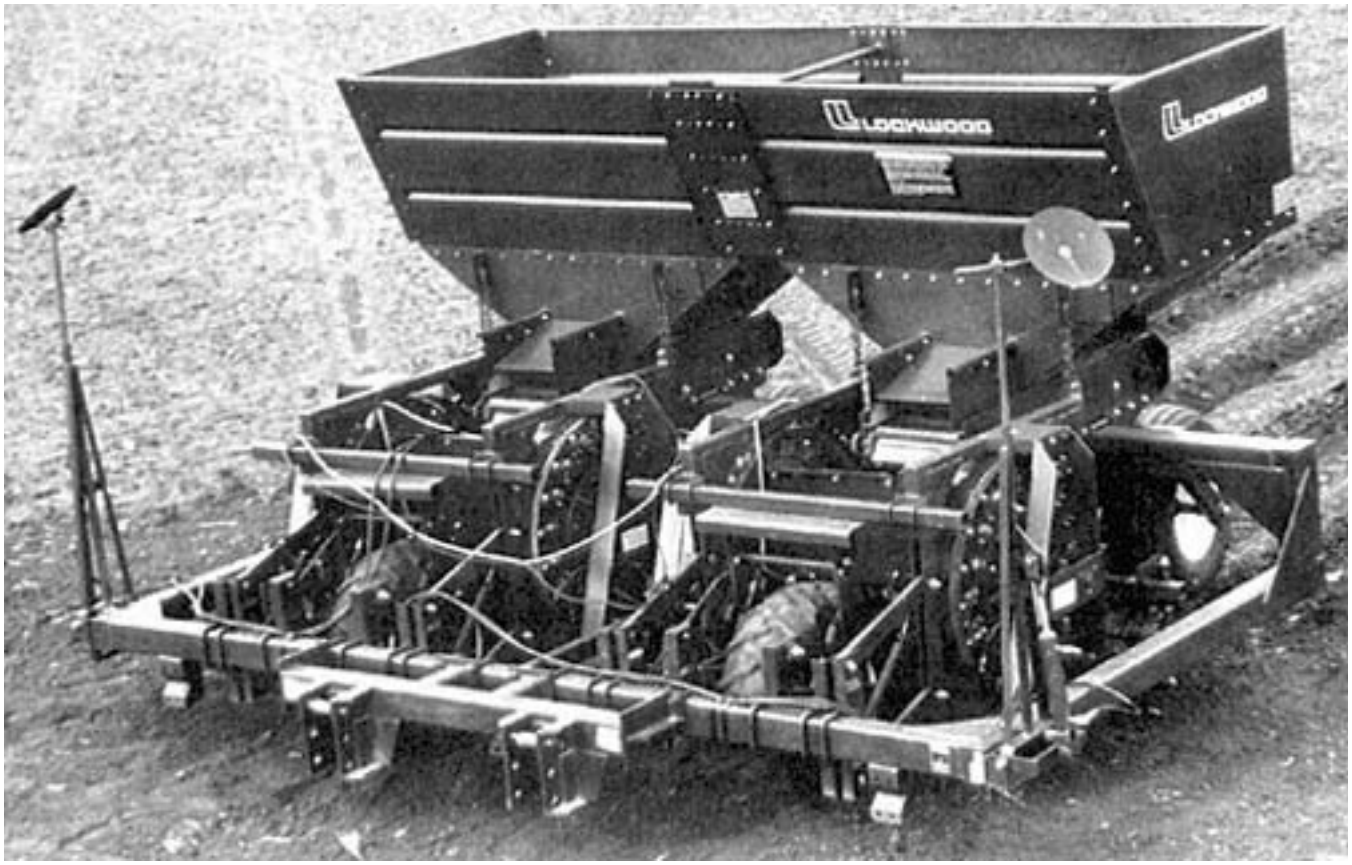
Evaluation Report No. E0480
Printed: December, 1980
Tested at: Portage la Prairie
ISSN 0383-3445

Evaluation Report 206



Lockwood L06200-00403 Accumatic Potato Planter

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

LOCKWOOD L06200-00403 ACCUMATIC POTATO PLANTER

MANUFACTURER:

Lockwood Corporation
P.O. Box 160
Gering, Nebraska
U.S.A. 69341

RETAIL PRICE:

$18,100.00 (December 1980, f.o.b. Winkler, Manitoba, with hydraulic row markers, electronic flow control, new-V opening shoe, 355 mm covering discs, 12.5L x 15 tires).

