

Evaluation Report 340



Ber-Vac 810 Row Crop Cultivator

A Co-operative Program Between



BER-VAC 810 ROW CROP CULTIVATOR

MANUFACTURER:

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RETAIL PRICE: \$6,670.00 (February 1984, f.o.b. Portage la Prairie, Manitoba) 8-row, 36 inch (900 mm) spacing with 4 in (100 mm) sweeps, rolling shields, support wheels with tires, and guide wheels.

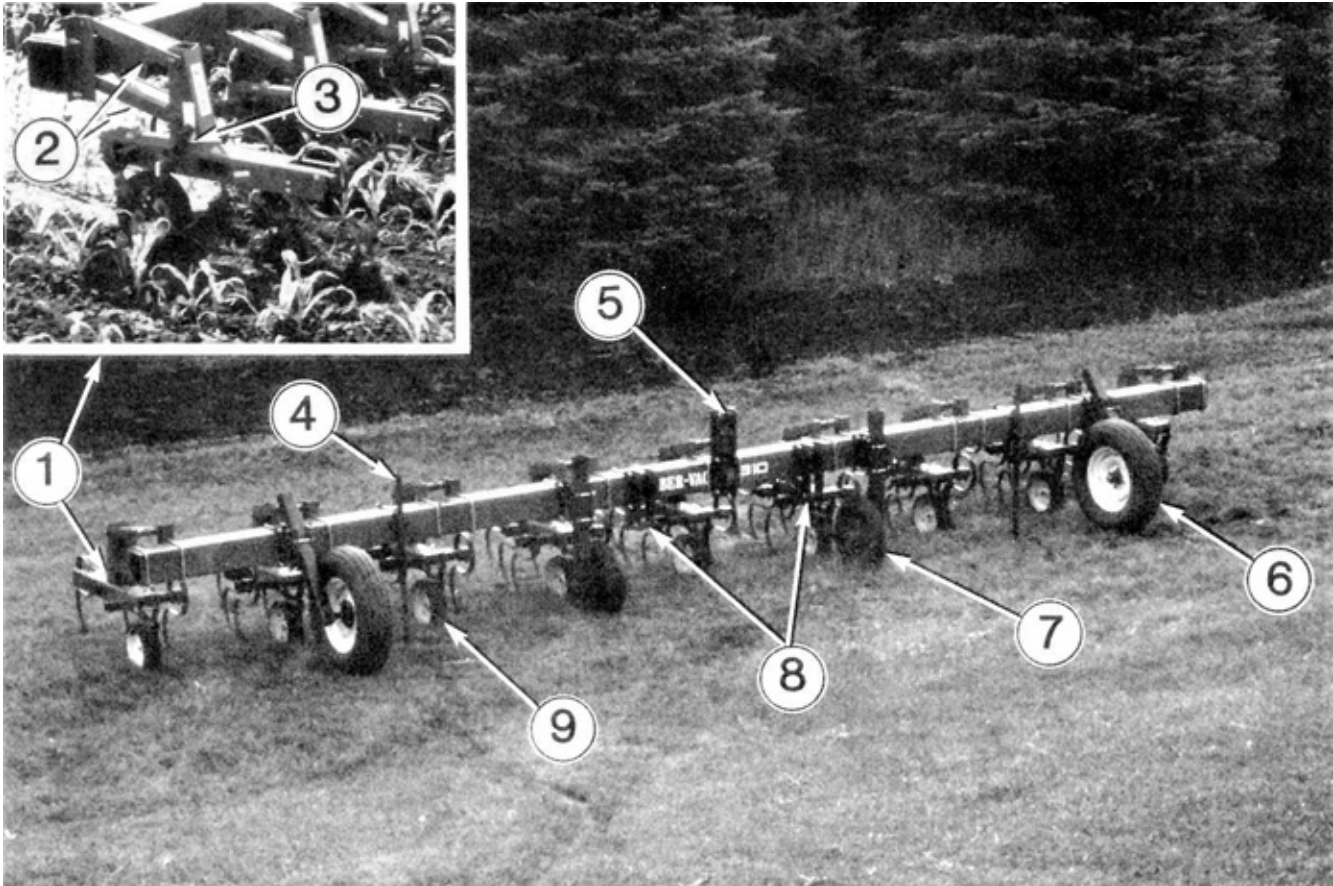


FIGURE 1. Ber-Vac 810: (1) Gangs, (2) Parallel Linkage, (3) Depth Adjustment, (4) Parking Stands, (5) Upper Hitch Mast, (6) Support Wheels, (7) Guide Wheels, (8) Lower Hitch Points, (9) Gauge Wheels

SUMMARY AND CONCLUSIONS

Overall Performance: The overall performance of the Ber-Vac 810 row crop cultivator was fair.

Quality of Work: Weed kill was good with the 4 in (100 mm) sweeps. Penetration was good in average field conditions. The flexibility of the tines provided a high speed vibrating action, and allowed clearance of large stones.

Trash burial in light trash was fair. In areas of moderate and heavy trash, the gangs plugged continually. This caused the gang to push the soil instead of tilling it. Skewing occurred where soil hardness varied across the machine width.

Ease of Operation and Adjustment: The Ber-Vac 810 evaluated was awkward to transport due to the large transport width. The optional folding model would be more practical if transporting frequently or over a great distance. The 14 in (360 mm) sweep-to-ground clearance was ample for normal transport.

Tillage depth was usually level across the cultivator width except where the ground was packed hard from the tractor wheels. Fore-and-aft and lateral leveling was accomplished on the three-point hitch of the tractor. One man could hitch or unhitch the cultivator in about 4 minutes.

Power Requirements: Total draft (pull force) under average row crop conditions at 5 mph (8 km/h) varied from 1260 to 2100 lb (5.6 to 9.3 kN) for depths of 2 to 4 in (50 to 100 mm) respectively. Under average soil conditions, at 6 mph (10 km/h) and 4 in (100 mm) depth, the draft power requirement was 64 hp (48 kW). A tractor of about 100 hp (75 kW) was required for safe overall operation of the Ber-Vac 810.

