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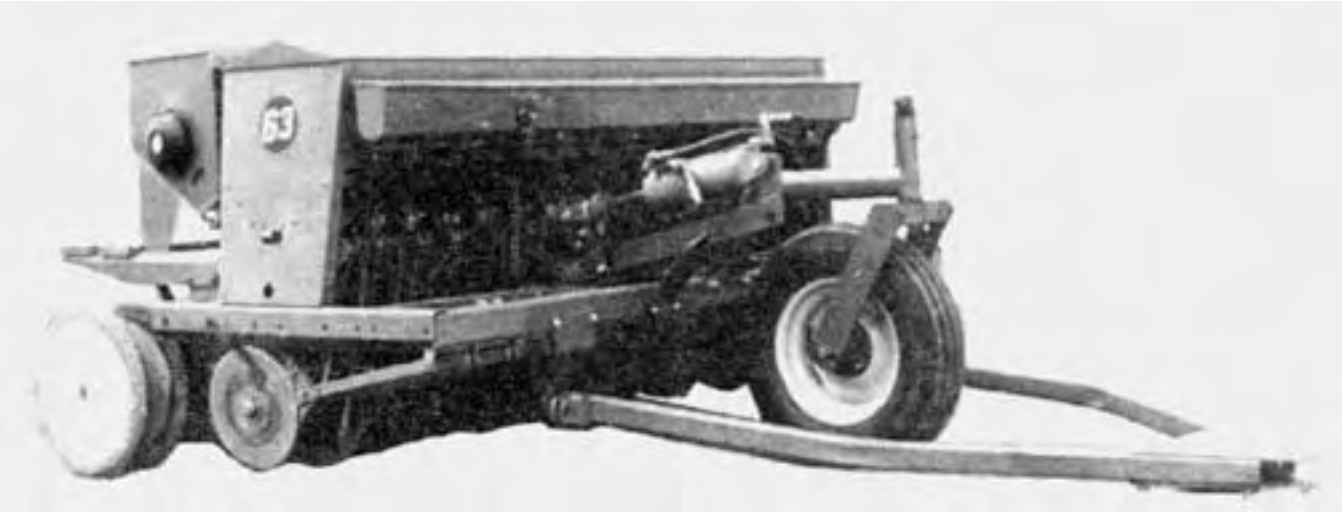
Evaluation Report 42



Massey Ferguson 63 Grain Drill

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

MASSEY FERGUSON 63 GRAIN DRILL

MANUFACTURER AND DISTRIBUTOR:

Massey Ferguson Industries Ltd.
915 King Street West
Toronto, Ontario, Canada
M6K 1E3

DISTRIBUTORS:

Massey Ferguson Industries Ltd.
2330 - 34 South Railway Street
Regina, Saskatchewan
S4P 0B6

2615 Barlow Trail S.E.
Calgary, Alberta
T2C 1G3

RETAIL PRICE:

$3,962.00 (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, grass seeding attachment, and rock guard attachment)

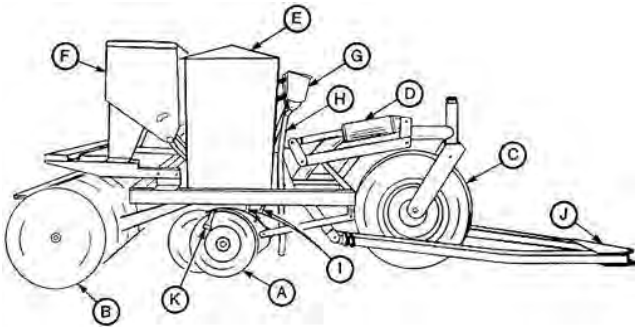


FIGURE 1. Schematic of Massey Ferguson 63: (A) Double Disk Openers, (B) Solid Press Wheels, (C) Castor Wheel, (D) Hydraulic Lift, (E) Grain Box, (F) Melroe 2710 Fertilizer Attachment (See Report No. E2677), (G) Grass Seed Box, (H) Grass Seed Delivery Tubes, (I) Fertilizer and Grain Delivery Tubes, (J) Hitch, (K) Double Disk Scrapers.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Massey Ferguson 63 was 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 number of stones lodging between the press wheels.

