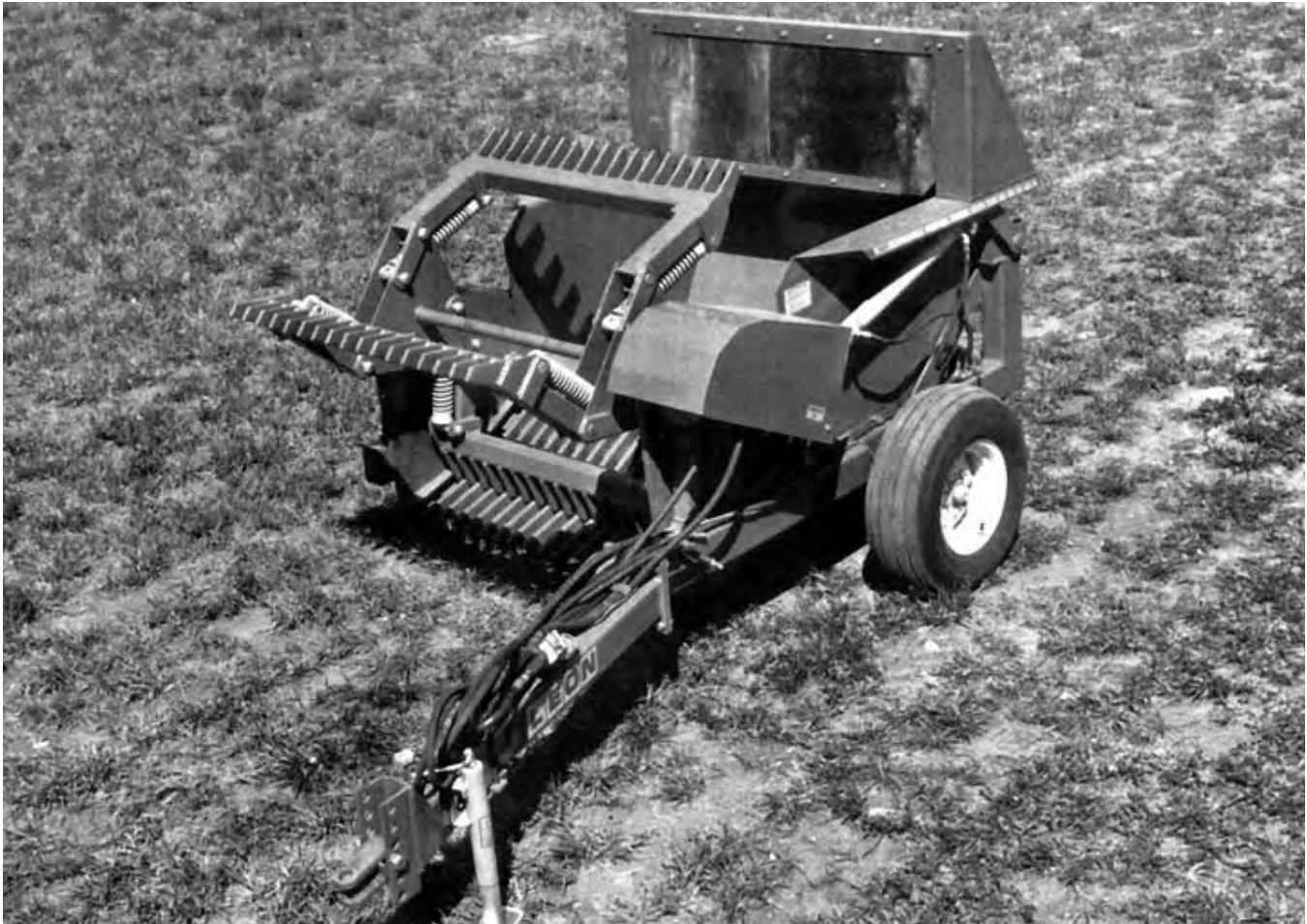


Evaluation Report

232



Leon Model A3000 Series II Rotary Rock Picker

A Co-operative Program Between



LEON A3000 SERIES II ROTARY ROCK PICKER

MANUFACTURER AND DISTRIBUTOR:

Leon's Manufacturing Co. Ltd.
135 York Road East
Yorkton, Saskatchewan

RETAIL PRICE:

\$6,878.00 (July, 1981, f.o.b. Humboldt, complete with optional hydraulic reel drive and optional stone guard.)