DISTRIBUTORS:

Kroeker Machinery Sales
P.O. Box 1450
Winkler, Manitoba
R0G 2X0

Mid-Plains Implements, Ltd.
P.O. Box 610
Carberry, Manitoba
R0K 0H0

Barrich Farms Ltd.
Box 610
Outlook, Saskatchewan
S0L 2N0

O & R Irrigation Ltd.
Box 10
Taber, Alberta
T0K 2K0

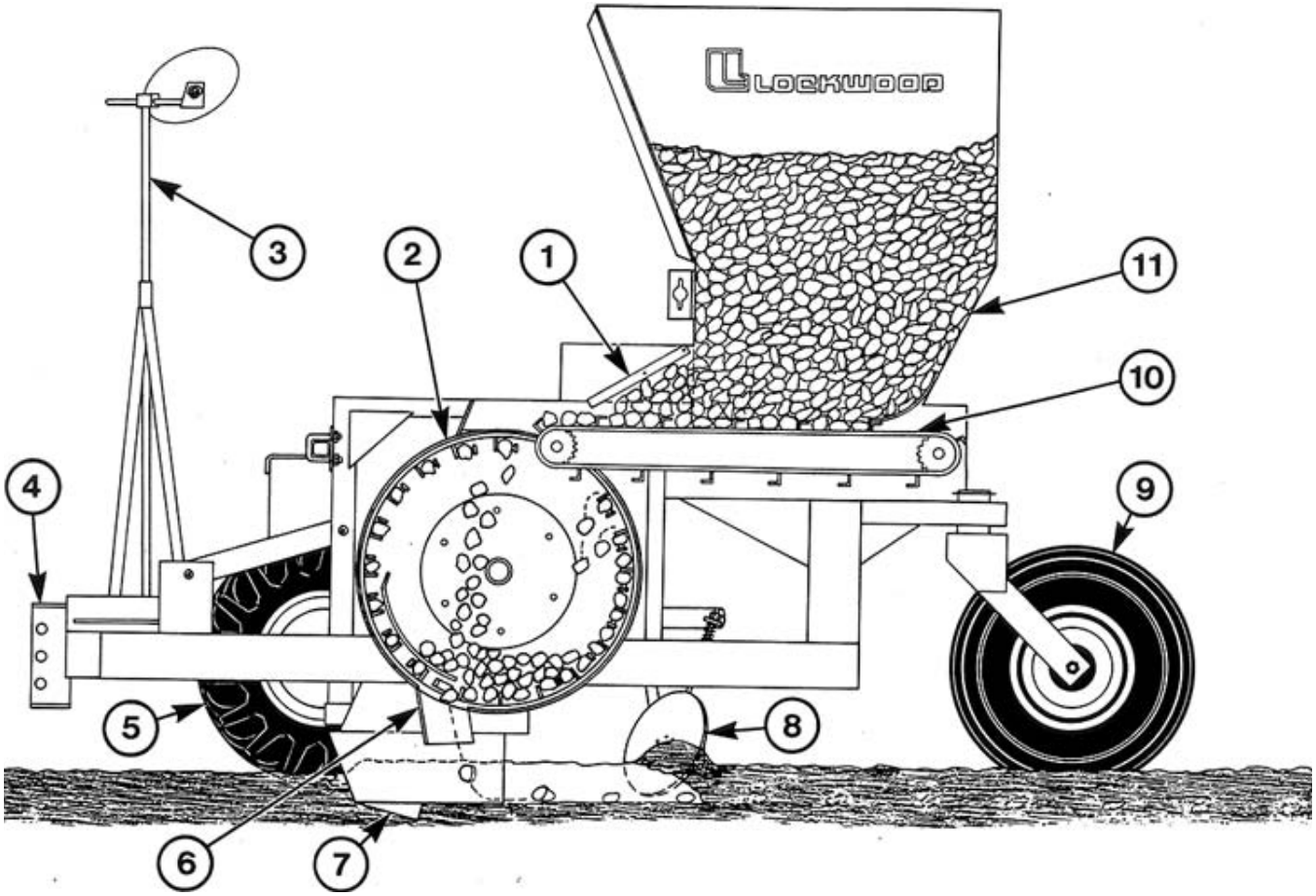


FIGURE 1. Lockwood LO6200-00403 Accumatic: (1) Adjustable Seed Gate, (2) Picker Wheel Assembly, (3) Row Marker, (4) Hitch, (5) Drive Wheel, (6) Seed Chute, (7) Planting Shoe, (8) Covering Disc, (9) Castor Wheel, (10) Draper Chain Conveyor, (11) Seed Hopper.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Lockwood 403 Accumatic Potato Planter was very good. Performance in wet fields ranged from good to very good.

Performance of the electronic seed flow control system was very good, resulting in trouble free seed flow to the picker bowls. Both seed hoppers emptied evenly. Seed spacing was good. When set at a nominal spacing of 460 mm (18 in), 54% of the seed was spaced between 230 and 690 mm (9 and 27 in), with an average spacing of 475 mm (19 in). The coefficient of variation (CV) of single seed spacing was 26%. This coefficient was fairly constant for all planting speeds. The overall CV was 64% when planting at 10 km/h (6 mph). Control of seeding depth was very good. The covering discs produced fair hills in most soil conditions.

The planting mechanism was very convenient to adjust, service and operate. No access was provided to enter the seed hopper for cleaning.

A 60 kW (80 hp) tractor would have adequate power to operate the Lockwood 403, in most soils, at speeds up to 10 km/h (6 mph), but a tractor with at least 100 kW (130 hp) is recommended. This size of tractor would provide better maneuverability and adequate floatation to carry the large hitch weight.

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

The Lockwood transported well at speeds up to 25 km/h (15 mph) although transport ground clearance of 70 mm (3 in) was inadequate.

Operator visibility of the two outer pick wheels was very good, while visibility to the rear was poor. Maneuverability was very good, but use of tractor wheel brakes was often required on headlands.