Durability: No mechanical problems developed during the 90 hours of field operation.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Making available a stiffer tine or a tine helper spring as an option to provide extra penetration force where required.
2. Modifying the gangs to improve trash movement between the gauge wheels and the tines.
3. Providing an operator manual with more illustrations and step-by-step instructions on set-up and adjustments,

Senior Engineer -- G.M. Omichinski

Project Engineer -- D.J. May

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Ber-Vac offers an optional 1/2 in (12 mm) thick S-tine in place of our standard 3/8 in (10 mm) thick for extra penetration force where required. Where even greater penetration force is required, a helper spring is available for use with both tines.
2. The cultivator design has been modified to improve trash movement between the gauge wheels and the tines by moving the gauge wheel forward an additional 12 in (300 mm).
3. An updated manual will be prepared to provide further illustrations and more detailed instructions on set-up, operation and adjustment, safety and servicing.

GENERAL DESCRIPTION

The Ber-Vac 810 evaluated was a mounted, solid, eight-row, row crop cultivator suitable for light tillage, and chemical incorporation in row crops with 28 to 36 in (710 to 910 mm) row spacing. The cultivator had nine gangs with five tines on each of the inner gangs while the two outer gangs had three tines each. The test machine was equipped with 4 in (100 mm) sweeps, rolling and floating shields.

FIGURE 1 shows the location of the major components. Support and guidance are controlled by the two support wheels near the ends of the toolbar and the guide wheels which run behind the tractor wheels. A solid toolbar model was tested although a folding model is available. A tractor with a Category II or III three-point hitch is required to operate this cultivator.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST¹

The Ber-Vac 810 was operated under field conditions as shown in TABLE 1 for 90 hours, while cultivating 720 ac (291 ha). It was evaluated for quality of work, ease of operation and adjustment, power requirements, operator safety, and suitability of the operator manual.