FIGURE 1. Leon A3000.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Leon A3000 Series II rock picker was good in both small and large rocks. Ease of operation and adjustment were good.

Typical field speeds were from 2 to 4.5 km/h (1 to 3 mph) in scattered rocks and from 1 to 3 km/h (0.5 to 2 mph) in windrowed rocks. Ground speed was usually limited by rock build-up on the grate. The Leon A3000 could pick rocks from 50 to 740 mm (2 to 29 in) in size. In rocks greater than 300 mm (12 in) in size, the workrate was reduced by rocks frequently jamming between the reel and the grate.

The amount of soil and trash delivered to the hopper depended on operating depth, reel speed and field conditions. In most conditions, soil retention was small.

Hopper capacity was about 1750 kg (3850 lb). The hopper dumping height of 860 mm (34 in) was adequate for piling rocks.

A tractor with 45 kW (60 hp) maximum power take-off rating had sufficient power reserve to operate the Leon A3000 in most field conditions. The Leon A3000 transported well at speeds up to 40 km/h (25 mph).

The operator manual contained a parts list, detailed assembly instructions, a list of safety precautions and information on adjustments and operating procedures.

The Leon A3000 was hazardous to operate if the tractor was not equipped with a cab. The reel bats often threw rocks towards the tractor if rocks built up on the grate. A serious safety hazard was also encountered when removing rocks jammed between a reel bat and the grate. A slow moving vehicle sign was not supplied.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to reduce rock jamming between the reel bats and grate.

2. Providing a more convenient grate transport lock.
3. Modifications to eliminate interference between the hitch jack handle and the hydraulic hoses.
4. Supplying a slow moving vehicle sign.
5. Modifications to protect the hydraulic hoses and valves from rock damage.

Chief Engineer -- E.O. Nyborg

Senior Engineer -- G.E. Frehlich

Project Technologist -- D.H. Kelly

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Modifications to the reel bat assembly have been completed with positive results. This rock picker is designed primarily to pick rocks up to 12 inches in diameter. However, as 14 inches is the reel bat tripping clearance, rocks of this size can be picked without jamming.
2. With some operator skill and experience, picking rocks up to 28 inches in diameter is within the capabilities of this machine. All 1981 models of the A3000 Rock Picker were equipped with a much improved set of transport locks, with storage provisions when not required.
- 3 & 5. On all 1981 models of the A3000 Rock Picker the hydraulic valves were relocated under the chain guard where they are well protected. The repositioning of the hydraulic valves eliminated the interference with the jack handle.
4. We are investigating the need to supply a slow moving vehicle sign with these machines.

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

GENERAL DESCRIPTION

The Leon A3000 is a pull-type rock picker with a 1.3 m (53 in) wide grate. As standard equipment, it is supplied with a ground driven reel. The test machine was equipped with an optional hydraulic reel drive, powered by the tractor hydraulic system.

The Leon A3000 is designed for picking rocks from the soil surface. An inclined, adjustable finger grate, consisting of 16 steel bars spaced at 51 mm (2 in) operates just beneath the soil surface. Rocks are assisted onto the grate and conveyed along it, into a hopper, by a circular reel. The reel has three spring-loaded bats, each with 17 teeth. The hopper holds about 1750 kg (3850 lb) of rocks. Grate height and hopper dumping are hydraulically controlled.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Leon A3000 was operated in the conditions shown in TABLE 1 for 100 hours. It was evaluated for rate of work, quality of work, ease of operation and adjustment, power requirements, safety and suitability of the operator manual.

TABLE 1. Operating Conditions

Rock Size	Hours
Less than 200 mm (8 in)	15
200 to 300 mm (8 to 12 in)	50
Greater than 300 mm (12 in)	35
Total	100
Rock Concentration	Hours
Light	20
Medium	54
Heavy	16
Total	100

RESULTS AND DISCUSSION

RATE OF WORK

Suitable field speeds ranged from 2 to 4.5 km/h (1 to 3 mph) in scattered rocks and from 1 to 3 km/h (0.5 to 2 mph) in windrowed rocks. Maximum speed was determined by operator

skill, rock size, rock concentration, and field conditions. In heavy rock concentrations, rock build-up on the grate limited ground speed to 3 km/h (2 mph). Ground speed was further reduced in rocks over 350 mm (14 in) since the reel frequently jammed.