Accuracy of the seed metering system was very good in barley, wheat and oats and fair in rapeseed. The minimum seeding rate in rapeseed was 3.0 kg/ha (2.7 lb/ac) and only a limited number of settings were within the common rapeseed seeding range. The rapeseed seeding rate was very sensitive to slight movements of the selection lever. Variation in seeding rates among seed runs was high when seeding small seeds such as rapeseed and insignificant when seeding large seeds such as wheat, oats and barley. Seeding rates in all crops were unaffected by field slope, ground speed or the level of grain in the seed box.

Performance of the grass seeding attachment was fair for small seeds. As is common with such attachments, it was not suited for large, light seeds, such as bromegrass or Russian wild ryegrass. Such crops are usually seeded through the main grain box using an agitator attachment. An agitator was not available with the MF 63. The grass seed attachment was unsuitable for seeding rapeseed as the seed was ground up considerably at the normal seeding rates.

Adjustment of the seed drive and the grass seed attachment were convenient. The seed box and the Melroe fertilizer box were convenient to fill as an adequate walkway was provided. The large grain box lid was flimsy but opened wide for easy filling. Only eight lubrication fittings required greasing.

About 21.0 kW (28 hp) of tractor power should be available for each 2440 mm (8 ft) section of drill. An 85 kW (115 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 good. It contained useful information on adjustment, repair and maintenance. The Massey Ferguson 63 was safe to operate if normal safety precautions were followed.

No major 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. Modifying the disengaging arm of the grain drive to permit seeding at shallower depths.
3. Indicating in the operator's manual the actual seed densities used in the preparation of the calibration tables and supplying metric calibration charts, in addition to the regular charts, to aid operators in metric conversion.
4. Redesigning the transport lock for the double disk openers.
5. Supplying a slow moving vehicle sign to comply with provincial safety regulations

Chief Engineer - E. 0. Nyborg
Senior Engineer - L. G. Smith
Project Engineer - G. E. Frehlich

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. The feasibility of a low speed drive arrangement for seeding rapeseed is being investigated.
2. Modification to parts associated with the disengaging arm of the grain drive to permit seeding at shallower depths is under consideration.
3. Metric seed calibration charts, in addition to charts already supplied, will be provided on 1979 production machines.
4. Improvement to the transport lock will be incorporated in 1979 production.
5. Due to variations in numbers of grain drills hitched together by various means by farmers to transport them on roadways, it is impossible for any manufacturer to know which machine to equip with a slow moving emblem. Also, ASAE Volunteer Standard S276.3 and Provincial Laws state that only one SMV emblem is to be used. It is to be placed on the back of the rear series of machines being transported. The MF-63 Operator's Manual does show usage of SMV in transport mode. No change to current practice is intended.

GENERAL DESCRIPTION

The Massey Ferguson 63 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 grain is metered from the 407 L (11.2 bu) grain box by externally fluted feed rolls through the flexible rubber hoses to the openers. The test machine is equipped with a Melroe Model 2710 fertilizer attachment. Evaluation of the Melroe fertilizer attachment is covered in report No. E2677. Two gangs of 508 mm (20 in) diameter solid press wheels pack the soil directly behind the openers.

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

SCOPE OF TEST

The Massey Ferguson 63 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 seeding system 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 pins and the setting of the hydraulic lift cylinder. When these two adjustments were properly made adequate penetration was obtained with the depth adjustment pin slightly clearing the hydraulically controlled arm. Too much clearance between the arm and the pin resulted in excessive penetration or downward motion of the disks in soft or loose soils.

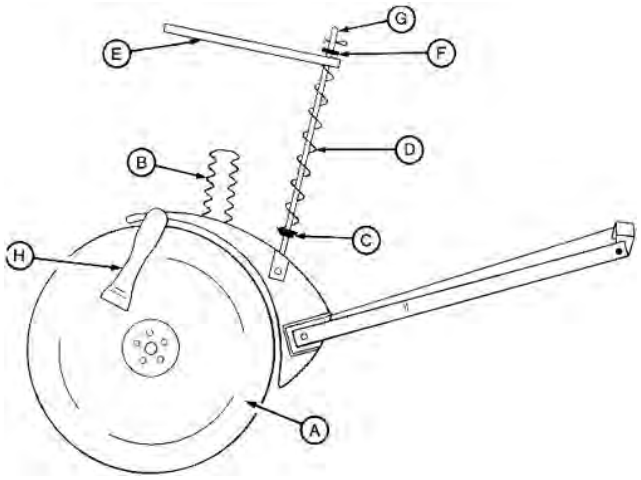


Figure 2. Double Disk Opener: (A) Disks, (B) Grain Tube, (C) Pressure Adjusting Washer, (D) Spring, (E) Lift Arm, (F) Depth Adjusting Washer, (G) Pressure Rod, (H) Exterior Scrapers.

