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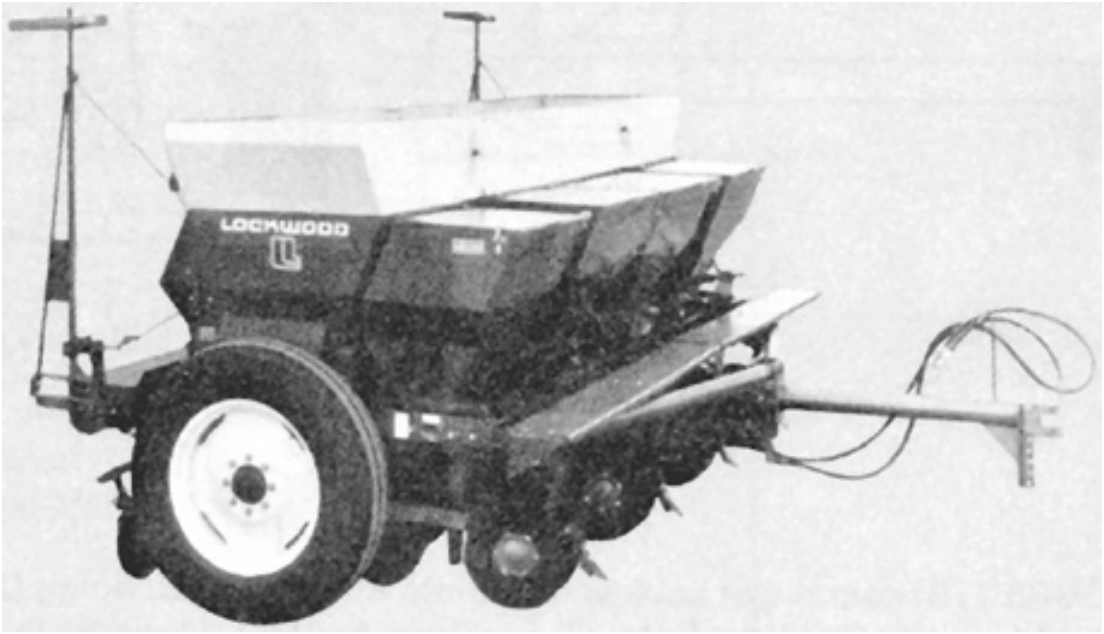

Lockwood Model L06200-00423 Potato Planter

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

LOCKWOOD MODEL L06200 - 00423 POTATO PLANTER

MANUFACTURER:

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

RETAIL PRICE:

$13,188.00 (September, 1978, f.o.b. Winkler, Manitoba with 9.00 x 24 tires, 400 mm (16 in) opening and closing disks, Potee shoe, long covering bar, 38" row spacing, 18" seed spacing, row markers).

DEALERS:

