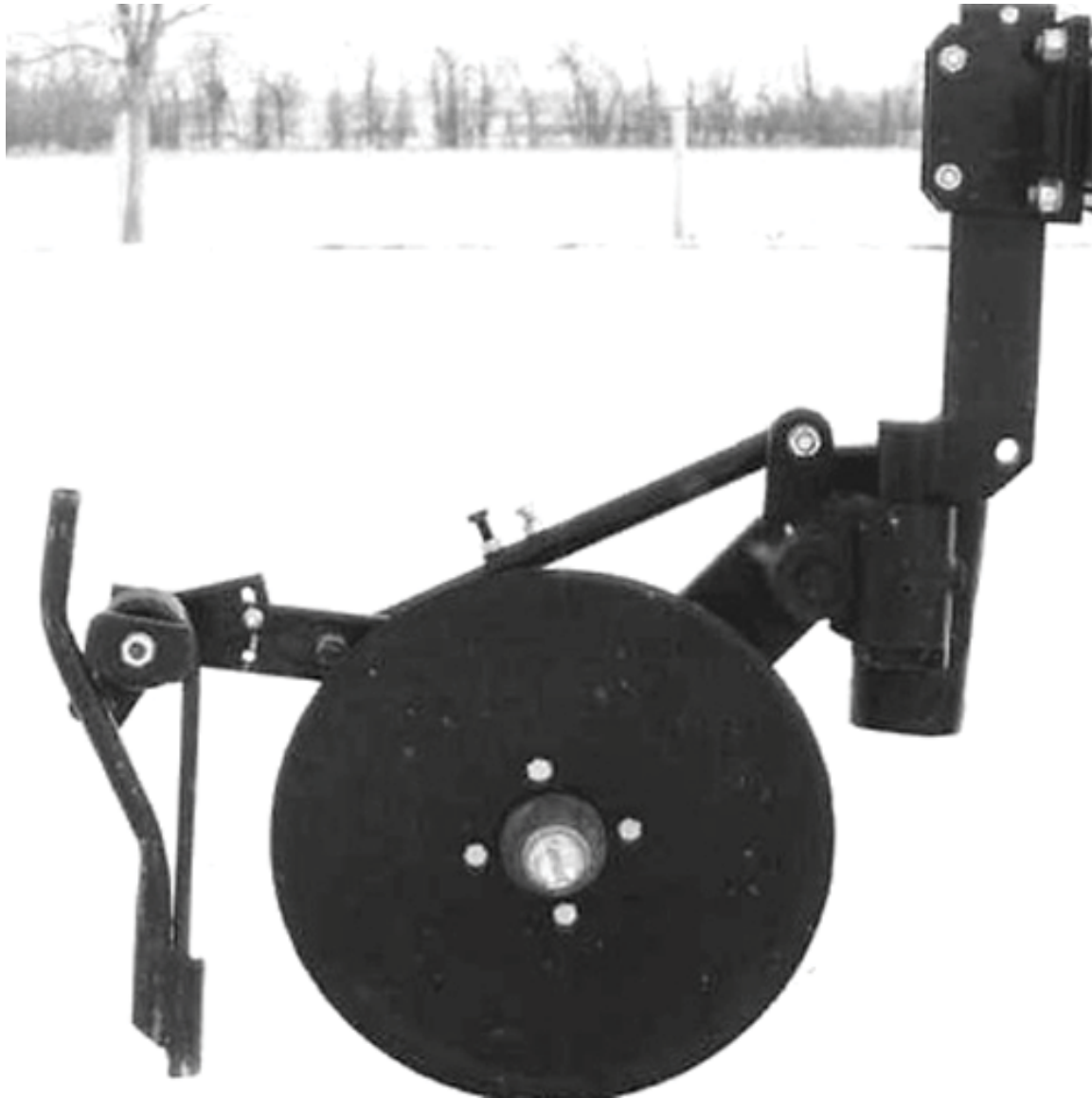


Evaluation Report

734



K-Hart Coulter

A Co-operative Program Between



K-HART COULTER

Manufacturer:

K-Hart Industries Ltd.
P.O. Box 520
Elrose, SK S0L 0Z0
(306) 378-2258

Retail Price:

\$425.00 (March 1997 f.o.b. Elrose, SK) for K-Hart Coulters.

