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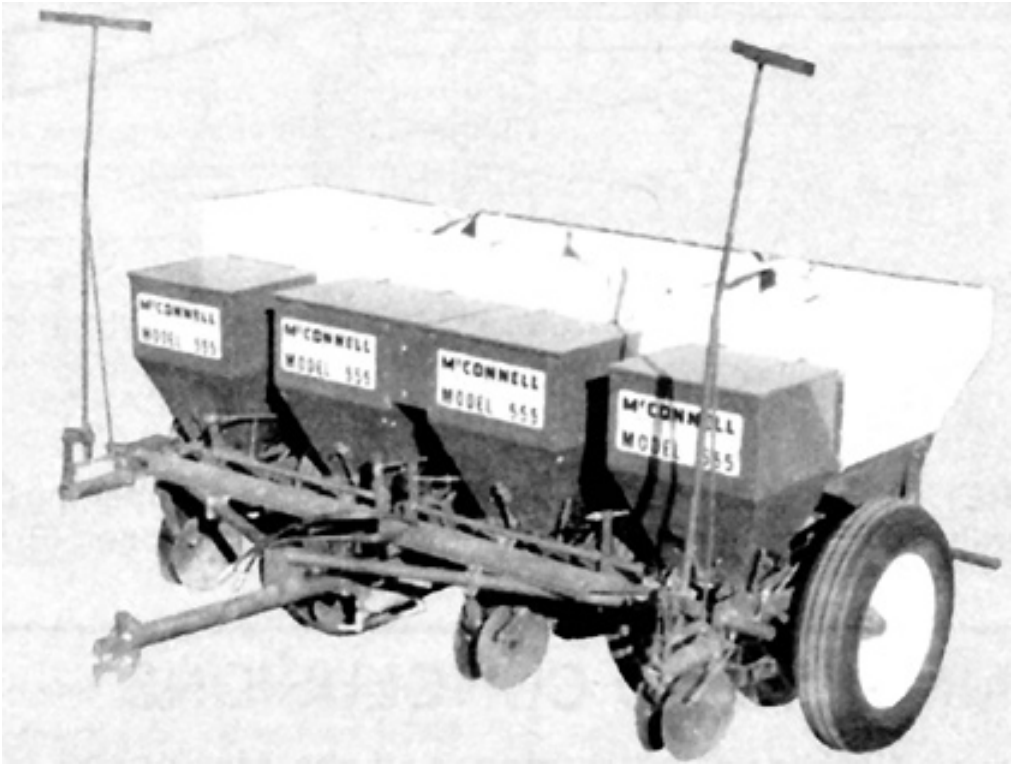
Evaluation Report 56



McConnell Model 555 Potato Planter

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

McCONNELL MODEL 555 POTATO PLANTER

MANUFACTURER:

McConnell Manufacturing Co., Inc.
Prattsburg, New York 14873
U.S.A.

DISTRIBUTOR:

McConnell Manufacturing Co., Inc.
Grand Forks, North Dakota
58201 U.S.A.

RETAIL PRICE:

$11,129.20 (March, 1977, f.o.b. Grand Forks, North Dakota, U.S.A. with cam rollers, 9:00 x 24 tires, lubrication bank system, row marker poles, seed hopper extensions, 16" opening and covering disks and foot operated throwout clutch)