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

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

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

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

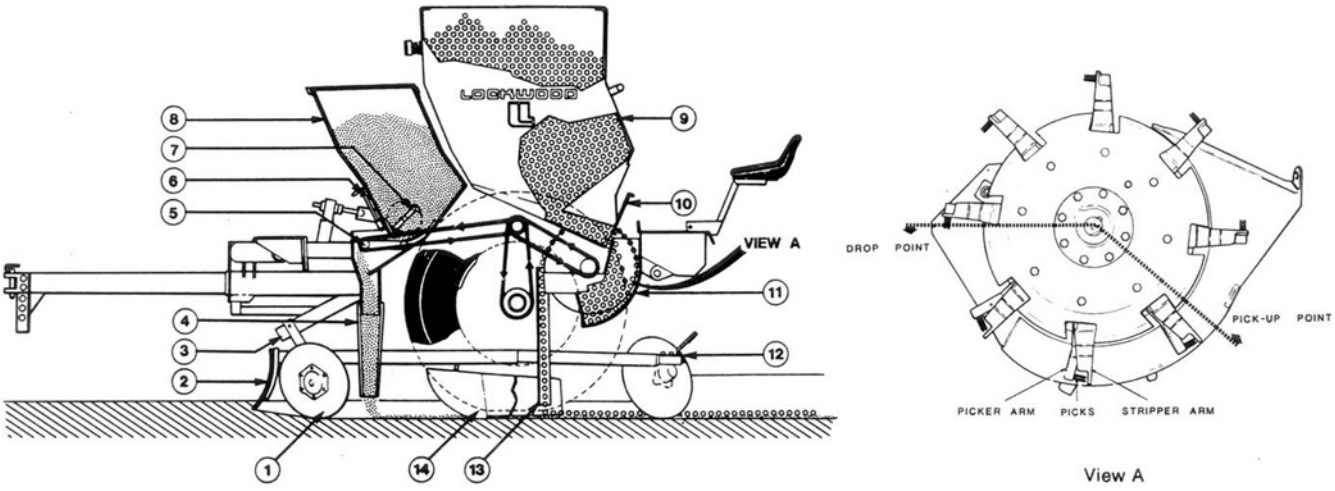

FIGURE 1. Schematic of Lockwood Potato Planter: (1) Opening Disk, (2) Cultivator Tooth, (3) Adjustable Linkage, (4) Fertilizer Feed Hose, (5) Fertilizer Feed Chain, (6) Fertilizer Gate, (7) Fertilizer Agitator, (8) Fertilizer Hopper, (9) Seed Hopper, (10) Seed Gate, (11) Picker Bowl, (12) Closing Disk, (13) Seed Chute, (14) Planting Shoe.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Lockwood Model L06200-00423 potato planter was very good.

The seed feeding and 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), 70% of the seed was spaced between 240 and 780 mm (9 and 30 in) with an average spacing of 490 mm (19 in). The coefficient of variation of single seed spacing was 28% at a speed of 9.4 km/h (6 mph). Acceptable seed spacing occurred at all speeds below 12 km/h (7 mph). Control of seeding depth was very good with seed pieces placed within 12 mm (0.5 in) of the desired depth. The closing disks could be adjusted to produce very good hills with uniform soil cover in all soil conditions encountered.

Performance of the fertilizer metering system was very good. 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. Opener adjustment was sufficient to permit the fertilizer bands to be placed below seed level in all soil conditions encountered. The fertilizer calibration chart was inaccurate necessitating recalibration for fertilizer commonly used in the prairie provinces.

Both the fertilizer and seed systems were convenient to adjust and service and were easy to operate. Adequate walkways were supplied for filling the seed and fertilizer hoppers. Access holes, provided in the back of the seed hoppers, were inadequate to enable the planter operator to conveniently break seed bridging.

A 65 kW (87 hp) tractor had adequate power to operate the Lockwood in most soils at speeds up to 10 km/h (6.2 mph).

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

No significant mechanical problems occurred during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Providing larger seed hopper access holes to aid the operator in breaking seed bridging.
2. Modifying the seed hopper extension to remove pinch points.
3. Modifications to reduce rotation of the scribes on the marker arm during operation.
4. Supplying fertilizer calibration charts for fertilizer commonly used in the prairie provinces.
5. Clarifying the fertilizer feed gate adjustment in the operator's manual.

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

THE MANUFACTURER STATES THAT

With regard to recommendations 1 through 5: Since these recommendations have been made known to us, our engineering department has been investigating the possibility of design improvements. We intend to consider each one of these and carry out field tests, on any changes decided upon, in 1979.

GENERAL DESCRIPTION

The Lockwood Model L06200-00423 (FIGURE 1) is a four row, pull-type pick potato planter. The main frame is fabricated in three sections and supported by four wheels. It is designed for use with one operator seated on the rear of the planter, in addition to the tractor driver.

The Lockwood is equipped with a 2330 L (82 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. Stainless steel picks on each picker arm pierce the seed, carry it out of the picker bowls, dropping 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 cover each seed row with soil hills.

