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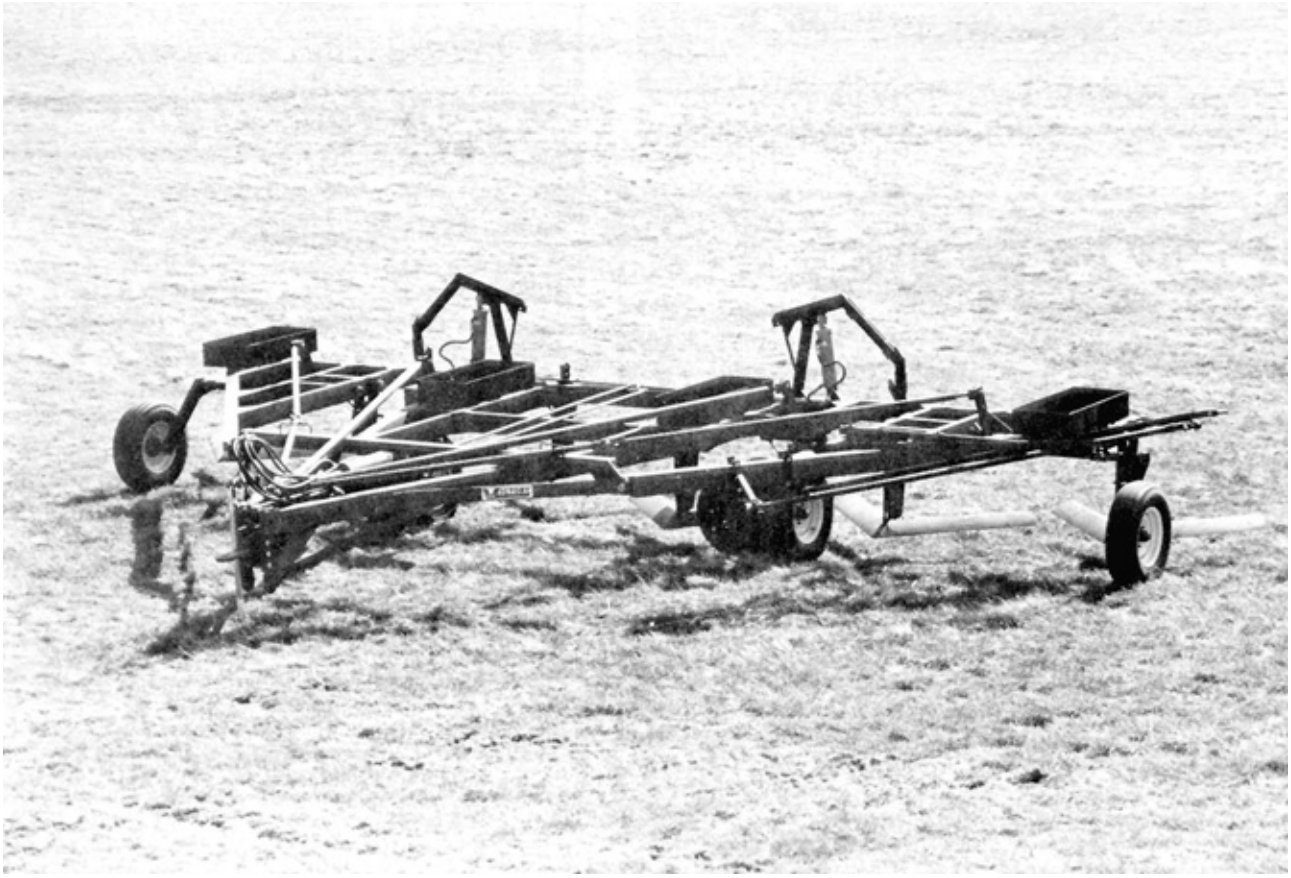
Evaluation Report 178



Victory Blade (9.7 m) Cultivator

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

VICTORY BLADE CULTIVATOR

MANUFACTURER AND DISTRIBUTOR:

Victory Equipment Ltd.
920 Second A Avenue North
Lethbridge, Alberta
T1H 0E3

RETAIL PRICE:

$9,825.00 (April, 1980, f.o.b. Lethbridge, 9.7 m width, complete with marker).