The downward force of each opener could be adjusted from zero up to about 420 N (95 lb) for the front row of openers and up to 355 N (80 lb) for the back row. 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.

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 significantly affected by ground speed. Seed coverage was reduced in moist heavy soils due to decreased penetration and soil flow. Seeds 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.

FIGURE 3. Soil Surface after Seeding in Trash.

FIGURE 4. Soil Surface after Seeding Loose Summerfallow.

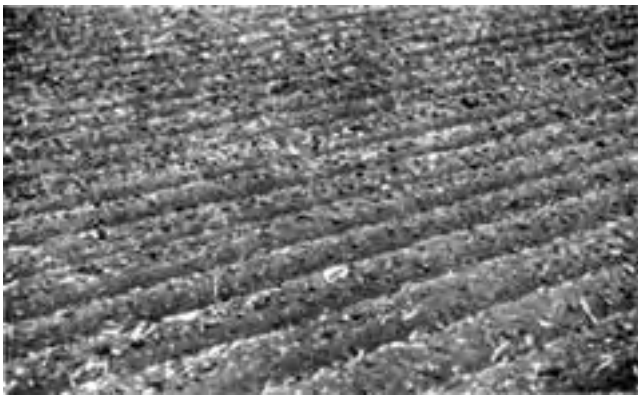


FIGURE 5. Soil Surface after Seeding Dry Lumpy Summerfaliow. (Top: Seeded Bottom: Unseeded).

Average packing force exerted by each press wheel ranged from 410 N (92 lb) with empty seed and fertilizer boxes, to 665 N (150 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. FIGURE 6 and 7 illustrate emergence in fields of barley and rapeseed.

Metering Accuracy: The grain and optional grass seed metering systems (FIGURE 8) 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, it is not possible for a manufacturer to present charts to include all the variations of seed used. Field calibration checks may be necessary for seed with properties differing from those indicated in the manufacturer's tables. Research has, however, shown that small variations in seeding rates will not significantly affect grain crop yields.

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

FIGURE 6. Barley Emergence after 17 days.

FIGURE 7. Rapeseed Emergence after 18 days.

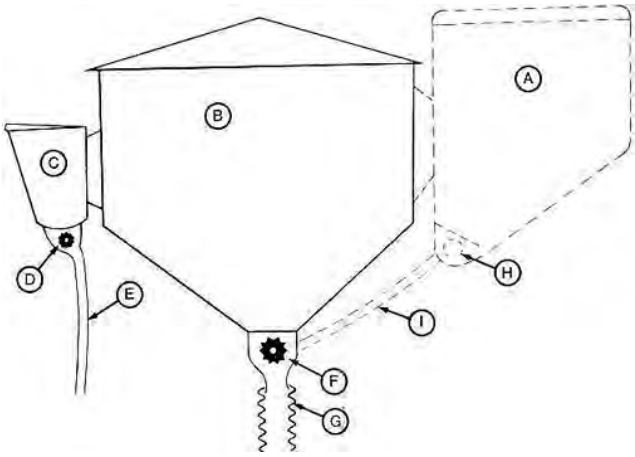


FIGURE 8. Grain, Fertilizer and Optional Grass Metering Systems: (A) Melroe Fertilizer Box (See Report No. E2677), (B) Grain Box, (C) Grass Seed Box, (D) Externally Fluted Feed Roll, (E) Grass Seed Tube, (F) Externally Fluted Feed Roll, (G) Combined Grain and Fertilizer Tube, (H) Feed Shaft, (I) Fertilizer Tube.

Grain Metering System: FIGURES 9 to 12 show calibration curves by PAMI and the manufacturer for the Massey Ferguson 63 in wheat, barley, oats and rapeseed. The difference 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 manufacturer indicated that standard U.S. seed densities were used in their calibration but these densities were not given in the operator's manual. 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, field vibrations and variation in ground speed did not affect the seeding rate for either large or small seeds. Variations in field slope did not affect the seeding rate for small seeds but affected the seeding rate for larger seeds only when the optional grain run shields were used. The manufacturer had specified using the grain shields for only the very small seeds.

The coefficient of variation (CV)[2] is commonly used to describe 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 quite uniform whereas if the CV is much greater than 15%, the variation among individual seed cups is excessive.