TABLE 1. Operating Conditions

FIELD CONDITION	OPERATING HOURS	EQUIVALENT FIELD AREA* ac (ha)
Soil Type:		
— sand	15	120 (48)
— sandy loam	24	190 (77)
— loam	20	160 (65)
— clay loam	31	250 (101)
TOTAL	90	720 (291)
Crop:		
— corn	87	700 (283)
— sunflowers	3	20 (8)
TOTAL	90	720 (291)

* EQUIVALENT FIELD AREA includes two to three successive cultivations on the same field. Duration between cultivations was about two weeks.

During the test only a few small stones were encountered. They did not have a significant effect on the test.

RESULTS AND DISCUSSION

QUALITY OF WORK

Tine/Sweep characteristics: There is a large variation in tine and sweep angles (FIGURE 2) on cultivators from different manufacturers. Sweeps and tines must be matched to obtain sufficient sweep pitch to achieve and maintain penetration. To achieve this, manufacturers usually recommend the use of sweeps with a stern angle from 0 to 5 degrees less than the tine stem angle.

Sweep pitch increases in proportion to draft, due to the deflection of the tine (FIGURE 3). A small positive sweep pitch provides

uniform tillage depth and a smooth furrow bottom, while excessive sweep pitch causes furrow ridging and rapid sweep wear.

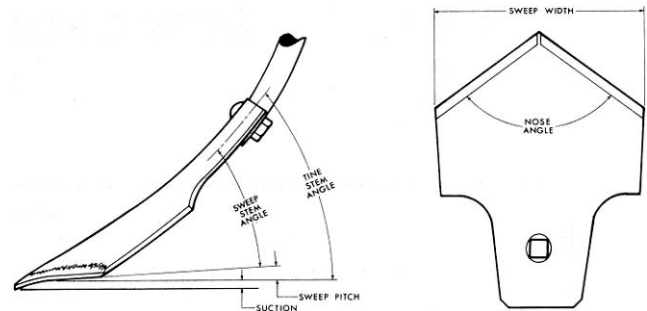


FIGURE 2. Tine and Sweep Terminology.

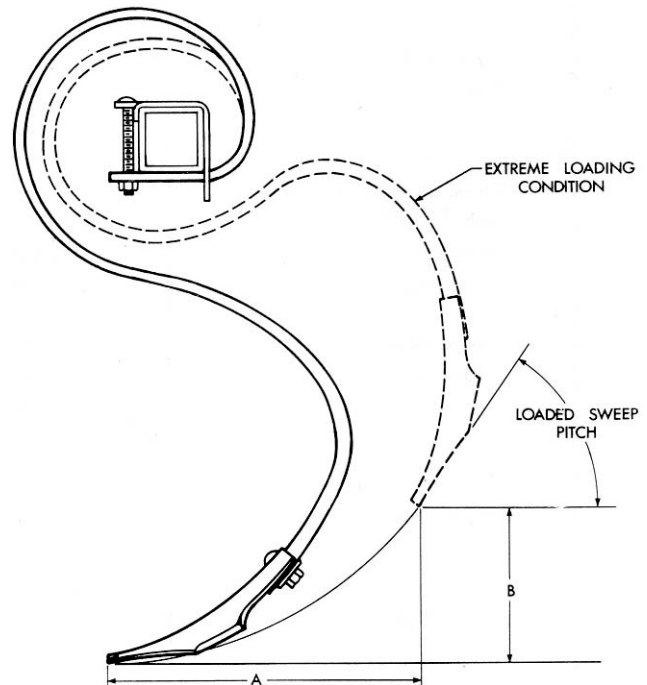


FIGURE 3. Schematic showing the increase in sweep pitch with increase in draft. This also illustrates the relative movement of a tine as it passes over an obstruction. (A) 10 in (250 mm), (B) 4 in (100 mm).

The force/deflection characteristics of the S-tine on the Ber-Vac 810 are presented in FIGURE 4. In general, the high speed vibrating action of the S-tines provided effective weed kill, crust shattering, and soil levelling.