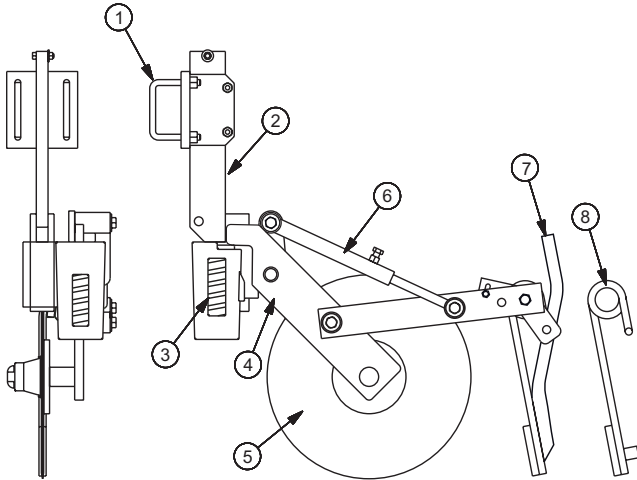


Figure 1. K-Hart Coulters: (1) Frame Mount, (2) Shank, (3) Spring Assembly, (4) Coulters Arm, (5) Coulters Blade, (6) Adjustable Rod, (7) Granular Fertilizer Attachment and (8) Anhydrous Ammonia Fertilizer Attachment.

SUMMARY

QUALITY OF WORK

Penetration of the K-Hart Coulters was very good. The coulters did not ride out of the ground except in very hard soil such as wheel tracks.

Fertilizer placement was good. Variation in fertilizer depth was uniform when soil conditions were uniform. The adjustable arm for the fertilizer attachment minimized but did not prevent soil surface fertilizer placement.

Soil finishing was very good. Soil disturbance of the coulters blades was very low.

Residue clearance was very good. The coulters blade cut through residue in firm soil and dry residue. Operation in stony conditions was very good. Maximum trip clearance of the coulters was 6 in (152 mm).

EASE OF OPERATION AND ADJUSTMENT

Ease of maintenance was very good. The coulters required regular lubrication at 2 pivot points.

Ease of setting the operating depth was good. The depth was set by vertically sliding the shank in the frame mount. The coulters were lowered as far as possible during field testing. The tine depth was set with an adjustable arm. The tine angle was adjusted with a slotted hole located in the tine mounting support. Wrenches were required for all depth settings.

POWER REQUIREMENTS

The tractor size needed to operate 1 coulters at 5 mph (8 km/h) varied from 1.2 to 2.7 PTO hp (0.9 to 2 PTO kW). Maximum tractor size needed to operate each coulters at 5 mph (8 km/h) was 3.1 PTO hp (2.3 PTO kW).

OPERATOR SAFETY

The coulters was safe to use if normal safety precautions were observed.

OPERATOR'S MANUAL

An operator's manual was not provided with the coulters.

MECHANICAL HISTORY

Several nuts were tightened on the adjustable arm for the fertilizer tine depth during the test.

RECOMMENDATIONS

The Alberta Farm Machinery Research Centre (AFMRC) recommends the manufacturer:

1. Supply shorter wheel bolts for the coulters assembly.
2. Extend the coulters shank to allow for deeper coulters depth settings.
3. Increase the tine angle adjustment.
4. Provide an operator's manual.
5. Use locking nuts on the bolts securing the ends of the adjustable arms.

MANUFACTURER'S REPLIES TO RECOMMENDATIONS

The manufacturer states with regard to recommendation number:

1. Shorter wheel bolts supplied in hub assembly so they do not protrude past the hub.
2. Coulters shank extended for deeper coulters depth settings.
3. Tine adjustment angle has been increased by 30%.
4. An operator's manual has now been supplied.
5. Locking nuts used to secure the ends of the adjustment arms.

ADDITIONAL MANUFACTURER'S COMMENTS

1. A grease nipple was installed on hub assembly.
2. Lubrication points were eliminated at 2 pivot points. One was replaced by using a chrome pin and nylon bushing.
3. A better type of dust cap was used on the hub assembly to eliminate the cap from being knocked off by stones.

GENERAL DESCRIPTION

The K-Hart Coulters is a tool bar mounted furrow opener. The coulters is designed to cut residue prior to soil openers and/or place fertilizer. The coulters mounts to the front or back of a frame with 2 U-bolts. The unit consists of a frame mount, shank, spring assembly, coulters arm, coulters blade and fertilizer attachment. The shank slides vertically in the frame mount and is secured with 2 bolts. The coulters arm pivots from side to side and vertically at the bottom of the shank. The side to side swivel can be locked in a straight position. A vertically mounted spring at the front of the coulters arm provides the force for coulters penetration. The coulters blade is bolted to a stub axle. The axle is welded to the end of the coulters arm. The fertilizer attachment consists of a spring loaded tine. The attachment is secured to the assembly by an arm bolted to the coulters arm and an adjustable rod bolted to the shank. A delivery tube is welded to the back of the tine. Delivery tubes are available for granular and anhydrous ammonia fertilizers. Various coulters blade types are available. An auxiliary spring is available to increase spring force.