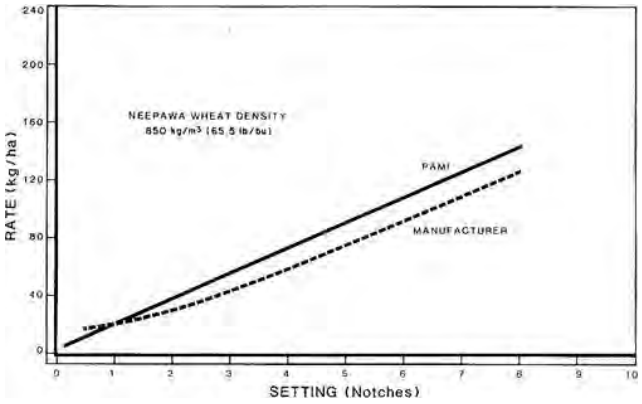


FIGURE 9. Wheat Calibration.

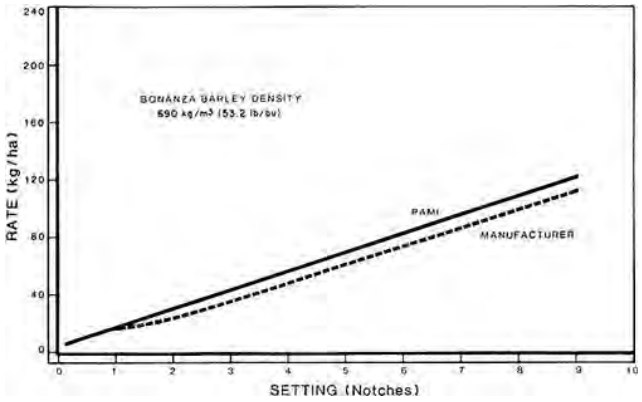


FIGURE 10. Barley Calibration.

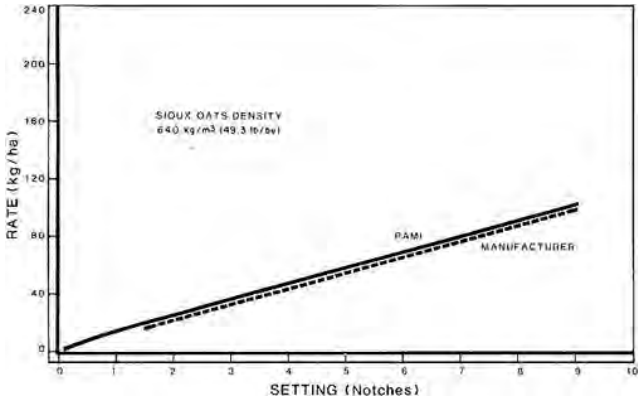


FIGURE 11. Oats Calibration.

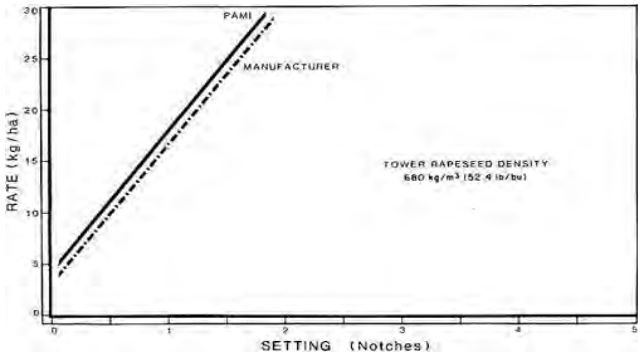


FIGURE 12. Rapeseed Calibration of the Main Grain Box.

[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.

For wheat, oats and barley, seeding was very uniform. For example when seeding wheat at 75 kg/ha (67 lb/ac) the CV was only 4%. When seeding rapeseed the variation among the seed cups was high and slightly beyond the suggested limit. At a rapeseed seeding rate of 12 kg/ha (10.7 lb/ac) the CV was 17%.

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.

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 by mixing with the seed heavier material such as cracked grain. FIGURE 13 shows grass seed attachment calibration for alfalfa while FIGURE 14 shows the calibration for rapeseed.

