

Evaluation Report

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McKee Bale-rustler

A Co-operative Program Between



McKee Bale-rustler

Manufacturer:

McKee Bros. Limited
P.O. Box 70
Elmira, Ontario

Distributor:

Saskatchewan- Farmland Sales Ltd., Regina
Alberta - Br. McKee Harvester (Alberta) Ltd., Red Deer
Wheat-Belt Industries Ltd., Calgary
Manitoba - Yetman's Ltd., Winnipeg

Retail Price:

\$4395.00 (June, 1977, f.o.b. Regina)



Figure 1. McKee Bale-rustler in Transport Position.



Figure 2. McKee Bale-rustler in Loading Position.

Summary and Conclusions

The functional performance of the McKee Bale-rustler was good for loading and hauling large round bales from the field as well as for unloading at the storage area.

The McKee Bale-rustler moved firm bales effectively. Five large round bales could be loaded providing the bales were placed tightly together and there was little overhang. If the bales were fluffy or ragged it was difficult to load the last bale without losing a bale off the rear of the conveyor. The wagon load rating of 3625 kg (8000 lb) could be exceeded if average bale weight was more than 725 kg (1600 lb). If the first bale loaded was heavier than 680 kg (1500 lb), the wagon became unstable with the right wheel rising from the ground during loading. Successive bales did not tip the wagon as the weight of the first bale on the bed prevented unbalance. Operator experience was needed before bales could be loaded or unloaded in a continuous, uniform and orderly manner.

The Bale-rustler towed very well, when fully loaded, at speeds up to 29 km/h (18 mph). The wagon trailed directly behind the tractor for safe road transport and easy maneuvering in confined areas.

Overall durability was very good but was reduced by failure of the cradle cylinder frame bracket.

In average field conditions it took an experienced operator four minutes to load five bales, while unloading and placing five bales in the storage area took about two and one-half minutes. Field efficiency depended largely on hauling distance and the speed at which the tractor could safely travel during transport. For example, in one field of alfalfa and brome grass it took from 20 to 25 minutes to load, transport and unload five bales and return to the field. This included 0.4 km (0.25 mi) of field transport and 0.8 km (0.5 mi) of road transport.

No safety hazards were apparent when the mover was operated according to normal recommended procedures.

Recommendations

It is recommended that the manufacturer consider:

1. Modification to eliminate failure of the cradle cylinder frame bracket.
2. Providing hydraulic hose support clamps beneath the hitch tongue.
3. Providing the outrigger assembly as standard equipment.
4. Using carriage bolts in side panel assembly to prevent twines from catching on the bolt heads.

Chief Engineer- E. O. Nyborg

Senior Engineer- L. G. Smith

Project Engineer- T. G. Strilchuk

The Manufacturer States That

With regard to recommendation number:

1. The area of failure reported has been strengthened and redesigned, to prevent further failures, under a factory rework program.
2. Hose support brackets have been added in new production machines to improve this situation.
3. Presently, there have not been sufficient requests for this option to indicate that it should be applied as standard equipment.
4. It appears, that on the machine tested, the bolts were improperly located. Steps are being taken to ensure their proper location.

General Description

The McKee Bale-rustler (Figure 1) is a self-loading, tilting bed, two wheel trailer for use with tractors 30 kW (40 hp), or larger, equipped with dual hydraulics. Bales are picked up on the left side at the tractor with an hydraulic cradle pickup and are placed lengthwise on the bed.

The main frame consists of a solid axle with an A-frame hitch. The bed, which tilts backward for unloading, consists of two chain rails spaced at 915 mm (36 in) complete with floor and side panels.

The 8080 mm (318 in) long bed holds five bales.

Complete specifications are found in Appendix I.

Scope of Test

The Bale-rustler was operated in typical prairie fields (Table 1) for 106 hours while moving about 480 large round bales.

It was evaluated for ease of operation, quality of work, operator safety, and suitability of the operator's manual.

Table 1. Operating Conditions

<u>Crop</u>	<u>Hours</u>	<u>Field Topography</u>	<u>Field Condition</u>
Brome Alfalfa & Crested Wheatgrass	16	Gently rolling	Rough Occasional stones
Wheat Straw	32	Moderately rolling	Slightly ridged
Alfalfa	19	Moderately rolling	Smooth
Brome grass	22	Strongly rolling	Ridged
Wheat straw	17	Moderately undulating	Slightly ridged

Results and Discussion

EASE OF OPERATION

Hitching: The Bale-rustler was equipped with a fixed clevis hitch. A properly sized hitch pin with a suitable locking device made the hook-up reliable and safe. Four hydraulic hoses and two selector valve ropes also had to be attached to the tractor.