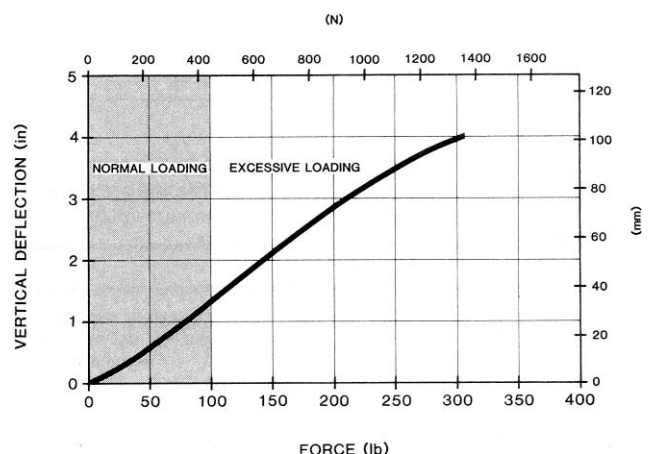


FIGURE 4. Tine deflection characteristics. (Excessive loading can occur in very hard soil or when contacting obstructions such as rocks.)

¹Prairie Agricultural Machinery Institute Detailed Test Procedure for Row Crop Cultivators.

Penetration: Penetration was good under average field conditions. However, penetration was not always uniform across the cultivator width. The cultivator tines behind the tractor and implement wheels tended to ride on top of hard soil, packed by these wheels. It is recommended that the manufacturer consider making available a stiffer tine or a tine helper spring as an option to provide extra penetration force where required.

Uniform penetration also depended on the levelness of the cultivator, which was adjusted on the three-point hitch of the tractor.

Trash Effects: The Ber-Vac 810 plugged often in row crop conditions of light trash (residue corn stalks and weeds) and plugged continually in areas of heavy trash (FIGURE 5). The gauge wheels were too far back on the gang thus interfering with trash movement through the gang. The mud scrapers also caused plugging by building up with trash. It is recommended that the manufacturer consider modifying the gang to improve trash movement between the gauge wheel and the tines.

Various tine formations could be assembled since the tubings were removable, but the standard formation (FIGURE 6) gave the best trash clearance possible with this gang.



FIGURE 7. Normal surface left by cultivator.



FIGURE 5. Plugged gang due to gauge wheel interference.

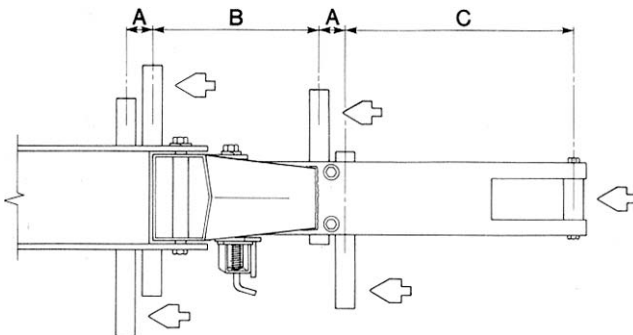


FIGURE 6. Standard tine configuration. (A) 2.6 in (65 mm), (B) 12.3 in (310 mm), (C) 15 in (380 mm).

Trash and weed burial were fair under most conditions. In moderate and heavy trash conditions the dry, lighter stalks were left on top of the soil, while the moist, heavy ones were tilled under.

Field Surface: In normal row crop conditions, the field surface was left quite smooth with a small furrow between the rows and the soil slightly hilled towards the row (FIGURE 7). Shields were used during the first cultivation where crop height was about 2 to 8 in (50 to 200 mm). The rolling shields gave better protection to the young plants since the tunnel shields tended to rub out the young plants if there was any skewing of the cultivator.

Furrow Bottom Ridging: Furrow bottom ridging² was apparent wherever the ground was hard packed such as behind the tractor tire or in soils with a hard subsurface layer.

