling with grain or fertilizer safe and convenient. Separate lids were used for each hopper. The partition between the grain and fertilizer boxes (FIGURE 9) could be set in two positions to suit application rates, thereby minimizing down time for filling. This permitted carrying 490 L (13.6 bu) of grain and 350 kg (770 lb) of fertilizer or 340 L (9.5 bu) of grain and 500 kg (1100 lb) of fertilizer. Windows in the grain box aided in determining a low grain level providing conditions were not too dusty. The larger grains could be seen as they were metered past the front openings of the grain cups to the openers.

Moisture: The grain and fertilizing boxes were adequately sealed to prevent leakage into the box in the light rains. In heavy rains, water entered the fertilizer box especially at both ends. If the drill is forced to stand out in rain, the fertilizer attachment must be checked before operation to ensure that the feed shaft is free to turn and that fertilizer has not caked.

Cleaning: As with most drills, a vacuum cleaner or compressed air was needed for thorough cleaning of the grain box. The feed gates on each of the seed cups could be opened to aid in cleaning. The fertilizer box was quite easy to clean. The bottom panels on the box could be opened allowing fertilizer to be removed through cleanout holes. The complete feed shaft assembly could easily be removed for thorough cleaning at the end of each season.

Acreage Counter: The acreage counter was accurate to within 4% if the drill was operated at full seeding width. The counter recorded the nearest tenth acre up to 1000 acres. A metric counter was not available.

Transporting: The manufacturer recommends that the drill not be transported at speeds above 16 km/h (10 mph). For multiple hook-ups and long transport distances, the operator should consider using a drill transporter.

EASE OF ADJUSTMENT

Lubrication: Lubrication was easy with good access to the six pressure grease fittings. A grease gun with a flexible hose was needed for three fittings. Three fittings needed greasing every 10 hours while three needed greasing every five hours.

Seeding Rate: The grain seeding rate was easily set. To set the seeding rate the operator's manual stated that the feed shaft be

opened past the desired setting and then the shifter brought back to the desired notch. The feed gates in the individual seed cups were easily set by hand.

Fertilizing Rate: The fertilizer application rate was easily set by shifting the multiple speed gearbox to the appropriate setting.

Opener Adjustments: The openers (FIGURE 2) were convenient to adjust. The pressure adjusting washer could be repositioned without the use of tools, while a cotter pin had to be removed to reposition each depth adjusting collar.

POWER REQUIREMENTS

Maximum draft, with filled grain and fertilizer boxes on level fields with average soil moisture was about 4670 N (1050 lb) while average draft was about 3420 N (770 lb). When considering variation in soil and field conditions, about 18.5 kW (25 hp) of tractor power should be available for each 2440 mm (8 ft) section of drill. In other words, a 75 kW (100 hp) tractor should have sufficient power reserve to operate a multiple hook-up of four drills in most soils at 10 km/h (6 mph).

OPERATOR SAFETY

The John Deere 9350 was safe to operate if normal safety precautions were observed.

The drill was equipped with reflectors but was not equipped with a slow moving vehicle sign. Provincial highway regulations require displaying a slow moving vehicle sign when transporting machinery on public highways.

The metal platform at the rear of the drill was large enough for safe and convenient filling of the grain and fertilizer boxes.

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 recommended feed gate settings for various grain sizes. It also did not include the densities (bushel weights) for the grains presented in the calibration charts. It is recommended that both these items be included in the operator's manual to aid the operator in setting the grain feed rate.

DURABILITY RESULTS

The John Deere 9350 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. No mechanical problems occurred during functional testing.

APPENDIX I
SPECIFICATIONS

MAKE:	John Deere Grain and Fertilizer Drill
MODEL:	9350
SERIAL NO.:	001905
OVERALL DIMENSIONS:	
-- height	1430 mm (56.4 in)
-- length	3460 mm (136.3 in)
-- width	2430 mm (95.7 in)
-- effective seeding width	2438 mm (96 in)
-- transport ground clearance	150 mm (6 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
FERTILIZER METERING SYSTEM:	
-- type	externally ribbed traction feed wheels on horizontal shaft
-- drive	chain and gear drive from press wheels
-- adjustment	multiple speed gearbox controlling feed shaft speed
-- transfer to openers	convoluted rubber hose
GRASS SEED ATTACHMENT (OPTIONAL):	
-- type	externally fluted feed rolls
-- drive	chain from grain box drive shaft
-- adjustment	lever controlling feed roll protrusion
-- seed transfer	rubber tubes broadcasting behind the openers
OPENERS:	
-- type	double disk
-- disk diameter	340 mm (13.5 in)
-- number of openers	16
-- opener spacing	150 mm (6 in)
-- number or rows	2
-- distance between rows	140 mm (5.5 in)
-- options	hoe openers; 180, 250, 305 and 360 mm (7, 10, 12 and 14 in) opener spacing; various opener shovels; disk scrapers
PRESS WHEELS:	
-- type	solid with convex rim
-- diameter	660 mm (26 in)
-- width	45 mm (1.75 in)
-- number	16
-- spacing	150 mm (6 in)
-- number of gangs	2
-- options	concave rim spoked wheels, semi-pneumatic wheels, pneumatic wheels, rock guards
CASTOR WHEELS:	
-- number	1
-- tire size	11L x 14, 4-ply
GRAIN AND FERTILIZER BOX CAPACITIES:	
-- with box partition in position 1	
-grain	490 L (13.6 bu)
-fertilizer	350 kg (770 lb)
-- with box partition in position 2	
-grain	340 L (9.5 bu)
-fertilizer	500 kg (1100 lb)
-- grass seed attachment	40 L (1.1 bu)

WEIGHT:	**boxes empty**	**boxes full**
-- weight on press wheels	923 kg (2030 lb)	1208 kg (2653 lb)
-- weight on castor wheels	400 kg (880 lb)	586 kg (1311 lb)
total weight	1323 kg (2910 lb)	1802 kg (3964 lb)

NUMBER OF CHAIN DRIVES:	5
NUMBER OF LUBRICATION POINTS:	6
NUMBER OF HYDRAULIC LIFTS:	2 (includes lift for marker)
NUMBER OF SEALED BEARINGS:	47
OTHER OPTIONAL ATTACHMENTS:	mechanical power lift; grain box agitator; multiple hitches for two, three or four drills; grain and fertilizer feed stops; markers

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 metres(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)

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