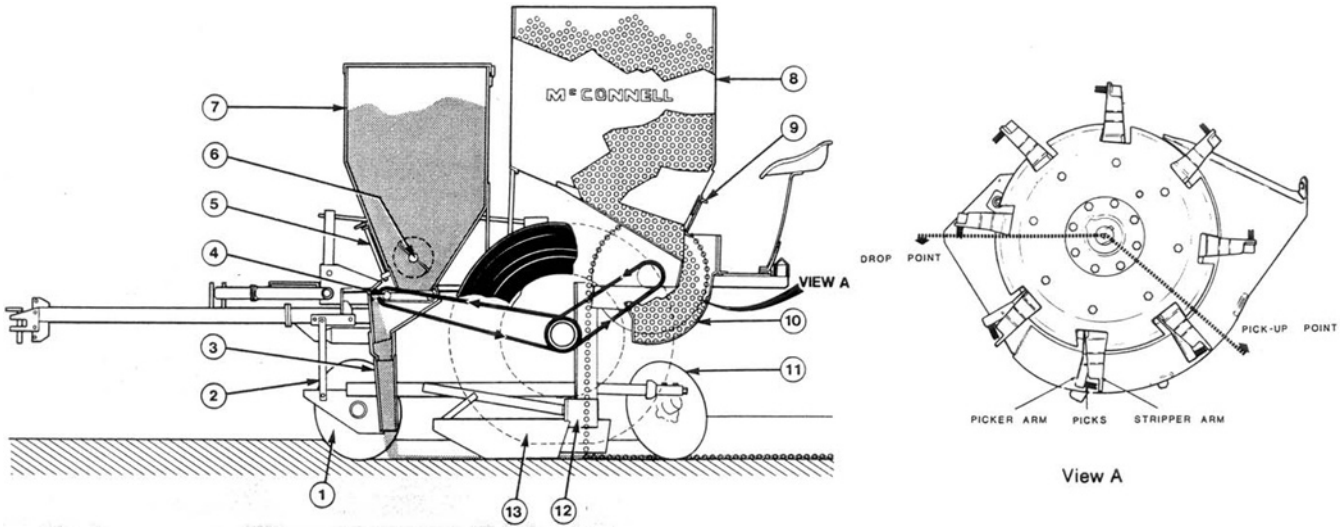


FIGURE1. Schematic of McConnell Potato Planter: (1) Opening Disk, (2) Adjustable Linkage, (3) Fertilizer Feed Hose, (4) Fertilizer Feed Belt, (5) Fertilizer Gate, (6) Fertilizer Agitator, (7) Fertilizer Hopper, (8) Seed Hopper, (9) Seed Gate, (10) Picker Bowl, (11) Closing Disk, (12) Seed Chute, (13) Planting Shoe.

SUMMARY AND CONCLUSIONS

Overall functional performance of the McConnell Model 555 potato planter was *very good.*

The seed metering system was *very good,* which resulted in few misses or doubles. Seed spacing was *good.* When set at a nominal spacing of 460 mm (18 in), 82% of the seed was spaced between 180 and 760 mm (7 and 30 in) with an average spacing of 465 mm (18 in). The coefficient of variation of single seed spacing was 31% at a speed of 8.6 km/h (5.3 mph). Acceptable seed spacing occured at all speeds between 3 and 10 km/h (2 and 6 mph). Control of seeding depth was *very good.* Seed pieces were placed within 12 mm (0.5 in) of the desired depth. The closing disks were adjustable to produce very good hills with a uniform soil cover in all the soil conditions encountered.

Performance of the fertilizer metering system was *good.* Performance was red uced by the lack of available adjustment for low fertilizing rates. The application rate was not affected by field roughness, field slope, ground speed or fertilizer level in the hoppers. Fertilizer placement was *good,* with bands placed 50 mm (2 in) to each side of the seed. Opening disk adjustment was sufficient to permit the fertilizer bands to be placed below the seed level in all the soils encountered. No fertilizer calibration chart was supplied which necessitated calibrating the system.

Both the fertilizer and seed systems were convenient to adjust, service and operate. An adequate walkway was supplied for filling of the fertilizer hoppers but the seed hopper walkway was inadequate. No access holes were provided in the seed hoppers to enable the planter operator to break seed bridging.

A 85 kW (87 hp) tractor was adequate to operate the McConnell 555 in most soils at speeds up to 12 km/h (8 mph).

The operator's manual was *good,* and contained instructions on operation, adjustment, maintenance and safety. The McConnell was safe to operate if normal safety procedures were followed.