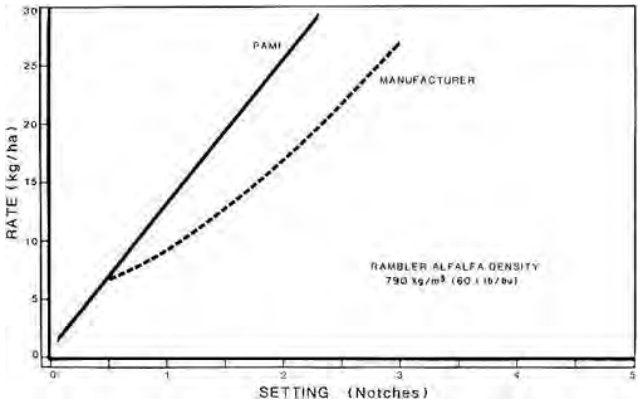


FIGURE 13. Alfalfa Calibration for the Grass Seed Attachment.

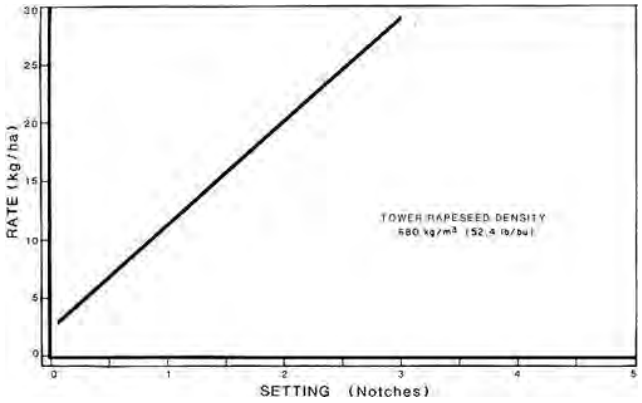


FIGURE 14. Rapeseed Calibration for the Grass Seed Attachment.

The seeding rates were not significantly affected by the level of seed in the box, ground speed or field vibrations. The grass seeding attachment excessively ground the rapeseed at the seed rate settings normally used. However, the accuracy of the grass seed attachment was higher with better rate control and a lower adjustment sensitivity. The coefficient of variation among seed cups when seeding rapeseed through the grass seed attachment was 11% at a seeding rate of 9.9 kg/ha (8.8 lb/ac) and 8% at a rate of 22 kg/ha (19 lb/ac).

The grass seed attachment broadcasted the seed on top of the soil in front of the openers. To obtain better soil coverage of the seeds it may be more suitable to insert the grass seed tubes into the openers along with the grain tubes from the main box.

EASE OF OPERATION

Wet Fields: The optional rock guards effectively prevented mud from plugging the press wheels when seeding through small potholes 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, but 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 ranged from 165 to 190 mm (6.5 to 7.5 in) for the front row of openers and 114 to 165 mm (4.5 to 6.5 in) for the back row of openers. The optional rock guard attachment effectively prevented stones from lodging between the press wheels.

Disk Scrapers: The Massey Ferguson 63 was equipped with inner and outer disk scrapers. The spring loaded inner scrapers required no adjustment and effectively prevented mud accumulation. The outer scrapers were difficult to maintain in a working position and they were easily bent which occasionally prevented disk rotation. The outside scrapers should be placed in working position only when required. The disks turned freely in all soils except the dry loose soils that had been pre-worked too deeply.

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 320 mm (12.5 in) wide walkway at the rear of the drill made filling of the grain box and the Melroe fertilizer box safe and convenient. If a fertilizer attachment was not mounted, the width of the walkway could be increased by adding more footboards. The grain box lid was large and flimsy and several times it came off its hinges. The windows on the grain box aided in determining a low grain level providing conditions were not too dusty.

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.

Acreage Counter: The acreage counter was accurate to within 3% if the drill was operated at full seeding width. The counter recorded to the nearest tenth acre and up to 1,000 acres. A metric counter was not available.

Transporting: A maximum transporting speed was not recommended by the manufacturer. An acceptable maximum for grain drills equipped with press wheels is a speed of 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 fair access to the pressure grease fittings. A grease gun with a flexible hose was needed for five fittings. All eight fittings required greasing daily or every 4 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 position and then the pointer brought back to the desired setting. The feed gates in the individual seed cups were easily set by hand.

Opener Adjustments: The openers (FIGURE 2) were difficult to adjust. The depth adjusting pin and the pressure adjusting washer and pin required tools to be repositioned.