Fertilizer hoppers are provided for each row. Fertilizer is metered from the hoppers with feed chains. Application rate can be varied either with adjustable gates or by changing feed chain 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 test machine was equipped with optional, manual, row markers.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Lockwood was operated in the conditions shown in TABLE 1 for 80 hours while seeding about 130 ha (320 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. In addition, the fertilizer system was calibrated in the laboratory.

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

TABLE 1. Operating Conditions

SOIL TEXTURE	FIELD AREA		HOURS
	ha	(ac)	
Very fine sandy loam	18	(45)	11
Sandy clay loam	14	(35)	9
Loamy sand	98	(240)	60
TOTAL	130	(320)	80

RESULTS AND DISCUSSION

RATE OF WORK

Average planting rates obtained with the Lockwood in loamy sand were about 2 ha/h (5 ac/h). Work rate was not affected by soil moisture. Maximum planting rates of about 4 ha/h (11 ac/h) were obtained. Maximum planting rates do not include the time required to fill both the fertilizer and seed hoppers.

QUALITY OF WORK

Seed Placement: Seeding depth uniformity was very good. Deviations of less than 12 mm (0.5 in) from the desired depth were maintained for planting speeds from 3 to 11 km/h (2 to 7 mph).

Seed spacing in the rows, was good. TABLE 2 shows seed placement uniformity. When planting at 9.4 km/h (5.8 mph) in level loamy sand, with the planter at a nominal 460 mm (18 in) setting, seventy percent of the seed was spaced between 240 and 780 mm (9 and 30 in). Average spacing of single seeds was 490 mm (19 in) with a coefficient of variation[2] (CV) of 28%. It is commonly accepted that for acceptable seed placement uniformity, the CV should be less than 40%. CV values below 40% resulted at all speeds below 12 km/h (7 mph). An increase in speed from 4 to 10 km/h (2.5 to 6 mph) resulted in a change in CV from 30% to 40%.

Seed spacing increased slightly with an increase in speed. Average spacing increased from 485 to 505 mm (19 to 20 in) when the planting speed was increased from 3.2 to 10.8 km/h (2 to 6.7 mph).

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

TABLE 2. Seed Placement

UNIFORMITY OF PLACEMENT	PERCENT OF TOTAL SEED
Single seed	70
Double seed	13
Missed seed	14
Double missed seed	3
	100

Fertilizer Placement: Fertilizer placement was good for planting speeds from 3 to 11 km/h (2 to 7 mph). The fertilizer 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 were compact and well defined. As speed was increased, the fertilizer bands were less clearly defined.

Fertilizer Metering System: The operator's manual provided a calibration table for fertilizer with a density of 880 kg/m³ (55 lb/ft³). FIGURE 2 shows PAMI calibration results for 16-20-0 fertilizer with a density of 1010 kg/m³ (63 lb/ft³). Comparisons to the manufacturer's calibrations on the same figure show large differences between the two calibration curves even though the manufacturer's curve was adjusted to account for differences in fertilizer density. It is recommended that the manufacturer supply modified fertilizer application rate tables for fertilizers commonly used in the prairie provinces.

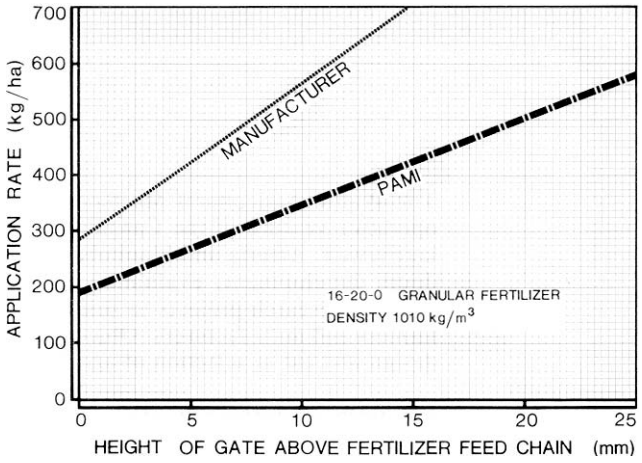

FIGURE 2. Calibration of Fertilizer Metering System.