No major durability problems occurred during the test, although several minor problems occurred with the picker arms, hydraulic raising linkage and row markers.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying the hydraulic raising linkage to eliminate bending.
2. Providing seed hopper access holes to aid the operator in breaking seed bridging.
3. Modifying the seed hopper extension to remove the pinch points.
4. Modifying the row markers to eliminate bending of the booms during operation, extending the booms for marking 1100 mm rows on centre and improving the ease of operation of the row markers.
5. Supplying fertilizer calibration charts for fertilizer types commonly used in the prairie provinces and providing for lower application rates.
6. Modifying the rear walkway to improve safety and ease of use.
7. Modifying the vibrating chutes to eliminate jamming of seed in the vibrating mechanism.
8. Supplying a slow moving vehicle sign as standard equipment.

Chief Engineer -- E.O. Nyborg
Senior Engineer -- J.C. Thauberger
Project Engineer -- R.J. Van Kleeck

THE MANUFACTURER STATES THAT:

With regard to recommendation number:

1. The hydraulic raising linkage problem has been eliminated by using a longer linkage with the large tires.
2. This is under active consideration.
3. We are conducting tests to develop an improved design.
4. An all new hydraulic marker is now available for the 1978 season.
5. Fertilizer calibration charts, for lower application rates, are now available.
6. Redesigned prototypes are now in the field.
7. This is under active consideration.
8. This is under active consideration.

GENERAL DESCRIPTION

The McConnell Model 555 (FIGURE 1) is a four row, pull-type pick potato planter. The main frame is fabricated in three sections and is supported by four wheels. It is designed for use with an operator seated on the rear of the planter, in addition to the tractor driver..

The McConnell is equipped with a 1900 L (67 ft^3) seed hopper placed above four picker bowls. A picker wheel assembly, containing 16 cam-activated picker arms, is located in each picker bowl. Steel picks on each picker arm pierce the seed, carry it out of the picker bowls and drop it through seed chutes into furrows formed by the planting shoes. Seed spacing can be varied by changing drive sprockets while seed depth is controlled by adjustable linkages and a hydraulic cylinder. Two covering disks form soil hills over each seed row.

Fertilizer hoppers are provided for each row. Fertilizer is metered from the hoppers with feed belts. The application rate can be varied either with the adjustable gates or by changing feed belt drive sprockets. Flexible hoses deliver the fertilizer to opening disks on each side of each seed row. Fertilizer placement depth is controlled by an adjustable linkage.

The machine tested was also equipped with optional, manual, row markers and a foot operated throwout clutch.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The McConnell was operated in the conditions shown in TABLE 1 for 120 hours while seeding about 190 ha (470 ac). It was evaluated for rate of work, quality of work, ease of adjustment, power requirements, operator safety and suitability of the operator's manual. In addition, the fertilizer system was calibrated in the laboratory.

TABLE 1. Operating Conditions

SOIL TEXTURE	FIELD AREA ha	(ac)	HOURS
Very fine sandy loam	85	(210)	48
Light loam	40	(100)	34
Loamy sand	65	(160)	38
TOTAL	190	(470)	120

All seed placement trials[1] were performed with cut Netted Gem seed of about 40 g (0.1 lb) average size planted at a nominal spacing of 460 mm (18 in).

RESULTS AND DISCUSSION

RATE OF WORK

Average planting rates obtained with the McConnell in loamy sand were about 2 ha/h (5 ac/h). Maximum planting rates of about 3.5 ha/h (9 ac/h) were obtained. Maximum planting rates did not include the time required to fill the fertilizer and seed hoppers.

QUALITY OF WORK

Seed Placement: Uniformity of seeding depth was very good. Deviations of less than 12 mm (0.5 in) from the desired depth resulted for planting speeds from 3 to 10 km/h (2 to 6 mph).