No significant mechanical problems occurred during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to the covering discs, to produce more uniform hills, to reduce the need for repeated adjustments and to

increase ground clearance during transport.
2. Modifications to improve the ease of adjustment to the picker wheels and the seed piece holding baffles.
3. Modifications to the flow splitters to reduce seed piece damage.
4. Modifications to prevent the row markers from coming out of adjustment during operation.

Chief Engineer -- E.O. Nyborg
Senior Engineer -- J.C. Thauberger
Project Engineer -- Gregory R. Pool

THE MANUFACTURER STATES THAT:

With regard to recommendation number:

1. Star washers are being provided to hold the disc in place during planting operation. A lift assist will be offered to provide additional ground clearance for turns and transportation.
2. With a new baffle design and other improvements, the need to adjust the picker wheel and baffles will be substantially reduced for varying sizes.
3. The flow splitter will be replaced by an automatic flow divider.
4. The row marker disc assembly is now a telescoping square shaft and tube.

Note: This report has been prepared using SI units of measurement. A conversion table is given in APPENDIX III.

GENERAL DESCRIPTION

The Lockwood 403 Accumatic (FIGURE 1) is a four-row, semi-mounted, pick-type potato planter. The main frame is fabricated in one section, and is supported by the two lifting links of a tractor three-point hitch (Category II) and by two rear castor wheels. It is designed for use without a riding operator.

The Lockwood is equipped with a 4000 L (140 ft³) seed hopper with a holding capacity of about 2800 kg (6200 lb). Two draper chain conveyors feed seed to the four picker bowls. An electronic shut-off regulates the seed level in the picker bowls by controlling a pawl on the draper chain ratchet drive. A picker wheel assembly, containing 20 cam activated picker arms, is located in each picker bowl. Steel picks 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 set by manually adjusting the height of each planting unit. Two covering discs are used on each row to form soil hills.