Skewing and Stability: The Ber-Vac 810 was stable and did not skew excessively under average field conditions. The symmetrical gang pattern (FIGURE 6) did not impose any side forces on the cultivator during normal tillage. Some skewing did occur where soil hardness varied across the machine width despite the three-point hitch rigid mounting.

The individual gangs had a parallel linkage with wide stance upper and lower links which kept the gangs very rigid to reduce skewing. The hinge bolts through the parallel linkage remained tight throughout the evaluation.

Weed Kill: The amount of weed kill depends upon the sweep width and the field speed. In general, a wide sweep will provide better weed kill and more soil movement but less crust and lump shattering than a narrow sweep. High field speeds will provide better weed kill, more soil movement and more crust shattering than low field speeds. Sweeps and field speeds should be matched to field conditions and desired results.

At a field speed of 5 mph (8 km/h) with a 4 in (100 mm) sweep, the weed kill was good under average field conditions.

EASE OF OPERATION AND ADJUSTMENT

Hitching: One person could hitch or unhitch the cultivator in about 4 minutes. Bushings were provided to permit hitching the cultivator to tractors with a Category II or III three-point hitch. As with all rear-mounted implements careful backing of the tractor was required to hitch the cultivator quickly. Care should be taken if more than one person is hitching the cultivator.

During the test some difficulty was encountered with hitching the cultivator to some tractors. The hitch pins were so close to the cultivator frame that high profile tractor tires would sometimes rub on the cultivator guide wheels (FIGURE 8). Hitch extensions were available from the manufacturer as an option to provide more clearance.



FIGURE 8. Interference between tractor tire and cultivator.

²Ridges left by ground tool in hard surface or subsurface soil.

Frame Levelling: Levelling of the cultivator was achieved by shortening or lengthening the linkage on the three-point hitch. The two bottom links controlled the lateral levelling while the top link controlled the fore-and-aft levelling. The links were adjusted until all of the sweeps touched the ground at the same time. Some adjustments on the levelness could also be made at the support wheels.

Tillage Depth: Tillage depth was control led by a gauge wheel at the front of each gang. Raising the gauge wheel lowered the gang thus increasing the tillage depth. The depth adjustment allowed fast, simple and precise settings to 1/2 in (13 mm) increments. The lower links on the three-point hitch had to be adjusted low enough to allow the cultivator to float at the required tool bar working height.

Maneuverability: Maneuvering the Ber-Vac 810 was convenient due to the three-point hitch rigid mount. Cultivating with the outer tines of each gang set close to the rows, required extra operator alertness to keep skewing loss to a minimum. The heavy cultivator weight required ballasting of the tractor front end, in order to retain tractor stability.

Transporting: The machine evaluated did not fold and was awkward to move on the road due to its large width of 25.3 ft (7.7 m) (FIGURE 9). Great care was required when transporting on public roads, through gates and over bridges. If the cultivator is going to be transported long distances an optional folding model would be more practical.

The Ber-Vac 810 transported without sway at normal transport speeds. The transport sweep-to-ground clearance of 14 in (360 mm) was ample on slopes and rough terrain. Care should be taken not to engage the clutch too quickly as the front tractor tires may tend to lift off of the ground, even when front end ballast is used.



FIGURE 9. Transport position.

Sweep Installation: The 41 sweeps could be changed by one person in about one hour. The sweep bolts extended beyond the nuts thus exposing the bolt threads to damage by soil abrasion. Sweep-to-ground clearance of 14 in (360 mm) was adequate for easy sweep removal.

Tine Installation: The tines were easily removed or adjusted by loosening one bolt and sliding them along the cross members.

POWER REQUIREMENTS

Draft Characteristics: FIGURE 10 shows draft requirements per row for the Ber-Vac 810 under average field conditions at a speed of 5 mph (8 km/h) in moist clay loam. It should be noted that variation in soil conditions affect draft much more than variation in machine make, usually making it difficult to measure significant draft differences between different makes of row crop cultivators.