Seed spacing in the rows was good. TABLE 2 shows seed placement uniformity. When planting at 8.6 km/h (5.3 mph) in level loamy sand, with the planter at a nominal 460 mm (18 in) setting, eighty-two percent of the seed was spaced between 180 and 760 mm (7 and 30 in). Average spacing of single seeds was 465 mm (18 in) with a coefficient of variation[2] (CV) of 31%. It is commonly accepted that for acceptable seed spacing uniformity, the CV should be less than 40%. CV values below 40% resulted at all speeds between 5 and 12 km/h (3 and 7 mph). The most uniform spacing occurred at 8 km/h (5 mph).

Seed spacing increased slightly with an increase in speed. Average spacing increased from 440 to 470 mm (17 to 19 in) when the planting speed was increased from 3 to 10 km/h (2 to 6 mph).

[1]PAMI T7714-R78, Detailed Test Procedure for Potato Planters

TABLE 2. Seed Placement

UNIFORMITY OF PLACEMENT	PERCENT OF TOTAL SEED
Single seed	82
Double seed	8
Missed seed	9
Double missed seed	1
TOTAL	100%

Fertilizer Placement: Fertilizer placement was good for planting speeds from 3 to 10 km/h (2 to 6 mph). The chemical was placed in bands on either side and slightly below the seed. At slow speeds the bands were compact and well defined. As speed was increased, the fertilizer bands became less clearly defined.

Fertilizer Metering System: FIGURE 2 shows PAMI calibration results for 16-20-0 fertilizer with a density of 1010 kg/m^3 (63 lb/ft^3). No calibration tables were presented in the operator's manual. The minimum application rate was 600 kg/ha (670 lb/ac). It is recommended that the manufacturer modify the fertilizer applicator to provide adjustments for application rates down to 200 kg/ha (220 lb/ac) and supply suitable fertilizer application rate tables.

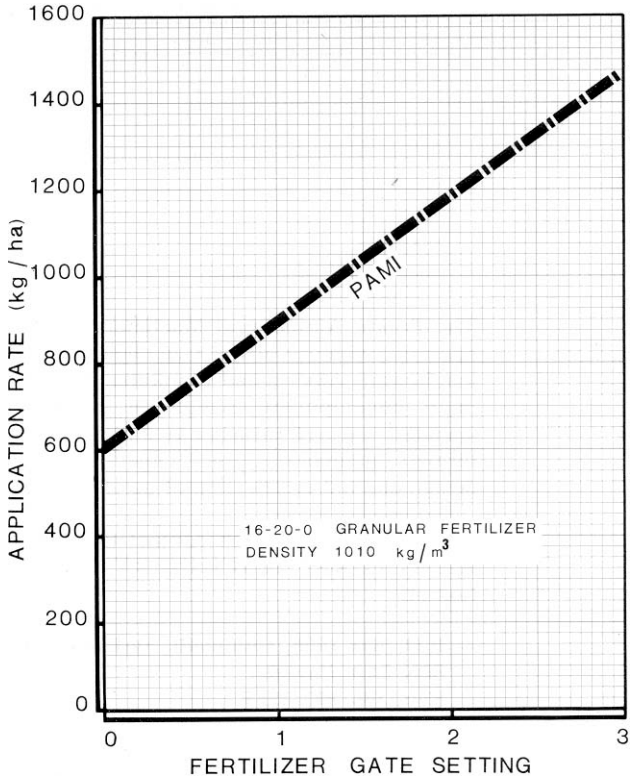


FIGURE 2. Calibration of Fertilizer Metering System.

The fertilizer application rate was not significantly affected by the fertilizer level in the hopper, ground speed, sloping terrain or field roughness.

Hill Formation: Very good hills were produced over the seed in all cases. Hills were uniform in size for all planting speeds from 3 to 10 km/h (2 to 6 mph).

Flotation: The McConnell was equipped with four support wheels, which provided good flotation in soft soil. The wheels operated between the rows and did not cause undue soil compaction of the hills.

