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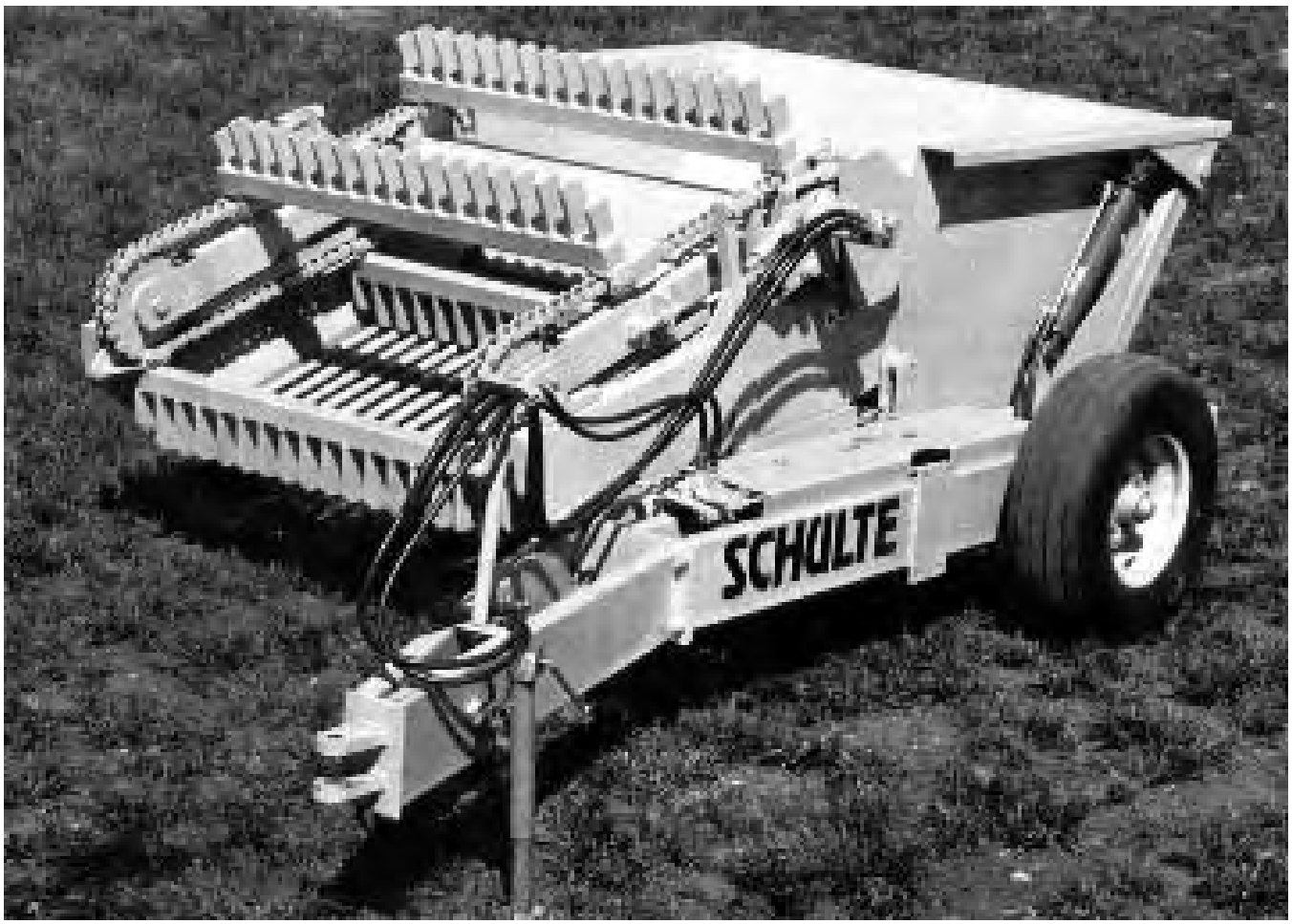


Schulte RSH-4 Semi-High Lift Rock Picker

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

SCHULTE RSH-4 SEMI-HIGH LIFT ROCK PICKER

MANUFACTURER AND DISTRIBUTOR:

Schulte Industries Ltd.
Box 70
Englefeld, Saskatchewan
S0K 1N0

RETAIL PRICE:

$6,015.00 (July, 1981, f.o.b. Humboldt, complete with optional hydraulic conveyor drive.)