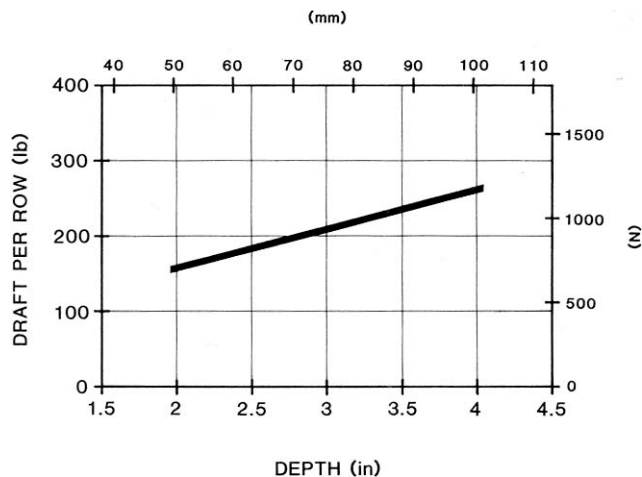


FIGURE 10. Typical draft requirements for Ber-Vac 810 at 5 mph (8 km/h), under average conditions.

Increasing speed by 1 mph (1.6 km/h) increased draft by about 32 lb/row (142 N/row). This represents a draft increase of about 256 lb (1139 N) for the eight-row test machine.

Actual draft power requirement for the Ber-Vac 810 at the 4 in (100 mm) depth varied from 33 to 79 hp (25 to 59 kW) for speeds of 4.0 to 7.0 mph (6.4 to 11.3 km/h) respectively.

Tractor Size: Tractor size was dictated by the stability requirements for this eight-row test machine. A tractor (with front ballasting) of about 100 hp (75 kW) was suitable.

OPERATOR SAFETY

The model evaluated did not fold so there were no problems with regard to power and telephone lines.

The test machine was 25.3 ft (7.7 m) wide in transport position thus it was not safe or practical to transport more than a short distance on the road. A slow moving vehicle (SMV) sign was not provided by the manufacturer, although a mounting bracket for the SMV sign was supplied.

The test machine could be safely hitched to a tractor by one person. If additional personnel are involved with hitching the cultivator they should stand behind the cultivator away from the tractor, for maximum safety.

OPERATOR MANUAL

The operator manual included instruction on set-up, operation, adjustment, maintenance and safety. However, the manual was generally lacking in detailed and descriptive information. It is recommended that the manufacturer consider providing an operator manual with more illustrations and step-by-step instructions on set-up and adjustments.

DURABILITY

The Ber-Vac 810 row crop cultivator was operated for about 90 hours while cultivating about 720 ac (291 ha). The intent of this evaluation was a measure of general performance. An extended durability evaluation was not conducted. No mechanical problems occurred during the test.

APPENDIX I

SPECIFICATIONS

MAKE: Ber-Vac
MODEL: 810, eight-row, 36 inch spacing
SERIAL NUMBER: 811038

DIMENSIONS:	FIELD POSITION	TRANSPORT POSITION
- width	253 ft (7.7 m)	25.3 ft (7.7 m)
- length (from lower hitch point to rear of cultivator)	5.9 ft (1.8 m)	5.6 ft (1.7 m)
- height	4.0 ft (1.2 m)	6.2 ft (1.9 m)
- ground clearance		14 in (360 mm)

TINES:	FIELD POSITION	TRANSPORT POSITION
- number	41	
- trash clearance (frame to sweep tip)	15 in	(380 mm)
- number of tine rows	5	
- longitudinal distance between tine row		
- first-second	2.6 in	(65 mm)
- second-third	12.3 in	(310 mm)
- third-fourth	2.6 in	(65 mm)
- fourth-fifth	15 in	(380 mm)
- tine cross section	1-1/4 x 3/8 in	(30 x 10 mm)
- sweep bolt size	3/8 x 1-1/4 in UNC	