The test machine was not equipped with a fertilizer attachment. The optional disc type row markers were hydraulically operated.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Lockwood 403 was operated in the conditions shown in Table 1 for about 66 hours while seeding about 96 ha (240 ac). It was evaluated for rate of work, quality of work, ease of operation, ease of adjustment, power requirements, operator safety and suitability of the operator's manual.

All seed placement trials[1] were performed with cut Netted Gem seed, with an average seed size of about 70 g (0.15 lb). The machine was set for a nominal 460 mm (18 in) seed spacing.

TABLE 1. Operating Conditions

Soil Texture	Field Area	Hours
	ha	
Loam	12	11
Silty Clay	28	18
Silty Loam	56	37
Total	96	66

RESULTS AND DISCUSSION

RATE OF WORK

Average planting rates in silty loam were about 1.5 ha/h (3.8 ac/h) while maximum planting rates were as high as 3.0 ha/h (7.5 ac/h) at a speed of 9.5 km/h (6 mph). Maximum planting rates do not include the time needed to fill the seed hopper.

QUALITY OF WORK

Seed Placement: Seeding depth uniformity was very good. Deviations of less than 10 mm (0.4 in) from the desired depth were maintained for planting speeds from 6 to 10 km/h (3.5 to 6 mph).

Seed spacing (TABLE 2) was good. When planting at 10 km/h (6 mph) in level silty loam, with the planter at a nominal 460 mm (18 in) setting, 54% of the seed was singly spaced between 230 and 690 mm (9 and 27 in). Average spacing of single seed was 475 mm (18.7 in) with a coefficient of variation[2] (CV) of 26%. Seed spacing uniformity was not affected by planting speed over a range from 6 to 13 km/h (3.6 to 8 mph). The overall CV for the Lockwood at 10 km/h (6 mph) was 64%.

Average spacings ranged from 475 to 740 mm (18.7 to 29 in) throughout all the tests. No consistent trend, relating seed spacing and forward speed, was evident.

TABLE 2. Seed Placement at 10 km/h

Uniformity of Placement	Percent of Total Seed
Single seed	54
Double seed	16
Missed seed	30

Hill Formation: Hills of only fair quality were formed over the seed. Hill uniformity was also only fair, for planting speeds from 3 to 13 km/h (2 to 8 mph). It is recommended that the manufacturer consider modification to improve the quality and uniformity of hill formation.

Floatation: The Lockwood was equipped with two drive wheels and two rear castor wheels which provided good floatation in soft soil. All wheels operated between the rows without causing undue soil compaction.

EASE OF OPERATION

Row Markers: The hydraulically controlled row marker attachment was effective and easy to use. Two tractor hydraulic outlets were needed to operate the markers. The marker discs could be adjusted to leave a clear mark, and marker length was adjustable to suit the row spacing. Despite extreme tightening of the adjusting setscrews, the disc arms sometimes rotated within the marker assembly during use, causing the markers to go out of adjustment. It is recommended that modifications be made to eliminate rotating of the disc arms during operation.

Hopper Filling: The seed hopper was quite safe and convenient to fill, even though no walkways were provided at the rear or front of the planter. A ladder or step would have provided easier access to the seed hopper for cleaning and filling.

Cleaning: As with most potato planters, a pressure washer was most suitable for thorough machine cleaning and disinfecting. The leftover seed in the picker bowls had to be removed from the top, by hand, before washing.

Hitching: The Lockwood 403 was relatively easy to hitch to a tractor, if the tractor was equipped with extendible lift arms. The hitch pins were machined to two different sizes, to accommodate both Category II or Category III three point hitches. The accompanying spacer bushings that had to be used sometimes made hitching difficult.