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. Hills were uniform in size for planting speeds from 3 to 11 km/h (2 to 7 mph).

Flotation: The Lockwood was equipped with four support wheels, providing good flotation in soft soil. Average soil contact pressure under the tires, with full seed and fertilizer hoppers, varied from 80 to 155 kPa (12 to 23 psi). For comparative purposes, an unloaded pickup truck creates an average soil contact pressure of about 200 kPa (30 psi).

The wheels operated between the rows and did not cause any soil compaction of the hills.

EASE OF OPERATION

Row Markers: The optional row marker attachment was effective and easy to use. The spring scribes could be adjusted to create a clear mark, while marker length was adjustable to suit the row spacing. Despite extreme tightening of the mounting bolts the scribes occasionally rotated on the marker arms during use requiring repositioning (FIGURE 3). It is recommended that modifications be provided to eliminate rotation of the scribes during operation.

[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.

FIGURE 3. Rotated Scribe on Row Marker Arm.

Hopper Filling: Filling of both the seed and fertilizer hoppers was safe and convenient. Suitable metal walkways were supplied at the front and rear of the planter to aid in filling. Fertilizer hopper lids had latches to secure them in both the open and closed positions.

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

Cleaning: As with most potato planters, a pressure washer was most suitable for thorough machine cleaning. The seed hopper could be tilted backwards for seed removal and cleaning of the seed hopper and picker bowls. The fertilizer hoppers could be tilted forward for fertilizer removal and cleaning of the hoppers and feed chains.

Hitching: The Lockwood was relatively easy to hitch to the tractor. The unloaded hitch weight of 170 kg (374 lb) necessitated use of a suitable hitch jack.

Planting: It was easy for the planter operator to monitor seed flow while, with the fertilizer feed chain 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 the access holes in the back of the hoppers were too small for convenient access with a poke stick. It is recommended that the manufacturer consider providing larger hopper access holes to aid in breaking seed hopper bridging.

Transporting: The Lockwood transported well at speeds up to 25 km/hr (15 mph). Higher speeds resulted in excessive bouncing of the outer two planter units.

EASE OF ADJUSTMENT

Seed Spacing: Seed spacing could be adjusted by varying the picker wheel and counter shaft drive sprockets. Sprockets were accessible and easy to change. Nominal seed spacings of 85 mm to 595 mm (3 to 23 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, accessible by tilting the seed hopper back. Final field operating control was through the tractor hydraulics.

Fertilizer Placement: The placement level of the fertilizer in relation to the seed depth was easily adjusted with individual levers for each row. Two 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 could easily be produced, over the seed without disturbing the fertilizer, at normal operating speeds.

Fertilizer Application Rate: The fertilizer feed chain drive sprocket and the two jackshaft sprockets 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 adjustment was provided with an adjustable gate above each feed chain. To set the fertilizer rate, the operator's manual stated that the gate had to be opened from the zero setting to the desired setting. No zero setting was indicated on the gate to conform with the manual. It is recommended that the manufacturer modify the operator's manual to clarify this adjustment.

Lubrication: The Lockwood was equipped with 92 pressure grease fittings. Forty-eight fittings were easy to service as they were incorporated in a lubrication bank system. Twenty-four of the remaining fittings were easy to lubricate while twenty were difficult to lubricate, necessitating 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

Average draft in average soil conditions with full hopper, on level fields, was about 17,500 N (3850 lb). A 65 kW (87 hp) tractor had adequate power to operate the Lockwood, in most soils, at speeds up to 10 km/hr (6.2 mph).

OPERATOR SAFETY

The Lockwood 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 4). It is recommended that modifications be incorporated to remove these pinch points to prevent potential finger injury.