EASE OF OPERATION

Row Markers: The optional, manual row markers were effective but inconvenient to use. The boom length was inadequate to mark the centre of the next pass for 900 mm (36 in) row spacing and the booms frequently bent during operation. It is recom-

[2]The coefficient of variation is the standard deviation of seed spacing, expressed as a percent of the mean seed spacing. It is a measure of seed spacing uniformity.

mended that modifications be provided to eliminate bending of the row marker booms and to allow marking of the center line of the next pass for row spacing up to 1070 mm (42 in) and to improve the ease of operation.

Hopper Filling: The metal walkway at the front of the planter made filling of the fertilizer hoppers safe and convenient. Separate lids were supplied for each of the fertilizer hoppers. The seed hopper was easy to fill. The rear walkway was inconvenient to use, due to the narrow metal walkway which was only 235 mm (9 in) wide. As well, two gaps were present in the walkway which could permit an operator to lose footing (FIGURE 3). It is recommended that the manufacturer modify the rear walkway to improve ease and safety of use.

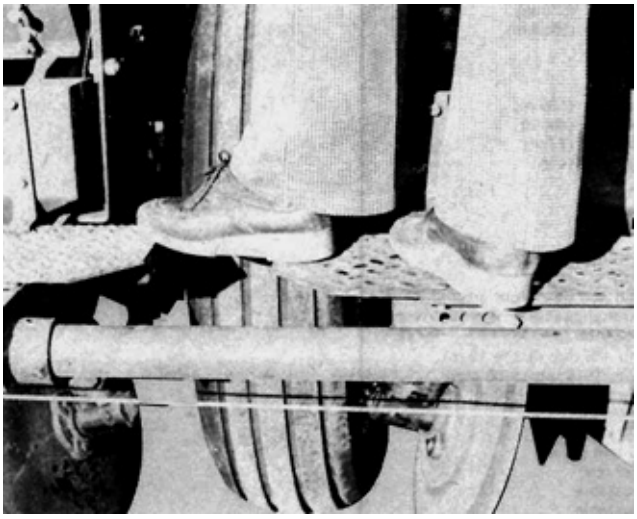


FIGURE 3. Narrow Rear Walkway.

Planting: It was easy for the planter operator to monitor seed flow. With the fertilizer feed belt covers removed, the tractor operator could monitor fertilizer application. It was difficult for the planter operator to break seed bridging in the seed hoppers as no access holes were provided. Holes had to be cut into the hopper (FIGURE 4). It is recommended that the manufacturer provide appropriate openings for breaking seed bridging.

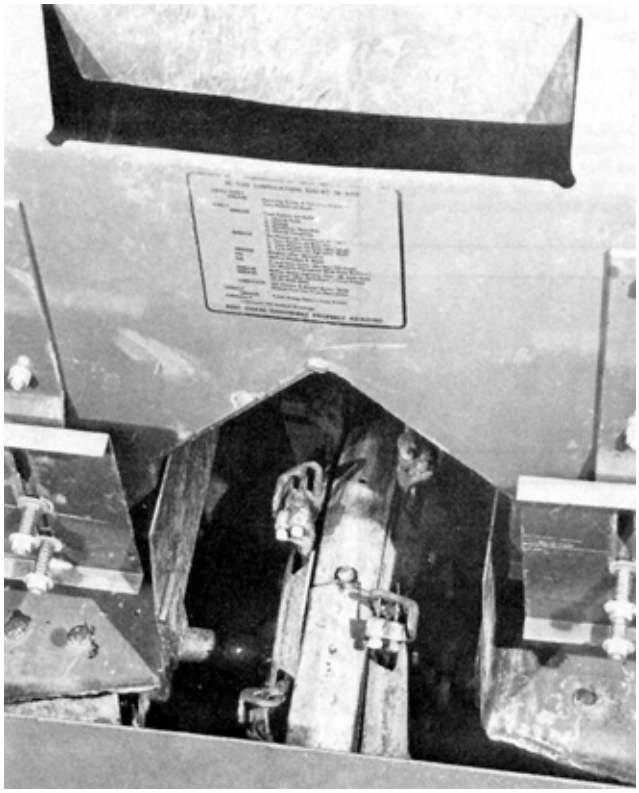


FIGURE 4. Access Holes Cut in the Seed Hopper.