Planting: It was very easy for the tractor operator to view the two draper chain conveyors that delivered the seed pieces from the seed hopper to the picker bowls. Pierced seed pieces on the two outside picker wheels could also be viewed easily from the tractor seat. A rapid, loud clicking noise from the planting mechanism also warned the operator of empty pick bowls during operation. The draper chain conveyors were controlled by electronic sensors. The control device disengaged a pawl from each draper chain drive ratchet whenever the picker bowl seed level reached a preset height. The electronic flow control was very effective in regulating picker bowl seed level. Erratic operation during the first part of the test, which was caused

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

[2] *The coefficient of variation/s the standard deviation of seed spacing, expressed as a percent of the mean seed spacing. It's a measure of seed spacing uniformity. The lower the CV, the more uniform is the seed spacing. For acceptable seeding, the CV of single seed placement should be less than 40% and the overall CV should be less than 70%.*

by a defective circuit board, was corrected with replacement of the board.

Both sides of the seed hopper emptied evenly. A flow splitter at the mouth of each opening was used to divide the flow between the two picker bowls below each opening. The flow splitters restricted the seed flow, causing erratic feeding and seed damage. This problem was corrected by removing the flow splitters. It is recommended that modifications be made to the flow splitters to reduce seed piece damage.

Transporting: The Lockwood 403 transported well at speeds up to 25 km/h (15 mph) on smooth roads. On rough or crowned roads, speed had to be reduced since the transport clearance of the covering discs was only 70 mm (3 in). It is recommended that the covering disc transport clearance be increased to reduce the possibility of damage during transport. The row markers could be locked in the raised position to reduce transport width.

EASE OF ADJUSTMENT

Seed Spacing: Seed spacing was adjusted by changing the centre jackshaft sprockets. The sprockets were quite accessible and easy to change. Ten nominal seed spacings between 150 and 380 mm (6 and 15 in) were possible with the standard sprockets. Special sprockets were also available for other seed spacings, up to 460 mm (18 in).

Seed Depth: Adjustment of planting depth was easy. Each planting unit was suspended, at the back, on two chains, which could be adjusted to keep the planting shoe level. The maximum planting depth was set by making adjustments to the drive wheel mounting brackets (FIGURE 2) at the front of the planter.

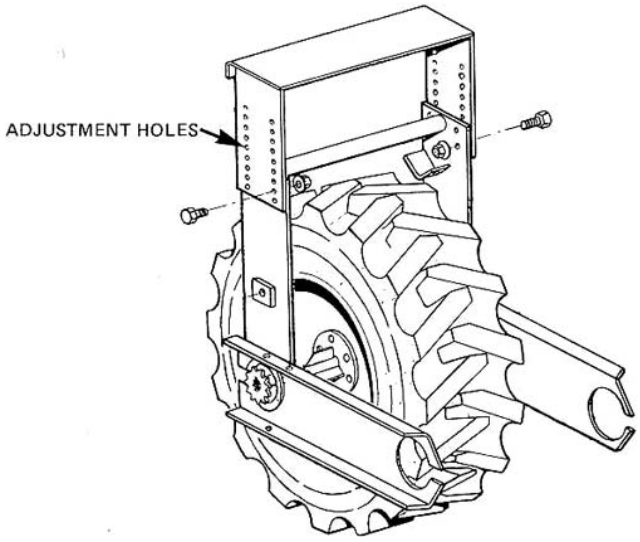


FIGURE 2. Drive Wheel Adjustment.

Hill Formation: A wide range of adjustments was provided for the covering discs. The discs however frequently came out of adjustment, despite repeated attempts to correct the problem. This was usually caused by the discs striking the ground, due to limited ground clearance, and being forced out of adjustment when the planter was backed in the field, in fully raised position, in the course of normal field operations. It is recommended that the manufacturer consider modification to the covering discs to eliminate this problem.

Picker Wheels: The picker wheels could be adjusted to accommodate various seed sizes. Adjustable baffles (FIGURE 3) could be positioned to hold various sizes of seed pieces for retention by the picks.