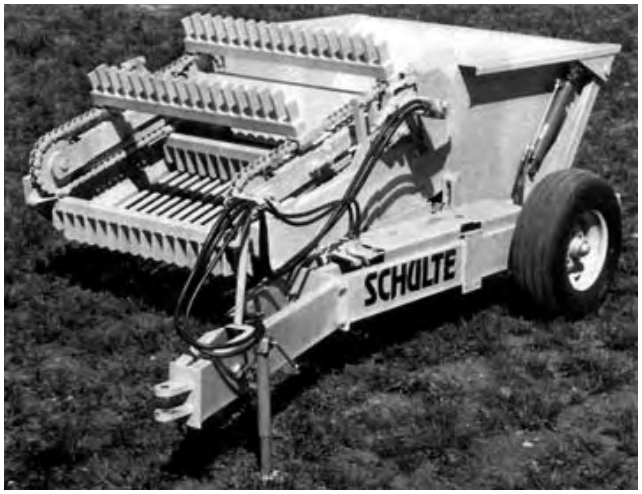


FIGURE 1. Schulte RSH-4.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Schulte RSH-4 rock picker was good in both small and large rocks. Ease of operation and adjustment were good.

Typical field speeds were from 2.5 to 5 km/h (1.5 to 3 mph) in scattered rocks and from 0.8 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 Schulte RSH-4 could pick rocks from 50 to 520 mm (2 to 20 in) in size. In rocks smaller than 75 mm (3 in), the workrate was reduced by rocks frequently jamming between the grate bars.

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

Hopper capacity was about 1980 (4360 lb). The hopper dumping height of 1080 mm (42 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 Schulte RSH-4 in most field conditions. The Schulte RSH-4 transported well at speeds up to 40 km/h (25 mph).

The operator manual contained a parts list, assembly instructions and some information on operation and servicing. No information was included on adjustments or safety.

No serious safety hazards were evident as long as normal safety practices were followed. A slow moving vehicle sign was not supplied.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to prevent small rocks from jamming between the grate bars.
2. Supplying an optional hydraulic valve kit for tractors that cannot divide the hydraulic flow to operate the grate lift and conveyor at the same time.
3. Providing a more convenient transport lock.
4. Expanding the operator manual to include detailed information on operation, adjustment and servicing.
5. Supplying a slow moving vehicle sign.
6. Modifications to protect the hydraulic selector valve 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. The tapered T-iron bars of 1980 and earlier machines are being replaced by a form steel tapered bar having a much wider base contact point, greatly reducing sideways deflection of the grate bars. This modification has virtually eliminated jamming of small rocks.
2. The absence of a flow divider kit for the hydraulic drive rock picker has not apparently restricted sale of this model. No change is contemplated.
3. A revised transport lock is being considered for 1982 model production. This system would use a simple pin lock arrangement.
4. The 'RS' rock picker manual will be expanded to include additional operation, adjustment and service information when it is reprinted in 1982.
5. A 'slow moving vehicle' decal is being provided as of August 1981.
6. Review of warranty claims indicate that a shield is not required over the hydraulic selector valve.

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

GENERAL DESCRIPTION

The Schulte RSH-4 is a pull-type rock picker with a 1.3 m (53 in) wide grate. As standard equipment, it is supplied with a 540 rpm power take-off driven conveyor. The test machine was equipped with an optional hydraulic conveyor drive powered by the tractor hydraulic system.