Seed occasionally jammed between the lower chute lips and the picker chamber walls preventing proper shaking action of the Vibrating chutes. When this occurred, the seed did not flow smoothly into the picking chambers. The protruding lips were removed from the lower part of the vibrating chutes which eliminated this problem (FIGURE 5).

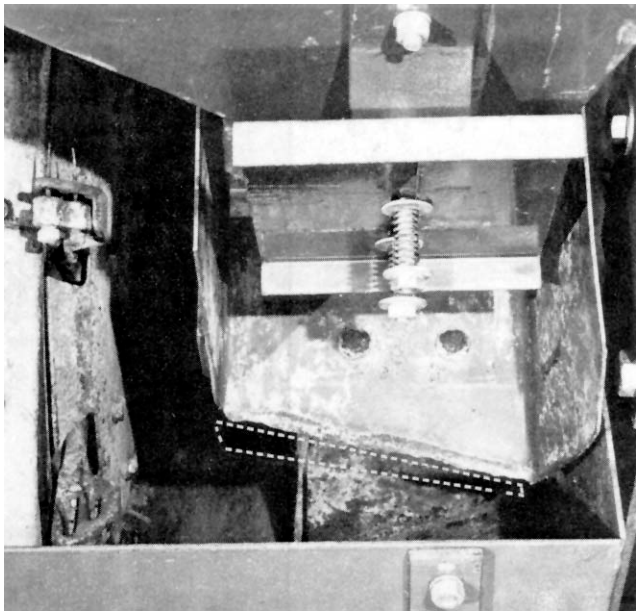


FIGURE 5. Modifications to Vibrating Chutes to Eliminate Jamming of Vibrating Mechanisms.

When the machine had to be raised from the planting position, the hydraulic linkage frequently went over centre, causing damage. This had to be carefully watched whenever the planter was raised. Despite operator awareness of this problem the linkage had to be removed and straightened several times (FIGURE 6). It is recommended that the manufacturer modify the raising linkage to eliminate this problem.

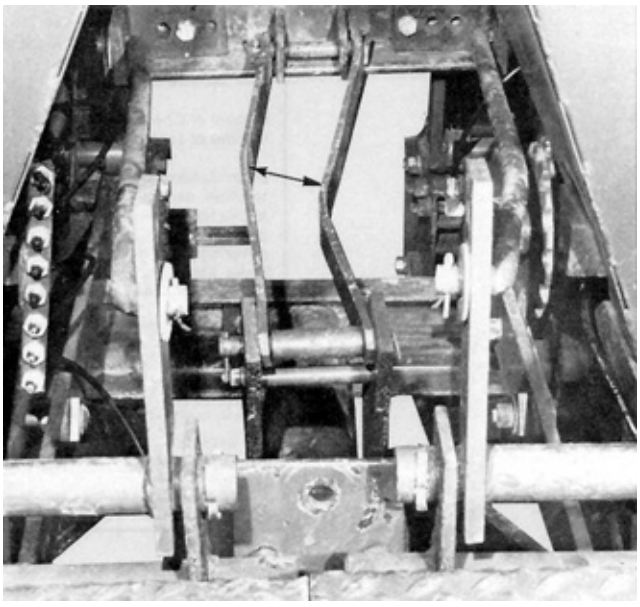


FIGURE 6. Link Damage Due to Hydraulic Linkage Dropping Over Center.

Moisture: The fertilizer hoppers were adequately sealed to prevent leakage into the hoppers during normal rains. In heavy rain, however, water leaked around the fertilizer feed belt covers. If the planter was left to stand in the rain with loaded fertilizer hoppers, the fertilizer belts and feed hoses had to be checked for fertilizer caking before operation.