The spacing between the picker wheels and the picker bowls was also adjustable to accommodate various seed sizes. It took about one hour to adjust all the picker wheel baffles for four rows. Adjusting the picker wheel clearance was more difficult. A large hammer or bar was needed to position each wheel on its shaft. It took about 20 minutes to reposition each picker wheel. It is recommended that the manufacturer consider modifications to improve the ease of adjustment to the picker wheels and the seed piece holding baffles.

FIGURE 3. Adjustable Baffles.

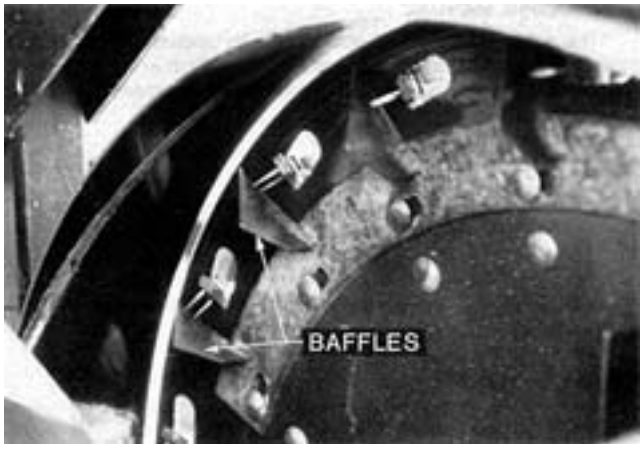


FIGURE 3. Adjustable Baffles.

Picker Arm Cams: An adjustable cam (FIGURE 4) was used to set the picker arm travel length, to ensure that the seed pieces were stripped from the picks as the arms retracted. Adjusting these cams was easy, as all bolts were very accessible. It took about 30 minutes to adjust all the cams on the four rows.

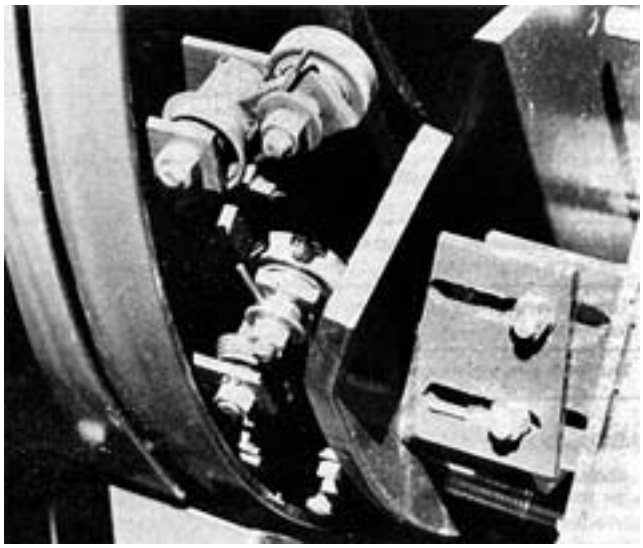


FIGURE 4. Adjustable Picker Arm Cam.

Seed Hopper Gates: The seed flow from the hopper to the picker bowls was controlled with two adjustable gates. Adjustment was easy, but the gates frequently required readjustment and tightening during operation.

Lubrication: The Lockwood 403 was equipped with 26 pressure grease fittings. All grease fittings, roller drive chains and other components were easily reached for lubrication. Daily servicing took about ten minutes.

POWER REQUIREMENTS

Average draft, in average soil conditions with a full seed hopper, was about 6 500 N (1300 lb). Although a 60 kW (80 hp) tractor had adequate power to operate the Lockwood 403 in most soils at speeds up to 10 km/h (6 mph), a tractor of at least 100 kW (130 hp) is recommended. Power is not the only consideration in determining a suitable tractor. Floatation and the ability of the three-point hitch to lift the planter with a full hopper, is of equal importance. Front ballast may be required on some tractors to properly handle the 2150 kg (4740 lb) hitch weight of the Lockwood 403. With an adequately sized tractor, maneuverability was very good, although use of wheel brakes was often required to turn on headlands.