The Schulte RSH-4 is designed for picking rocks from the soil surface. An inclined, adjustable finger grate, consisting of 17 steel bars spaced at 45 mm (1.8 in) operates just beneath the soil surface. Rocks are assisted onto the grate and conveyed along it into a hopper, by a floating undershot conveyor, consisting of four bats, with 18 teeth each, mounted between two roller chains. The hopper holds about 1980 kg (4360 lb) of rocks. Grate height and hopper dumping are hydraulically controlled.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Schulte RSH-4 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)	77
200 to 300 mm (8 to 12 in)	20
Greater than 300 mm (12 in)	7
Total	104
Rock Concentration	**Hours**
Light	27
Medium	72
Heavy	5
Total	104

RESULTS AND DISCUSSION

RATE OF WORK

Suitable field speeds ranged from 2.5 to 5 km/h (1.5 to 3 mph) in scattered rocks and from 0.8 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 smaller than 75 mm (3 in) as the conveyor frequently jammed on rocks that wedged between the grate bars.

QUALITY OF WORK

Picking Characteristics: The conveyor bats were rigidly attached to the two conveyor chains. The conveyor assembly could lift up to 190 mm (7 in) to clear large rocks. The clearance between the grate and the conveyor cross member, with the conveyor fully raised, was 520 mm (20 in). The hydraulic conveyor drive was equipped with a pressure relief valve.

Conveyor aggressiveness was very good. If too many rocks were fed onto the grate, the conveyor assembly lifted causing rock build-up on the grate. In heavy concentrations of small rocks (FIGURE 2), two passes were usually needed to remove most of the rocks. Rocks smaller than 75 mm (3 in) frequently jammed between the grate bars stopping the conveyor (FIGURE 3). Most jammed rocks could be removed by reversing the conveyor. Small rocks in the hopper, however, sometimes jammed between the conveyor bat teeth and the rear of the grate, preventing the conveyor from being reversed. When this occurred, the jammed rocks had to be removed by hand. Modifications to prevent small rocks from jamming between the grate bars are recommended.

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

In large rocks (FIGURE 4), one pass was usually sufficient. Rocks larger than 520 mm (20 in) jammed between the header cross member and the grate (FIGURE 5). Such rocks could usually be removed by reversing the header chain.

The 1.3 m (53 in) wide grate was wide enough to accept most rock windrows. In non-windrowed areas of concentrated rock, a wider grate would be desirable.

Conveyor Speed: Proper conveyor 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 if the conveyor speed was too slow. If the conveyor speed was too fast, rocks were thrown over the back of the hopper. A conveyor chain speed of 14 rpm, corresponding to a hydraulic flow of 40 L/m (9 gpm), was adequate for most field conditions.

FIGURE 3. Small Rocks Jammed in the Grate.

FIGURE 4. Performance in Large Rocks: (Top: Before Picking, Bottom: After One Pass with Picker).

FIGURE 5. Typical Large Rock Jam.

To effectively remove surface rocks and to minimize soil retention in the hopper, both the conveyor speed and the ground speed had to be selected to suit field conditions. In scattered rocks, best performance was achieved with a tooth index[1] of about

[1]*The tooth index is the ratio of the tangential tooth tip speed to the forwardspeed. A high tooth index gives aggressive picking action.*

1.5 in fields with light rock concentrations, 2 in fields with medium rock concentrations and 3 in fields in heavy rock concentrations. In windrowed rocks, best performance was achieved with a tooth index of about 2.3 in fields with light rock concentrations, 3.7 in fields with medium rock concentrations and 9.2 in fields with heavy rock concentrations. Operating at a conveyor speed of 14 rpm, corresponding ground speeds were about 5, 3.7 and 2.5 km/h (3.0, 2.3 and 1.5 mph) in scattered rocks for light, medium and heavy concentrations, respectively. In windrowed rocks, ground speeds were about 3.2, 2.1 and 0.8 km/h (2.0, 1.3 and 0.5 mph) for light, medium and heavy rock concentrations, respectively.