POWER REQUIREMENTS

Maximum draft with filled grain and fertilizer boxes on level fields with average soil moisture was about 4630 N (1040 lb) while average draft under these conditions was about 4030 N (905 lb). When considering variations in soil and field conditions, about 21.0 kW (28 hp) of tractor power should be available for each 2.44 m (8 ft) section of drill. In other words, an 85 kW (115 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 Massey Ferguson 63 was safe to operate if normal safety precautions were observed.

The drill 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 wooden 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 for the Massey Ferguson 63 contained useful information on adjustments, repair and maintenance. The manual was brief regarding opener adjustments and the initial

adjustment of the seedcups. A pictorial indication of the lubrication points was not given and an error was observed on PAGE 5 regarding the location of the lock pin for transporting. The manual did not include the densities (bushel weights) for the grains presented in the calibration charts. It is recommended that the densities be included in the operator's manual to aid the operator in setting the grain feed.

DURABILITY RESULTS

The Massey Ferguson 63 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 failures that occurred during functional testing.

TABLE 2. Mechanical History

Item	Hours	Field Area ha	(ac)
A stop on the disengaging mechanism of the main feed drive did not permit full engagement of the drive when operating at a shallow depth. The stop was repositioned at	36	64	(159)
The opener depth adjustment pin broke and was replaced at	44	84	(207)
The latch on the grain box lid came loose and was retightened at	96	173	(427)
The acreage counter arm failed to spring back and the counter was replaced at	100	180	(448)
A cotter pin from the grain box supporting bracket fell out and was replaced at	116	220	(545)
The steel edge of the transport lock was worn off by the pin and rebuilt at	116	220	(545)
The idler gear in the main drive to the feed shaft vibrated loose and was replaced at	118	223	(550)
Several double disks came loose and were tightened at	End of Test		

DISCUSSION OF MECHANICAL PROBLEMS

Disengaging Arm on Feed Drive Clutch Assembly: The stop on the arm of the disengaging mechanism (FIGURE 15) was repositioned when the drive gears failed to mesh when seeding at shallow depths. It is recommended that the manufacturer reposition this stop on the disengaging arm.

FIGURE 15. Disengaging Rod and Stop for Clutch Assembly.

Transport Lock: The bolt used to lock the double disks in a raised position for transporting wore off the edge of the frame counterpart. The edge required rebuilding (FIGURE 16). It is recommended that the manufacturer increase the size of the frame counterpart to prevent transport lock failures.

FIGURE 16. Buildup Required for Transport Lock.

APPENDIX I
SPECIFICATIONS:

MAKE:	Massey Ferguson Grain Drill
MODEL:	63
SERIAL NO:	1478 802024
OVERALL DIMENSIONS:	
-- height	1245 mm (49 in)
-- length	3505 mm (138 in)
-- width	2410 mm (95 in)
-- effective seeding width	2438 mm (96 in)
-- transport ground clearance	114 mm (4.5 in)
SEEDING METERING SYSTEMS:	
-- 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	grain run shield kit
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 in front of openers.
OPENERS:	
-- type	double disk
-- disk diameter	340 mm (13.5 in)
-- number of openers	16
-- opener spacing	150 mm (6 in)
-- number of rows	2
-- distance between rows	114 mm (4.5 in)
-- options	disk scrapers
PRESS WHEELS:	
-- type	solid with convex rim
-- diameter	508 mm (20 in)
-- width	45 mm (1.75 in)
-- number	16
-- spacing	150 mm (6 in)
-- number of gangs	2
-- options	steel spoked wheels, semi-pneumatic spoked wheels
CASTOR WHEELS:	
-- number	1
-- tire size	6.70 x 15, 4-ply
GRAIN BOX CAPACITIES:	
-- grain box	407 L (11.2 bu)
-- grass seed attachment	29 L (0.8 bu)

WEIGHT:(includes Melroe fertilizer attachment)

	boxes empty	**boxes full**
-- weight on press wheels	664 kg (1420 lb)	1098 kg (2415 lb)
-- weight on castor wheels	252 kg (555 lb)	473 kg (1040 lb)
total weight	916 kg (2015 lb)	1571 kg (3455 lb)

NUMBER OF CHAIN DRIVES:	2
NUMBER OF LUBRICATION POINTS:	8
NUMBER OF HYDRAULIC LIFTS:	1
NUMBER OF SEALED BEARINGS:	34
OTHER OPTIONAL ATTACHMENTS:	mechanical power lift; packer hitch; multiple hitches for two or three drills, transport hitch, 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 metre (m) = 1000 millimetre (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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