Cleaning: As with similar machines, a pressure washer was best for thorough cleaning. The seed hopper could be tilted back-

wards for seed removal and cleaning of the seed hopper and picker bowls. Removal of the drive chain allowed the fertilizer hoppers to be tilted forward to permit more convenient fertilizer removal and cleaning of the hoppers and feed belts.

Hitching: The McConnell was relatively easy to hitch to the tractor. The unloaded hitch weight of 168 kg (370 lb) made it necessary to use a suitable hitch jack.

Transportation: The McConnell transporfed well at speeds up to 13 km/h (8 mph). Higher speeds resulted in excessive bouncing of the outer two planter units.

EASE OF ADJUSTMENT

Seed Spacing: Seed spacing was adjusted by varying the picker wheel and axle drive sprockets. Sprockets were accessible and easy to change. Nominal seed spacings of 85 mm to 475 mm (3 to 19 in) were possible with the standard sprockets supplied by the manufacturer.

Seed Depth: Adjustment of the planting depth was easy. The main adjustment was through an adjustable linkage. Final field operating control was provided through the tractor hydraulics.

Fertilizer Placement: The level of the fertilizer, in relation to the seed depth, was easily adjusted with individual adjustments for each row. Bands of fertilizer were applied slightly below the seed level and about 50 mm (2 in) to each side of the seed.

Hill Formation: A wide range of adjustments was provided for the closing disks. Uniform hills were easily produced, over the seed, without disturbing the fertilizer, at normal operating speeds.

Fertilizer Application Rate: The fertilizer feed belt drive sprocket had to be changed to adjust the fertilizer application rate. Changing sprockets was easy, however, both the seed and fertilizer hoppers had to be tilted out of the way to make this adjustment. Additional adjustments were provided with an adjustable gate above each feed belt.

Lubrication: The McConnell was equipped with 60 pressure grease fittings. Thirty-two fittings, incorporated in a lubrication bank system, were easy to service. Sixteen of the remaining fittings were easy to lubricate, while twelve were difficult to lubricate. These required tilting of the seed hopper and use of a flexible hose grease gun. All drive chains, idlers and other components were accessible for oiling. Daily servicing took about thirty minutes.

POWER REQUIREMENTS

A 65 kW (87 hp) tractor had adequate power to operate the McConnell in most soils at speeds up to 12 km/h (8 mph).

OPERATOR SAFETY

The McConnell was safe to operate if normal safety precautions were taken. It was important that a suitable poke stick be used, to clear hopper bridging, to avoid injury from the picker assembly. Two pinch points were present on the seed hopper extensions (FIGURE 7).

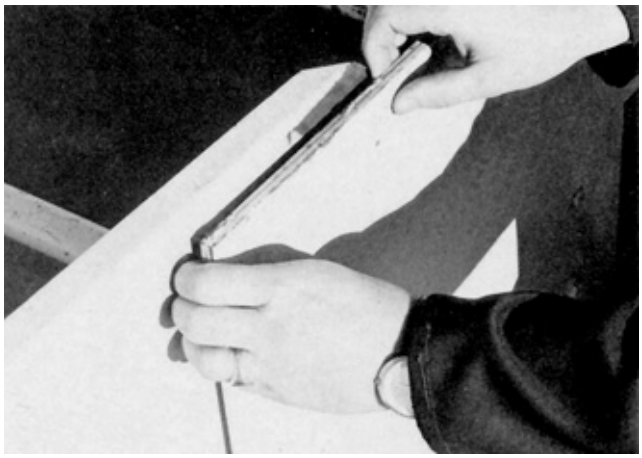


FIGURE 7. Pinch Points on Seed Hopper Extension.

It is recommended that modifications be incorporated to remove these pinch points to prevent potential finger injury.