Loading: The Bale-rustler is prepared for loading by raising the cradle and removing the safety channel from the cradle lift cylinder. A bale is approached from the end with the centre of the cradle arms aligned with the bale axis and the cradle is lowered to ground level just before contacting the bale. The fork tines slide under the bale until the bale contacts the rear cradle brace. The pickup cradle is then lifted to raise the bale onto the bed.

The first bale could not be loaded, without stopping the tractor, if the bale was heavier than 680 kg (1500 lb). The weight of the bale in the cradle caused the right wagon wheel to lift off "the ground (Figure 3) as the bale was loaded. The wheel continued to lift until the tractor drawbar restrained further tipping and the bale could be lifted onto the bed. Once one bale had been placed on the bed, the weight of this bale prevented tipping when loading successive bales. Fluid was added to the right tire but this helped only slightly. Since many bales weigh more than 680 kg (1500 lb) it is recommended that the optional automatic outrigger (not tested) be supplied as standard equipment with the Bale-rustler. The outrigger supports the wagon and eliminates tipping regardless of the weight of the first bale.

Once the first bale has been loaded, the cradle is left in raised position while travelling to the next bale. The bed chains are engaged to move the first bale rearward on the bed to give room for the second bale. Successive bales are loaded in the same way (Figure 4). Bales had to be placed tightly together on the bed to permit loading five bales.



Figure 3. Sideways Tipping of the Bale-rustler when the First Bale Loaded Weighs More than 680 kg (1500 lb)

Proper bale and cradle alignment was important to prevent twines being snagged by the fork tines. If the fork tines passed over the twine, during approach, the bale was held in the cradle by the twines and would not drop on to the bed when the cradle was raised. Slight bale misalignment could be tolerated, as long as no twines were snagged, since the bale straightened itself in the cradle during lifting.



Figure 4. Bale-rustler Approaching the Fifth Bale.

Operator experience was needed to load bales without stopping the tractor. The cradle had to be raised as soon as the bale contacted the cradle back brace. Allowing the bale to skid on the ground damaged the twines.

Bales could also be loaded from the rear by tilting the bed and backing the mover under the bale with the rail chains in reverse. The tractor speed had to match the rail chain speed to avoid twine damage. Rear loading was convenient for picking bales at field edges or loading bales which had already been placed in rows.

Bale damage during loading was insignificant for new bales. Slight damage occurred to old bales which had settled forming flat spot at the bottom. When bales are loaded from the front each bale is rotated as it is placed on the bed (Figure 5) leaving the flat spot up. Rotation during loading disturbed the ragged edges of poorly formed bales. Loose bales, which had not been wrapped with twine, unfurled during loading resulting in significant losses.



Figure 5. Fully Loaded Bale-rustler. Bales are Rotated During Loading Leaving the Weathered Side Down.

The Bale-rustler had a bed length of 8077 mm (26.5 ft). Some round balers form 1700 mm (5.7 ft) long bales, in which case the rear bale had to overhang at the back of the bed when loading the fifth bale. The rear bale sometimes fell off the end of the bed, when the last bale was being loaded, if the field was rough. As soon as the last bale was on the

bed, the load could be moved forward to equalize overhang at the front and rear of the bed during transport. The manufacturer's maximum load rating for the wagon was 3625 kg (8000 lb). If average bale weight was greater than 725 kg (1600 lb) the manufacturer's load rating would be exceeded with a full load.

The Bale-rustler loaded on the left side of the tractor. This meant that the operator faced left away from the tractor hydraulic controls but this did not hinder operator performance.

Transporting: When the bed is fully loaded (Figure 5) the cradle is left in raised position and safety channel is installed on the cradle lift cylinder for safe road transport. A permanent slow-moving vehicle sign was located at the rear of the mover.

The McKee Bale-rustler towed well on rough fields and trailed well on roadways at speeds up to 29 km/h (18 mph). Hay loss during transport was insignificant. The side and bottom panels on the bed prevented loss of loose hay. The length of the mover necessitated care in crossing sharp gullies and ravines.

Placement: The Bale-rustler is unloaded from the rear. With the bed tilted rearward the rail chains are engaged as the tractor advances forward slowly. It was very easy to place tight rows of bales (Figure 6). Sometimes, the bale twines snagged on the bolt heads on the bed side sheets, damaging or breaking the twines. The use of carriage bolts in bed assembly would eliminate this problem.



Figure 6. Bales Placed Tightly Together in a Row.

If preference was to space bales in the row during unloading the rail chains had been engaged intermittently as the bales were placed on the ground. Because of poor rear visibility it was difficult to space bales uniformly.

Depending on operator preference, rows of bales could easily be spaced or could be placed tightly together (Figure 7).

QUALITY OF WORK

The Bale-rustler was effective in loading large round bales, transporting them and placing them in the storage yard. Both the quality of work and the rate of work were very dependent on operator experience.