QUALITY OF WORK

Picking Characteristics: The reel bat arms were spring loaded to allow the bats to retract up to 350 mm (14 in) to clear obstructions. The hydraulic reel drive was equipped with a pressure relief valve.

Reel aggressiveness was good. If too many rocks were fed onto the grate, the reel bats retracted over the rocks causing rock build-up on the grate. By momentarily stopping forward travel, the rock build-up could be cleared with the reel. In heavy concentrations of small rocks (FIGURE 2), two passes were usually needed to remove most of the rocks.

In large rocks (FIGURE 3), one pass was usually sufficient. Large rocks frequently jammed between fully retracted reel bats and the grate (FIGURE 4) stopping the reel. Such rocks could usually be removed by reversing the reel. Occasionally, jammed rocks had to be removed with a tractor and a chain. Modifications to reduce rock jamming are recommended.

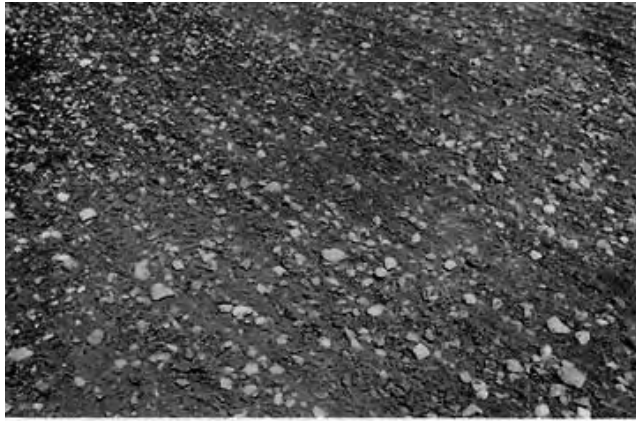


FIGURE 2. Performance in Small Rocks: (Top: Before Picking, Bottom: After Two Passes with Picker).

The 1.3 m (51 in) grate was wide enough to accept most rock windrows. In non-windrowed areas of concentrated rock, a wider grate would be desirable.

Reel Speed: Proper reel speed was necessary to fully utilize hopper capacity and to obtain maximum workrate. Rocks accumulated at the front of the hopper and reduced hopper capacity when the reel speed was too slow. If the reel speed was too fast, rocks were thrown over the back of the hopper. The optional stone guard reduced the number of rocks thrown over the hopper.

The operator manual recommends a reel speed of 45 to 50 rpm for most field conditions. A tractor capable of supplying a hydraulic flow of 54 L/m (12 gpm) was needed to run the reel at 45 rpm when using the hydraulic reel drive. This speed was adequate for most field conditions.

To effectively remove surface rocks and to minimize soil retention in the hopper, both the reel speed and the ground speed had to be selected to suit field conditions. In scattered rocks, best performance was achieved with a tooth index¹ of about 2.9 in fields with light rock concentrations, 4.7 in fields with medium rock

concentrations and 6.6 in fields with heavy rock concentrations. In windrowed rocks, best performance was achieved with a tooth index of about 4.4 in fields with light rock concentrations, 8.7 in fields with medium rock concentrations and 13 in fields with heavy rock concentrations. Operating at the recommended reel speed of 45 rpm, corresponding ground speeds were about 4.5, 2.8 and 2.0 km/h (2.8, 1.7 and 1.2 mph) in scattered rocks for light, medium and heavy rock concentrations, respectively. In windrowed rocks, ground speeds were about 3.0, 1.5 and 1.0 km/hr (1.8, 1.0 and 0.6 mph) for light, medium and heavy rock concentrations, respectively.



FIGURE 3. Performance in Large Rocks: (Top: Before Picking, Bottom: After One Pass with Picker).



FIGURE 4. Typical Rock Jam.

Operating Depth: The operator manual recommended operating with the grate just touching the soil surface. This was adequate for removing rocks lying on the surface, however, partially buried rocks were pushed back into the soil by the grate. The grate could be set below the soil surface to remove small embedded rocks if the field was not too firm. Caution was needed to prevent damage to the grate and frame when working in fields containing large embedded rocks.