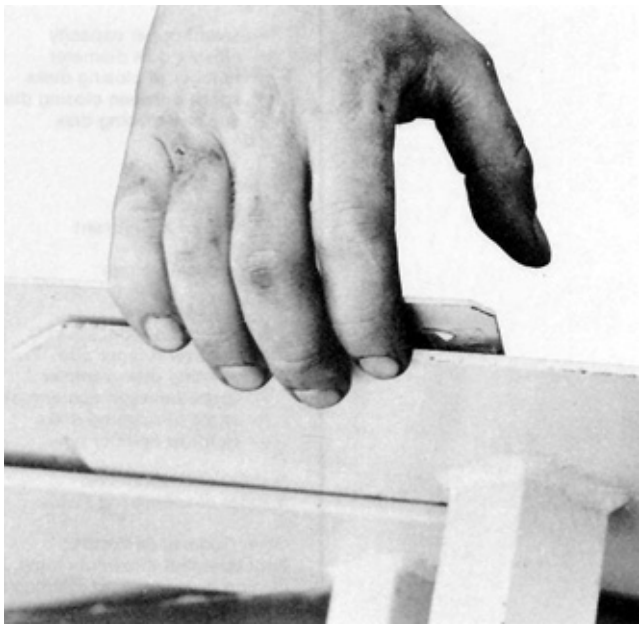

FIGURE 4. Pinch Points on Seed Hopper Extension.

The metal platforms at the rear and front of the hoppers were adequate and convenient for safe filling of hoppers. The operator's seat was reasonably safe, and convenient hand holds were provided near the seat.

The Lockwood was 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. As indicated previously, fertilizer feed, gate adjustment was not clearly outlined while the fertilizer application chart was considerably in error.

DURABILITY RESULTS

The Lockwood was operated for 80 h while seeding about 130 ha (320 ac). The intent of the test was evaluation of functional performance and an extended durability evaluation was not conducted. No serious mechanical problem occurred during testing. As with all pick type planters, the picks occasionally bent and had to be straightened. No other mechanical problems occurred.

APPENDIX I

SPECIFICATIONS

Make:	Lockwood
Model:	L06200-00423
Serial No:	9549RA
Weight (with hopper empty)	
-- right outside wheel	494 kg (1090 lb)
-- right inside wheel	806 kg (1780 lb)
-- left inside wheel	748 kg (1650 lb)
-- left outside wheel	482 kg (1060 lb)
-- hitch point	170 kg (375 lb)
-- total weight	2700 kg (5955 lb)
Overall Dimensions:	
-- tire size	9.00-24
-- length	4250 mm (167 in)
-- width	4695 mm (185 in)
-- height	2360 mm (93 in)
-- transport ground clearance	60 mm (2.4 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 mm to 600 mm (3.3 in to 23.4 in)
-- range of row spacing	860 mm to 1010 mm in 50 mm increments (34 in to 40 in. in 2 in increments)
seed hopper capacity	2330 L (82 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	190 kg/ha to 570 kg/ha (170 lb/ac to 510 lb/ac)
-- type of feed	positive displacement chain
-- number of hoppers	4
-- fertilizer hopper size	200 L per row (7.1 ft^3 per row)
-- opening disk diameter	400 mm (16 in)
-- space between opening disks	110 mm at front
-- angle of opening disks	15° toe in
-- fertilizer agitator type	finger
Number of Chain Drives:	20
Number of Lubrication Points:	92

Other Optional Equipment:
Foot operated throwout clutch, 7.50 x 24 tires, 355 mm (14 in) opening or closing disk, standard planting shoe.

APPENDIX II

MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

(a) excellent
(b) very good
(c) good
(d) fair
(e) poor
(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/hour (mph)
1 metre (m) = 1000 millimetres (mm)	= 39.3/inches (in)
1 kilowatt (kW)	= 1.34 horsepower (bp)
1 kilogram (kg) = 1000 g	= 2.2 pounds (lb)
1 newton (N)	= 0.22 pounds force (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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