Bale damage was insignificant for firm, fresh bales. Hay loss occurred only when handling loose or untied bales. Losses during transport were negligible.

The Bale-rustler rotated bales during loading leaving the weathered side down and the flat side, which had rested on



Figure 7. Rows of Bales Placed Closely Together.

the ground, upward. Since the bales are not returned to original position during unloading, bales would probably have less ability to shed rain and would have increased spoilage due to weathering on the previously unweathered side. It is recommended that bales be moved to storage soon after baling to eliminate the possibility of weathering on two sides.

Table 2 gives an indication of expected work rate with an experienced operator. This table gives the average time, based on five trips to load, transport, and place a load of five large round brome-alfalfa bales from a rough field yielding 2.2 t/ha (1 ton/ac). Each one-way trip involved 0.4 km (0.25 mi) of travel from the field to a grid road and 0.8 km (0.5 mi) of road travel. As can be seen, even for a short haul, most time is spent in transport rather than in loading or unloading.

Table 2. Average Rate of Work

Travel to Field (1.2 km)	6.7 Min
Load Five Bales	6.4 Min
Travel to Storage Yard (1.2 km)	7.1 Min
Unload Bales	2.3 Min
Round Trip	22.5 Min

OPERATOR SAFETY

The Bale-rustler was safe to operate if the manufacturer's safety precautions were observed. Bystanders should not stand near the cradle or on the mover during operation. Maintenance should not be carried out with a full or partial load. Large bales can cause severe injury.

The towing tractor should be sufficiently heavy and equipped with good brakes for road transport with a full load. The manufacturer recommends a minimum 30 kW (40 hp) tractor for safe road transport.

Bale-rustler was equipped with a permanently affixed slow moving vehicle sign for transport on public roads.

Individual tire loads, calculated for a fully loaded wagon of five 680 kg (1500 lb) bales, exceeded the Tire and Rim Association Standard maximum rating for 11L x 15, 12 ply tires by 34%. This could be hazardous when operating at high road speeds.

OPERATOR'S MANUAL

The operator's manual clearly described assembly set-up, operation, adjustment and maintenance. It also provided a comprehensive parts list. It was brief and easy to understand.

Durability

Table 3 outlines the mechanical history of the McKee Bale-rustler during 106 hours of operation while moving about 480 large round bales. The intent of the test was evaluation Of functional performance. The following failures represent only those which occurred during functional testing. An extended durability evaluation was not conducted.

Table 3. Mechanical History

Item	Hours	Number of Bales
The cradle cylinder frame bracket cracked at the weld and was re-welded at	41	285
The bed rail chains were tightened at	18	140
The main frame cross member broke at the cradle cylinder bracket and was welded at	94	400

Discussion of Mechanical Problems

Cradle Cylinder Frame Bracket: The main frame box section to which the cradle cylinder bracket is welded broke, in tension, with the failure initiating at the weld. Since two failures occurred during the test, modifications are indicated.

APPENDIX I

SPECIFICATIONS

Model: McKee Bale-rustler

Serial Number: 295

Pickup Side: Left

Dimensions:

-Length	9240 mm (364 in)
-Width (road)	2440 mm (96 in)
-Width (field)	4260 mm (167 in)
-Bed Height	787 mm (31 in)
-Length	8077 mm (318 in)
-Bed Rail Width	915 mm (36 in)
-Ground Clearance	279 mm (11 in)
-Tires	2, 11L x 15, 12 ply

Hydraulics:

-Cradle Cylinder	
Bore	102 mm (4 in)
Stroke	508 mm (20 in)
Retracted Length	805 mm (31.7 in)
Port Size	2, 1/2 NPTF
-Bed Cylinder	
Bore	76 mm (3 in)
Stroke	254 mm (10 in)
Retracted Length	515 mm (20.25 in)
Port Size	2, 1/2 NPTF

Weight: (unloaded)

-Left Wheel	617 kg (1360 lb)
-Right Wheel	515 kg (1135 lb)
-Hitch	338 kg (745 lb)
TOTAL	1470 kg (3240 lb)

Load Capacity: 3625 kg (8000 lb)

Tractor Requirements:

-Manufacturer Recommended Minimum Size	30 kW (40 hp)
-Hydraulics	Dual

Optional Equipment:

Outrigger assembly

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 kilometre/hour (km/h)	= 0.62 miles/hour (mph)
1 tonne (t)	= 2 204.6 pounds (lb)
1 tonne/hectare (t/ha)	= 0.45 ton/acre (ton/ac)
1 metre (m) = 1000 millimetres (mm)	= 39.37 inches (in)
1 kilowatt (kW)	= 1.34 horsepower (hp)
1 kilogram (kg)	= 2.2 pounds (lb)
1 kilopascal (kPa)	= 0.15 pounds/square inch (psi)



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