Four units were mounted and tested on the AFMRC mini air seeder. Row spacing for the units was 20 in (508 mm). John Deere cultivator shanks with McKay spoon openers were used for seeding. Offset rippled with smooth cutting edge, and smooth blade types were used in the test. **Figure 1** shows the location of major components. Detailed specifications are given in **Appendix I**.

SCOPE OF TEST

The K-Hart Coulters were operated in untilled fields with clay loam to clay soil texture. The coulters were used to apply granular urea and anhydrous ammonia. Fertilized area was 200 ac (80 ha). Area fertilized with each coulters unit was 50 ac (20 ha). The fields had occasional stones. The units were evaluated for quality of work, ease of operation and adjustment, power requirements and operator safety. An operator's manual was not provided with the units.

The units evaluated by AFMRC were configured as described in the General Description, **Figure 1**, and the Specifications section of this report. The manufacturer may have built different configurations of this machine before and after AFMRC tests. Therefore, when using this report check the machine under consideration is the same as the one reported here. If differences exist, assistance can be obtained from AFMRC or the manufacturer to determine changes in performance.

RESULTS AND DISCUSSION

QUALITY OF WORK

Penetration: Penetration of the K-Hart Coulters was very good. The coulters did not ride out of the ground except in very hard soil such as wheel tracks. Additional weight was not added to the AFMRC mini air seeder. Lighter tillage or seeding units would require additional weight for adequate penetration of the coulters. The coulters were operated at 5 to 6 mph (8 to 10 km/h) during the test. Penetration of the 17.3 in (439 mm) diameter smooth coulters was slightly better than penetration of the 18.4 in (467 mm) diameter offset rippled coulters.

Force was applied to the coulters by a vertical spring and lever arm assembly. **Figure 2** shows the force deflection curve for the coulters. The spring exerted a continuously increasing force on the coulters throughout the trip cycle. The force exerted on the coulters by the spring ranged from 95 lb (423 N) at a 0.3 in (7.6 mm) deflection to 1200 lb (5340 N) at a 5 in (127 mm) deflection. In normal field operation the coulters tripped 2 to 3 in (51 to 76 mm).

The soil exerted an upward force on the coulters in all conditions. The force ranged from 85 to 200 lb (378 to 890 N). The weight of the toolbar and openers must be enough to overcome the upward force exerted by the soil.

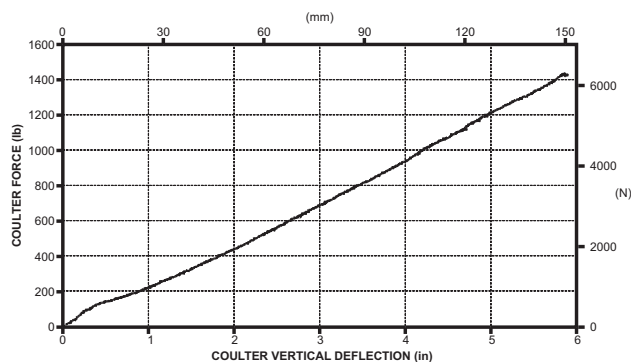


Figure 2. Force Deflection Curve for K-Hart Coulters.

Fertilizer Placement: Fertilizer placement of the K-Hart Coulters was good. The band widths of the rows varied from 0.8 to 1.8 in (20 to 46 mm). Variation in fertilizer depth was uniform when soil conditions were uniform. Uneven soil conditions caused the coulters to trip or penetrate deeper, resulting in varied fertilizer depth. The fertilizer tine was set 0.5 in (13 mm) above the coulters depth during the test.

The adjustable arm for the fertilizer attachment prevented the tine from raising out of the ground more than 1.9 in (48 mm) from the coulters blade during trip action when the initial coulters blade-to-tine separation was 0.5 in (13 mm). This feature was designed to prevent placement of fertilizer on the soil surface, but the 1.9 in (48 mm) separation distance only minimized soil surface fertilizer placement.