Operating Depth: It was usually best to operate 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 with the rocks depended on machine operation and field preparation. The amount of soil retained was small in most field conditions due to the long grate bars and the linear motion of the bats. Operating with the grate set too low, the conveyor speed too fast or working in fields containing dirt lumps or trash increased the amount of soil and trash retained. Properly formed, clean windrows were necessary to keep soil retention to a minimum 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 the rocks on the surface, and to firm the soil.

The use of a 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 Schulte RSH-4 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 Schulte RSH-4 could effectively remove rocks ranging in size from 50 mm (2 in) to 520 mm (20 in). Rocks smaller than 50 mm (2 in) fell through the grate and remained in the field. Rocks larger than 520 mm (20 in) would not pass between the conveyor cross member and the grate.

EASE OF OPERATION AND ADJUSTMENT

Conveyor Drive: The test machine was equipped with the optional hydraulic conveyor drive, powered by the tractor remote hydraulics. Conveyor speed could not be adjusted on the rock picker, but could be adjusted by changing the flow control valve on some tractors or by reducing tractor engine speed. The manufacturer recommended that a tractor with a hydraulic system capable of 10,350 to 13,800 kPa (1500 to 2000 psi) at 54 to 100 L/m (12 to 22 gpm) be used. The test machine was operated with a tractor capable of 15,500 kPa (2250 psi) at 54 L/m (12 gpm). This was adequate for most field conditions. The hydraulic pressure relief valve effectively prevented serious conveyor damage.

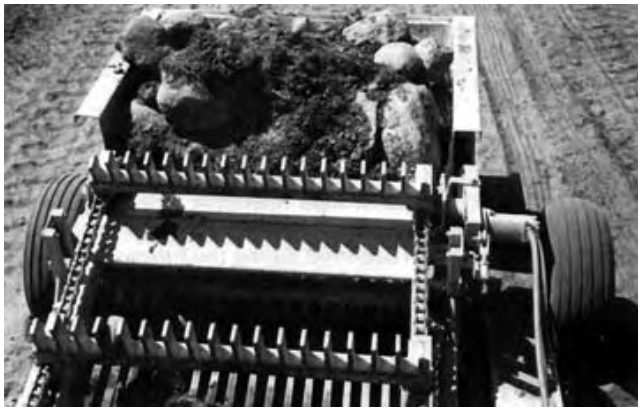
On some tractors, the grate height response was very slow when the conveyor was operating, even though the tractor hydraulic flow was sufficient to operate the conveyor and grate lift at the same time. Although the tractor flow was adequate it could not be properly divided between the two functions. It is recommended that the manufacturer supply an optional valve kit to allow the rock picker to be used on these tractors.

Proper conveyor chain tension was necessary for best operation. The bats rotated slightly, decreasing the angle between the bat teeth and the grate when the conveyor chains were too loose. When this occurred, rocks frequently jammed between the bat teeth and the grate. Proper chain tensioning was not discussed in the operator manual.

The conveyor could be easily reversed from the tractor to clear rock blockages.

Hopper Dumping: The hopper held about 1980 kg (4360 lb) of large or small rocks (FIGURE 6). One pair of tractor remote hydraulic outlets and a selector valve on the rock picker raised the hopper for dumping and controlled the grate height. To dump the hopper, the tractor hydraulic lever was activated after the selector valve was set to the hopper control position by pulling a rope running to the tractor. The hopper emptied completely and could pile the rocks 1080 mm (42 in) high.

(a)



(b)

FIGURE 6. Typical Hopper Loads in a) Small Rocks, b) Large Rocks.

Maneuverability: The Schulte RSH-4 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 900 mm (36 in).

Transporting: The Schulte RSH-4 was easily transported. It towed well at speeds up to 40 km/h (25 mph). The 196 mm (7.7 in) transport clearance was adequate. One transport lock (FIGURE 7) prevented the grate from being lowered while transporting. The transport lock was difficult to install and a storage location was not provided when it was not in use. Modifications to provide a more convenient transport lock are recommended.