As previously discussed, the metal platform at the front of the planter was adequate and convenient for safe filling of the fertilizer hopper. The metal platform at the rear of the planter was inadequate and inconvenient for safe filling of the seed hopper. The operator's seat was reasonably safe, however, hand holds were not provided near the seat.

The McConnell was not equipped with a slow moving vehicle sign.

OPERATOR'S MANUAL

The operator's manual was simple to understand, well illustrated and presented much useful information on adjustments, maintenance and safety. Fertilizer application charts were not supplied. A clear and comprehensive parts list was provided in the operator's manual.

DURABILITY RESULTS

TABLE 3 outlines the mechanical history of the McConnell 555 during 120 hours of field operation while seeding about 190 ha (470 ac). 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 3. Mechanical History

Item	Operating Hours	Equivalent ha	Field Area (ac)
-- A picker arm broke due to faulty casting and was replaced at	19	32	(80)
-- The bushing on one of the drive sprockets broke due to jamming of the picker wheel, and was replaced at	48	80	(200)
-- A picker arm broke due to a bent picker arm cam and was replaced at	67	112	(280)
-- The hydraulic raising linkage bent and was straightened	many times		
-- The row markers bent and were straightened	many times		
-- A fertilizer feed belt began to tear by	end of test		

APPENDIX I

SPECIFICATIONS

Make:	McConnell
Model:	555
Serial No.:	1917

Weight (with hopper empty)	
-- right outside wheel	439 kg (966 lb)
-- right inside wheel	745 kg (1639 lb)
-- left inside wheel	740 kg (1628 lb)
-- left outside wheel	434 kg (955 lb)
-- hitch point	168 kg (370 lb)
-- total weight	2526 kg (5558 lb)
Overall Dimensions:	
-- tire size	7:50-24
-- length	3960 mm (156 in)
-- width	4090 mm (161 in)
-- height	1950 mm (77 in)
-- transport ground clearance	100 mm (4 in)
Seeding System:	
-- type	pick
-- number of rows	4
-- pickers per row	16
-- picks per picker	2
-- type of drive	chain and gear from ground wheel
-- type of adjustment	interchangeable drive and driven sprockets
-- range of normal seed spacing	80 to 475 mm (3.3 to 19 in)
-- range of row spacing	860 to 1010 mm in 50 mm increments (34 to 40 in. in 2 in increments)
-- seed hopper capacity	1900 L (67 ft^3)
-- closing disk diameter	400 mm (16 in)
-- number of closing disks	2 per row
-- space between closing disk	adjustable
-- angle of closing disk	adjustable
Fertilizer System:	
-- type of drive	chain and gear from ground wheel
-- type of adjustment	interchangeable drive and driven sprockets and slide gate
-- application rate	600 to 1480 kg/ha (540 to 1332 lb/ac)
-- type of feed	belt
-- number of hoppers	4
-- fertilizer hopper size	235 L per row (8 ft^3 per row)
-- opening disk diameter	400 mm (16 in)
-- space between opening disks	150 mm (8 in) at front
-- angle of opening disks	15° toe in
-- fertilizer agitator type	finger
Number of Chain Drives:	12
Number of Lubrication Points:	60

Other Optional Equipment: tires 9 x 24, 6.50 x 36, 9 x 36 6 ply, disk marker, fertilizer extensions, cultivator tooth attachment, wheel equipment -- spoke type for 6.50 x 36 6 ply tires, cushioned seat, fertilizer boxes -- side dresser, pumps, tanks etc. for liquid fertilizer, stainless steel picks, Florida covering gang, heavy duty covering disk supports, extensions for covering disks, 355 mm (14 in) opening or closing disks.

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 kilometer/hour (km/h)	= 0.62 miles/hour (mph)
1 kilogram (kg) = 1000 g	= 2.2 pounds (lb)
1 litre (L)	= 0.035 $feet^3$ (ft^3)
1 kilogram/hectare (kg/ha)	= 0.9 pounds/acre (lb/ac)

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