Maximum flow by gravity of 46-0-0 fertilizer through the granular tube was 5.3 lb/min (144 kg/h). This corresponds to a rate of 315 lb/ac (353 kg/ha) at a 20 in (508 mm) coulters spacing and 5 mph (8 km/h). Fertilizer flow with an air delivery system was not restricted.

Soil Finishing: Soil finishing of the K-Hart Coulters was very good. Soil disturbance of the coulters blade was very low. The soil disturbance of the smooth coulters was less than the disturbance of the offset rippled with smooth edge coulters. The fertilizer tubes threw small amounts of soil and residue. Small amounts of soil froze to the anhydrous ammonia tine during field operation. The frozen soil did not increase the tine disturbance.

The K-Hart Coulters were lifted out of the ground when turning sharp corners during the field test. Large ruts were left in the field if the coulters were left in the ground on corners. Lifting on corners also prevented damage to the coulters.

Residue Clearance: Residue clearance of the K-Hart Coulters was very good. The coulters allowed residue to flow with no plugging. The coulters blades cut through residue in firm soil and dry residue. Shallow operating depths, soft, moist soil and damp residue conditions caused hairpin residue. The coulters blades' ability to cut residue decreased during the test because of wear.

Stony Conditions: Operation of the K-Hart Coulters in stony conditions was very good. The only stone damage that occurred was to the wheel bolts. The bolt ends protruded out past the hub and were exposed to stones in the field. The AFMRC recommends the manufacturer supply shorter wheel bolts for the coulters assembly. Maximum trip clearance of the coulters was 6 in (152 mm).

EASE OF OPERATION AND ADJUSTMENT

Maintenance: Ease of maintenance of the K-Hart Coulters was very good. The coulters required regular lubrication at the side-to-side and vertical coulters blade pivot points. Both lubrication points were easily accessible. Other maintenance required was to coat the coulters blades with oil or grease to inhibit rust when the units were stored outside for extended periods. The wheel bearings required grease packing once a year.

Transporting: Ease of transporting the test toolbar with the K-Hart Coulters mounted was good. The coulters shanks were slid up the frame mounts for transport. A toolbar with large ground clearance would be required if the coulters were not slid up the frame mounts because the coulters are usually set lower than the seed openers.

Depth Adjustment: Ease of setting the K-Hart Coulters operating depth was good. The depth was set by vertically sliding the shank in the frame mount. The frame mount secured the shank with 2 bolts. Vertical adjustment of the coulters was 6.7 in (170 mm). The coulters were lowered as far as possible during field testing. This setting resulted in a 2 in (51 mm) deeper setting than the seed openers. The AFMRC recommends the manufacturer extend the coulters shank to allow for deeper coulters depth settings. The tine depth was set with an adjustable arm. Two bolts secured the length of the arm. The tine depth was reset after 2 ac (0.8 ha) due to metal fatigue. The depth did not change during the rest of the test.

The tine angle was adjusted with a slotted hole located in the tine mounting support. A nut and bolt secured the tine angle. The tine angle was adjusted so the bottom of the tine was as close to the coulters blade as possible. This resulted in a tine distance of 12 in (305 mm) from the coulters blade centre. Tine distances closer to the coulters blade may be required in some conditions. The AFMRC recommends the manufacturer increase the tine angle adjustment. Wrenches were required for all depth settings.

POWER REQUIREMENTS

Draft: Draft (drawbar pull) requirements of the K-Hart Coulters depended on soil texture and moisture content.

Average draft in primary conditions and clay loam soil for 1 coulters ranged from 60 to 130 lb (267 to 579 N) over a 2.5 to 4 in (64 to 102 mm) depth range. Maximum draft was measured at 150 lb (668 N). Ground speed and coulters blade type did not significantly affect draft.

Tractor Size: The tractor size needed to operate 1 K-Hart Coulters at 5 mph (8 km/h) varied from 1.2 to 2.7 PTO hp (0.9 to 2 PTO kW). Maximum tractor size needed to operate each coulters at 5 mph (8 km/h) was 3.1 PTO hp (2.3 PTO kW). An increase in ground speed will increase power requirements. These tractor sizes have been adjusted to include tractive efficiency and represent a tractor operating at 80% of maximum power take-off ratings as determined by Nebraska tests or as presented by the tractor manufacturer. The tractor sizes given will have ample power reserves to operate in the stated conditions.

EASE OF INSTALLATION

Ease of installing the K-Hart Coulters was good. The coulters were difficult to manoeuvre because of the 120 lb (55 kg) weight. The coulters were held on the toolbar by 2 u-bolts. The u-bolts were made to fit around a 4 x 4 in (102 x 102 mm) frame. Caution must be taken when mounting the coulters on cultivator frames not to overload the axles and tires.