TINE TREES:	FIELD POSITION	TRANSPORT POSITION
- number of tines per gang	5	
- weight with shields (five tines)	185 lb	(84 kg)
- weight without shields	167 lb	(76 kg)
- gauge wheel adjustment	4 in	(100 mm)
- maximum width of cut per tree	29 in	(740 mm)

HITCH AND DEPTH CONTROL:

- three-point hitch
- Category II and III

FRAME:

- type solid toolbar
- tool bar 7 in (180 mm) square tubing, 0.19 in (5 mm) wall
- tine tree 2.5 in (51 mm) square tubing, 0.13 in (3 mm) wall

SUPPORT WHEELS:

- adjustment 4.5 in (115 mm)
- tire two, 7.60 x 15, 4 ply

GUIDE WHEELS:

- adjustment 4.5 in (115 mm)
- tire two, 4.5 x 20 high peak point

NUMBER OF LUBRICATION POINTS: 36 grease fittings

WEIGHTS:

- overall without shields 2200 lb (1000 kg)
- overall with shields 2380 lb (1080 kg)

OPTIONAL EQUIPMENT:

- gang extension
- guide markers
- weeder discs
- weeder knives
- three-point hitch extension

APPENDIX II

MACHINE RATINGS

The following rating scale is used in Machinery Institute Evaluation Reports:

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

APPENDIX III

CONVERSION TABLE

Acre (ac) x 0.405	= Hectare (ha)
Foot (ft) x 0.305	= Metre (m)
Inches (in) x 25.4	= Millimetres (mm)
Horsepower (hp) x 0.746	= Kilowatt (kW)
Miles/Hour (mph) x 1.61	= Kiiometre/Hour (km/h)
Pounds Force (lb) x 4.45	= Newton (N)
Pounds Force/Foot (lb/ft) x 14.6	= Newton/Metre (N/m)
Pounds Force-Feet (lb-ft) x 1.36	= Newton-Metre (N-m)
Pounds Force/Square Inch (psi) x 6.89	= Kilopascal (kPa)
Pounds Mass (lb) x 0.454	= Kilogram (kg)
Tons Mass (ton) x 0.91	= Tonnes (t)

SUMMARY CHART

BER-VAC 810 ROW CROP CULTIVATOR

Retail Price: \$6,670.00

(February, 1984, f.o.b. Portage la Prairie, Manitoba) 8-row, 36 inch (900 mm) spacing with 4 in (100 mm) sweeps, rolling shields, support wheels with tires and guide wheels.

<u>Evaluation</u>		
QUALITY OF WORK		
Penetration	Good	reduced in hard packed soil
Trash Clearance	Poor	severe plugging in trashy conditions caused by gauge wheel interference
Trash Burial	Fair	limited burial due to plugging
Field Surface	Good	generally left smooth and flat
Weed Kill	Good	with 4 inch (100 mm) sweeps at 5 mph (8 km/h) under average conditions
EASE OF OPERATION AND ADJUSTMENT		
Hitching	Very Good	about 4 minutes for Category III
Frame Levelling	Fair	guide and support wheels slow and difficult to adjust
Tillage Depth	Excellent	very fast and accurate
Maneuverability	Very Good	three-point hitch rigid mount
Transporting	Fair	optional folding model would be better suited for long distances
Sweep Installation	Good	ample sweep-to-ground clearance sweep bolts extended beyond nuts
Tine Installation	Very Good	tines easily removed or adjusted by sliding along cross members
OPERATOR SAFETY	Fair	very large transport width no caution decals
OPERATOR MANUAL	Fair	poorly illustrated and lacked detail
POWER REQUIREMENTS	Per Row	Total
Draft at 5 mph (8 km/h)	210 lb (0.9 kN)	1680 lb (7.5 kN)
Draft increase per mph (1.6 km/h)	32 lb (0.1 kN)	256 lb (0.9 kN)
Minimum Overall Tractor Size		100 hp (75 kW)
		in 3 in (75 mm) of moist clay
		for cultivator stability



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