Trash and Soil Retention: The amount of soil and trash placed in the hopper depended on machine operation and field conditions. Operating with the grate set too low, the reel speed too fast or in fields containing dirt lumps or trash increased the amount of soil and

¹The tooth index is the ratio of the tangential tooth tip speed to the forward speed. A high tooth index gives aggressive picking action.

trash retained. Properly formed, clean windrows were necessary to minimize soil retention when picking fields windrowed with a rock rake.

Field Preparation: Best performance was in fields with a firm base and a minimum amount of trash or dirt lumps. It is often desirable to use a rod weeder before picking to place rocks on the surface, and to firm the soil.

The use of the rock rake is recommended when working in fields with an abundance of rocks smaller than 300 mm (12 in). The rock rake brings most rocks to the surface and reduces picking time.

Stability: The Leon A3000 was very stable. Skewing occurred only when the grate hooked large subsurface rocks. When this occurred, the grate either jumped over the rock or the picker skewed to the left until the grate cleared the rock.

Rock Size: The Leon A3000 could effectively remove rocks ranging in size from 50 mm (2 in) to 740 mm (29 in). Rocks smaller than 50 mm (2 in) fell through the grate and remained in the field. Rocks larger than 740 mm (29 in) would not pass between the reel centre shaft and the grate.

EASE OF OPERATION AND ADJUSTMENT

Reel Drive: The test machine was equipped with the optional hydraulic reel drive, powered by the tractor remote hydraulics. Reel speed could be varied by adjusting a flow control valve on the rock picker. The operator manual recommended that a tractor with a hydraulic system capable of 12,750 kPa (1850 psi) at 54 L/m (12 gpm) be used. An optional power take-off driven hydraulic system was available for tractors unable to provide sufficient hydraulic flow and pressure to operate the reel. The hydraulic pressure relief valve effectively prevented damage to the reel and grate during the test.

On some tractors, the hydraulic flow was sufficient to operate the grate lift and reel at the same time but it could not be properly divided between the two functions. For these tractors, the reel slowed when the grate height was adjusted or the grate height response was too slow when the reel was operating. An optional hydraulic kit is available to divide the flow and permit the reel and grate lift to be operated at the same time.

Bat force and clearance between the bat teeth and the grate were adjusted by changing the tension of the reel springs. The reel springs were too weak to prevent rock build-up on the grate in heavy concentration of small rocks.

The reel could be easily reversed from the tractor to clear rock blockages or build-up on the grate.

Hopper Dumping: The hopper held about 1750 kg (3850 lb) of large or small rocks when completely filled (FIGURE 5). One pair of tractor remote hydraulic outlets raised the hopper for dumping and controlled the grate height. To dump the hopper, the hydraulics are activated to lower the grate. With the grate fully lowered, the hopper begins to rise. The hopper emptied completely and could pile the rock 860 mm (34 in) high.

Maneuverability: The Leon A3000 was quite maneuverable. Its turning radius was short enough for easy operation, however, normal care had to be taken to prevent interference between the tractor tire and the picker frame when making right turns.

Since it is desirable to feed rocks into the rock picker without driving over them, the distance between the hitch and the outside of the right tractor tire should not exceed 700 mm (23 in).

Transporting: The Leon A3000 was easily transported. It towed well at speeds up to 40 km/h (25 mph). The 160 mm (6 in) transport clearance was adequate. Two transport locks (FIGURE 6) prevented the grate from being lowered while transporting. The transport locks became very difficult to insert because the grate would not lift high enough due to wear in the lift linkage. A storage location was not provided for the transport locks when they were not in use. Modifications to provide more convenient transport locks are recommended.

Hitching: The Leon A3000 was easily hitched to a tractor. A hitch jack was provided and the hitch clevis was fixed allowing one-man hook-up. The hitch clevis was adjustable vertically to permit frame levelling. Interference between the hitch jack handle and the hydraulic hoses made raising and lowering inconvenient. Modifications to eliminate interference between the jack handle and the hydraulic hoses are recommended.

Ease of Servicing: Servicing was easy. All grease fittings and

chains required 10 hour lubrication and were accessible.



a)



b)

FIGURE 5. Typical Hopper Loads in a) Small Rocks, b) Large Rocks.



FIGURE 6. Improperly Positioned Transport Locks.