OPERATOR SAFETY

The Lockwood 403 was safe to operate and service, if the manufacturer's safety recommendations were followed. All moving parts were adequately shielded. No safety problems were evident. The rear tires were overloaded by 35%[3] when transporting at normal

speeds with a full hopper. If transporting the planter with a full hopper, speed should be less than 10 km/h (6 mph). Care had to be exercised while transporting on public roads, as visibility to the rear was poor.

OPERATOR'S MANUAL

The operator's manual was simple to understand, well illustrated, and presented much useful information on adjustments, maintenance and safety. A comprehensive parts manual was also provided.

DURABILITY RESULTS

TABLE 3 outlines the mechanical history of the Lockwood 403 during 66 hours of field operation while planting about 96 ha (240 ac). The intent of the test was evaluation of functional performance. The following failures are those, which occurred during functional testing. An extended durability evaluation was not conducted.

TABLE 3. Mechanical History

Item	Operating Hours	Field Area ha
-The mounting bracket on one row marker broke and was repaired at	4	6
-A jackshaft broke and was replaced at	18	20
-The drive shaft connecting the picker wheels were replaced at	32	36
-The electronic board malfunctioned and was replaced at	48	66
-The row marker adjusting set screws had to be retightened	many times during test	
-The covering discs had to be readjusted	many times during test	
-The hitch pins were loose at	end of test	

DISCUSSION OF MECHANICAL PROBLEMS

Jackshaft: The jackshaft twisted off due to backing the machine with the drive wheels on the ground. The manufacturer later corrected this problem by installing a one-way slip clutch on the drive shaft.

Covering Discs: The covering discs were usually pushed out of adjustment when backing the planter over uneven ground in the fully raised position. The discs would catch on soil ridges due to insufficient ground clearance.

Drive Shafts: The drive shafts connecting the picker wheels were replaced, to correct a problem of uneven picker wheel rotation. The U-joints on the drive shafts had worn out and resulted in erratic picker wheel speeds.

---

[3] *Tire and Rim Association, Inc., 1980 Year Book*

APPENDIX I
SPECIFICATIONS

MAKE:	Lockwood
MODEL:	Accumatic L06200-00403
SERIAL NO.:	9649 RB
WEIGHT: (Empty Hoppers)	
-- right castor wheel	890 kg
-- left castor wheel	810 kg
-- hitch point	1090 kg
Total	2790 kg
OVERALL DIMENSIONS:	
-- length	3950 mm
-- width	5410 mm
-- height	2470 mm
-- transport ground clearance	70 mm
SEEDING SYSTEM:	
-- type	pick
-- number of rows	4
-- picker arms per row	20
-- picks per picker arm	2
-- type of drive	chain and sprockets from drive wheel
-- type of adjustment	interchangeable sprockets
-- range of seed spacing	150 to 460 mm
-- range of row spacing	810 to 1010 mm
-- seed hopper capacity	4020 L
-- covering disc diameter	355 mm
-- space between covering discs	adjustable
-- angle of covering discs	adjustable
TIRES:	
-- rear castor	2, 12.5L x 15, 8-ply, rib implement
-- drive	2, 12.5L x 15, 6-ply, traction grip
Number of Chain Drives:	8
Number of Lubrication Points:	26
Other Optional Equipment:	
-- tool bar attachment	
-- end tow package	
-- hydraulic row marker	

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
CONVERSION TABLE

1 millimetre (mm)	= 0.04 inches (in)
1 kilometre/hour (km/h)	= 0.6 miles/hour (mph)
1 kilogram (kg) = 1000 g	= 2.2 pounds (lb)
1 kilogram/hectare (kg/ha)	= 0.9 pounds/acre (lb/ac)
1 newton (N)	= 0.2 pounds force (lb)
1 kilowatt (kW)	= 1.3 horsepower (hp)
1 litre (L)	= 0.035 cubic feet (ft^3)
1 hectare (ha)	= 2.5 acres (ac)

ALBERTA FARM MACHINERY RESEARCH CENTRE

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html

Prairie Agricultural Machinery Institute
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:

P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080