OPERATOR SAFETY

The K-Hart Coulters was safe to use if normal safety precautions were observed. The test toolbar was locked in position when adjusting the units to prevent the coulters from falling on the operator.

OPERATOR'S MANUAL

An operator's manual was not provided with the coulters. The AFMRC recommends the manufacturer provide an operator's

manual.

MECHANICAL HISTORY

The 4 K-Hart Coulters were operated for 50 hours while fertilizing 200 ac (80 ha). Area fertilized with each coulter was 50 ac (20 ha). The intent of the test was evaluation of functional performance. An extended durability evaluation was not conducted. As mentioned in the Stony Conditions section, several wheel bolts were damaged by rocks and replaced during the test. One of the spring clips used on the main vertical pivot was lost and replaced during the test. Two dust caps were lost and replaced during the test. Several nuts were tightened on the adjustable arm for the fertilizer tine depth during the test. The Alberta Farm Machinery Research Centre recommends the manufacturer use locking nuts on the bolts securing the ends of the adjustable arms. The following observations were made at the end of the test:

Blade Wear: The average wear of the smooth coulter blade was 0.2 in (5.1 mm) over 16 ac (6.5 ha). The average wear of the offset rippled with smooth cutting edge coulter blade was 0.3 in (7.6 mm) over 34 ac (14 ha). The smooth coulter blade consisted of a sharper point on the edge than the offset rippled coulter blade. Therefore, the initial wear rate was faster for the smooth coulter blade.

Tine Wear: Wear on the metal stock welded to the front of the tines was minimal.

APPENDIX I	
SPECIFICATIONS	
MAKE:	K-Hart
MODEL:	Coulter
MANUFACTURER:	K-Hart Industries Ltd. P.O. Box 520 Elrose, SK S0L 0Z0 Phone: (306) 376-2256
GENERAL:	
-opener type	coulter
-vertical adjustment	6.7 in (170 mm)
-hub size	4 hole, 5 in (127 mm) bolt circle 3.5 in (69 mm) pilot hole 1.5 in (36 mm) spindle diameter spring and lever arm
-force application	0.63 x 7 in (16 x 176 mm)
-spring size	tube welded behind spring loaded tine weld on replaceable point opener
-material delivery	0.63 in (16 mm) diameter 15 in (361 mm) long
-furrow	
-tine	
-delivery tube	
-granular	1 in (25 mm) OD narrowed at end
-anhydrous ammonia	0.56 x 0.61 in (14 x 21 mm) ID oval (EVA tube slides through)
MOUNTING:	
-type	u-bolt
-number	2
-size	0.56 x 4 x 4in (14 x 102 x 102 mm)
COULTER:	
-type	Offset rippled with smooth cutting edge Smooth
-number of offsets	100 0
-diameter	17.25 in (436 mm) 16.36 in (467 mm)
-material thickness	0.16 in (4.1 mm) 0.16 in (4.6 mm)
-offset width	0.31 in (7.9 mm)
DIMENSIONS:	
-width	9.3 in (236 mm)
-height	36.6 in (930 mm)
-length	30.1 in (765 mm) (mounted behind frame)
WEIGHT:	
-total	124 llb (56 kg) (with granular delivery tube)
OPTIONS:	auxiliary spring notched, fluted, bubble and wavy coulter blades in various diameters

APPENDIX II	
MACHINERY RATINGS	
The following rating scale is used in Alberta Farm Machinery Research Centre Evaluation Reports.	
	-Excellent
	-Very Good
	-Good
	-Fair
	-Poor
	-Unsatisfactory

SUMMARY CHART

K-HART COULTER

RETAIL PRICE:	\$425.00 (March 1997 f.o.b. Elrose, SK) for K-Hart Coulter
QUALITY OF WORK:	
-penetration	very good; did not ride out except in very hard soil
-fertilizer placement	good; uniform when soil conditions were uniform
-soil finishing	very good; low soil disturbance
-residue clearance	very good; cut residue in firm soil and dry residue
EASE OF OPERATION AND ADJUSTMENT:	
-depth adjustment	good; wrenches required
POWER REQUIREMENTS:	maximum tractor size: 3.1 PTO hp (2.3 PTO kW) per coulter
OPERATOR'S MANUAL:	not supplied
MECHANICAL HISTORY:	tightened several nuts on adjustable arms for fertilizer tine depth



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