POWER REQUIREMENTS

A tractor with 45 kW (60 hp) maximum power take-off rating had sufficient power reserve to operate the Leon A3000 in most conditions. Average power requirements varied widely, depending on field conditions. High draft forces occurred when the grate hooked partially buried rocks.

OPERATOR MANUAL

The operator manual contained a parts list, detailed assembly instructions, a list of safety precautions and information on machine adjustments. The manual also contained sufficient information on proper operating procedures.

OPERATOR SAFETY

The Leon A3000 was hazardous to operate with a tractor without a cab. Weak reel springs allowed the bat arms to retract when the grate became congested with rocks. Rocks were frequently thrown at the tractor by the reel when rock build-up occurred on the grate. The rear window of the tractor used during the test was broken by one of these rocks and illustrates the potential danger to

the operator. The operator manual recommends that the operator wear a safety helmet.

Large rocks that jammed between the reel bats and the grate also presented a safety hazard. Some rocks could only be removed with a tractor and a chain, which required the operator to work near the fully retracted reel bat. If the bat were to suddenly release, serious bodily harm could result.

Modifications to reduce rock build-up on the grate and rock jamming have been recommended.

The maximum load on each of the two 11L x 15, 8-ply tires was 1597 kg (3520 lb) with a full hopper. This exceeded the maximum load of 1324 kg (2930 lb) recommended by the Tire and Rim Association. Although the tires were overloaded, no failures occurred during the test.

A slow moving vehicle sign was not supplied. It is recommended that a slow moving vehicle sign be supplied as standard equipment.

DURABILITY RESULTS

TABLE 2 outlines the mechanical history of the Leon A3000 during 100 hours of field operation. The intent of the test was functional evaluation. The following mechanical problems are those, which occurred during the functional testing. An extended durability test was not conducted.

TABLE 2. Mechanical History

Item	Hours
Hydraulics:	
-A fitting on the flow control valve was broken by a flying rock and was replaced at	56
Hopper:	
-The spring clip on the hydraulic cylinder pin broke and was replaced at	60
-The hydraulic hose to the hopper cylinder was broken by a flying rock and was replaced at	76
Tires:	
-The right tire was punctured by a rock and was replaced at	88

DISCUSSION OF MECHANICAL PROBLEMS

Hydraulics: The hydraulic fitting on the hose supplying the flow control valve was broken by a rock thrown forward by the reel. It is recommended that the manufacturer consider modifications to protect the hydraulic valve and hoses from rock damage.

APPENDIX I SPECIFICATIONS

MAKE:	Leon Rotary Rock Picker
MODEL:	A3000 Series II
SERIAL NUMBER:	940-002
WEIGHT: (hopper empty)	
-- left wheel	588 kg
-- right wheel	768 kg
-- hitch	262 kg
TOTAL	1618 kg
TIRES:	2, 11L x 15, 8-ply
OVERALL DIMENSIONS:	
-- width	2560 mm
-- height	1930 mm
-- length	3970 mm
-- ground clearance	162 mm
GRATE:	
-- width	1356 mm
-- number of grate bars	16
-- space between grate bars	51 mm
-- length of grate bars	760 mm
-- grate angle, while operating	56 degrees
REEL:	
-- diameter	1575 mm
-- number of bat arms	3
-- number of teeth per bat	17
-- spacing between teeth	60 mm
-- tooth length	150 mm
-- reel speed	0 to 53 rpm @ 68 L/m
HOPPER:	
-- hopper dumping height	860 mm
-- hopper capacity	1750 kg
HYDRAULIC MOTOR:	1, Char-Lynn No. 107 1010 004
NUMBER OF HYDRAULIC CYLINDERS:	2
NUMBER OF CHAIN DRIVES:	1
NUMBER OF LUBRICATION POINTS:	22
OPTIONAL EQUIPMENT:	
-- hydraulic drive	
-- stone guard	

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 hectare (ha)	= 2.5 acres (ac)
1 kilometre/hour (km/h)	= 0.6 miles/hour (mph)
1 metre (m)	= 3.3 feet (ft)
1 millimetre (mm)	= 0.04 inches (in)
1 kilowatt (kW)	= 1.3 horsepower (hp)
1 kilogram (kg)	= 2.2 pounds mass (lb)



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