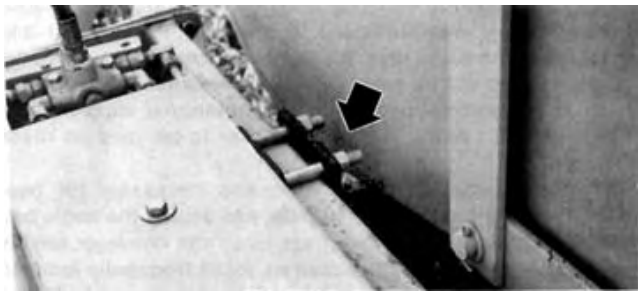


FIGURE 7. Transport Lock.

Hitching: The Schulte RSH-4 was easily hitched to a tractor.

A hitch jack was provided and the hitch clevis was fixed allowing one man hook-up. The vertical height of the hitch clevis was not adjustable and a tractor drawbar height of 390 mm (15 in) was needed to keep the picker frame level. If the tractor was equipped with a cab, it was sometimes difficult to find a suitable place for the hydraulic selector valve ropes to enter the cab and have the ropes completely operative.

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

chains were accessible. Frequency of lubrication was not given in the operator manual.

POWER REQUIREMENTS

A tractor with 45 kW (60 hp) maximum power take-off rating had sufficient power reserve to operate the Schulte RSH-4 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 and some information on operation and servicing. It is recommended that the operator's manual be expanded to include detailed information on operation, adjustment and servicing.

OPERATOR SAFETY

The Schulte RSH-4 was safe to operate as long as normal safety practices were observed. Shielding provided adequate protection from driveline components. Few rocks were thrown at the tractor.

The maximum load on each of the two 11L x 15, 6-ply tires was 1880 kg (4145 lb) with a full hopper. This exceeded the maximum load of 1122 kg (2470 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 Schulte RSH-4 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	Operating Hours
Reel:	
-A cast mounting flange for a conveyor chain bearing cracked and was replaced at	51, 65
-The conveyor drive chain broke and was replaced at	82
-A conveyor chain connector link broke and was replaced at	100
Hydraulics:	
-The hydraulic hose fittings on the selector valve were broken by a flying rock and were repaired at	95

DISCUSSION OF MECHANICAL PROBLEMS

Hydraulics: The hydraulic fittings were broken when rocks thrown forward by the conveyor, occasionally hit the selector valve and hoses located on top of the hitch frame. Modifications to protect the hydraulic valve and hoses from rock damage are recommended.

APPENDIX I
SPECIFICATIONS

MAKE:	Schulte Semi-High Lift Rock Picker
MODEL:	RSH-4
SERIAL NUMBER:	058245603
WEIGHT: (hopper empty)	
-- left wheel	606 kg
-- right wheel	862 kg
-- hitch	308 kg
TOTAL	1776 kg
TIRES:	2, 11L x 15, 6-ply
0VERALL DIMENSIONS:	
-- width	2955 mm
-- height	1400 mm
-- length	4270 mm
-- ground clearance	196 mm
GRATE:	
-- width	1341 mm
-- number of grate bars	17
-- spacing between grate bars	45 mm
-- length of grate bars	1080 mm
-- grate angle while operating	32 degrees
CONVEYORS:	
-- number of bat arms	4
-- number of teeth per bat	18
-- spacing between teeth	60 mm
-- tooth length	150 mm
-- conveyor chain speed	14 rpm @ 40 L/m
HOPPER:	
-- hopper dumping height	1080 mm
-- hopper capacity	1980 kg
HYDRAULIC MOTOR:	1, Char-Lynn No. 104 1027 005
NUMBER OF HYDRAULIC CYLINDERS:	3
NUMBER OF CHAIN DRIVES:	1
NUMBER OF LUBRICATION POINTS:	8
OPTIONAL EQUIPMENT:	
-- hydraulic drive	

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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