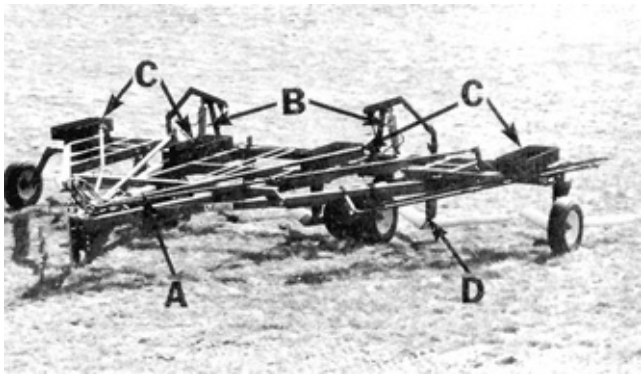


FIGURE 1. Victory Blade Cultivator: (A) Master Cylinder, (B) Wing Lift Cylinders, (C) Weight Boxes, (D) Trash Guards.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Victory Blade cultivator was very good in all working conditions.

The shear bolt trip shanks could lift only 75 mm (3 in) to clear stones. However, the shank assemblies performed well, with no blade or shank damage throughout the test.

Penetration was good in most conditions. In dry, hard soil additional weight was needed to obtain sufficient penetration and to maintain a uniform tillage depth. The Victory was very stable and did not skew appreciably. Skewing was never serious enough to affect weed kill. The Victory followed the contour of rolling land well and left an excellent trash cover. Weed kill was good except in very moist soil conditions. The Victory was capable of cleadng heavy trash and plugging seldom occurred.

The Victory blade could be conveniently placed in transport position in less than five minutes. The 230 mm (9 in) sweep to ground clearance in transport position was adequate. The Victory towed well at speeds up to 32 km/h (20 mph). Caution had to be observed when towing on public roads due to the large transport width. The 9.7 m (32 ft) wide test machine had a transport height of 4.1 m (13.5 ft), permitting safe transport under power lines in three prairie provinces. Larger models of the Victory have transport heights greater than minimum power line heights.

Adequate adjustment was provided for both lateral and fore-and-aft frame levelling. The hitch jack had insufficient lift for hitching in soft fields. Tillage depth was uniform across the width of the cultivator when the depth control linkages were propedy adjusted.

Average draft for the 9.7 m (32 ft) wide test machine in primary tillage, at 8 km/h (5 mph), varied from 28.1 kN (6 180 lbs) at 50 mm (2 in) depth to 48.5 kN (10 670 lbs) at 125 m (5 in) depth. In secondary tillage at 8 km/h (5 mph), average draft varied from 18.4 kN (4 050 lb) at 50 mm (2 in) to 45.6 kN (10 030 lb) at 125 mm (5 in) depth.

In primary tillage, at 8 km/h (5 mph) and 75 mm (3 in) depth, a tractor with 115 kW (154 hp) maximum power take-off rating will have sufficient power reserve to operate the 9.7 m (32 ft) wide Victory blade. In secondary tillage, at the same depth and speed, a 105 kW (141 hp) tractor is needed.

The Victory was equipped with transport lock pins for safe towing. No slow moving vehicle sign was provided. No operator's manual was available.

Only minor mechanical problems occured dudng the 225 hours of field operation.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying and relocating the hitch jack to increase maximum lift height and to facilitate easier hitching.
2. Providing a slow moving vehicle sign as standard equipment.
3. Supplying an operator's manual.
4. Working with the agricultural equipment industry to standardize hydraulic quick couplers and hydraulic hose fitting threads.

Chief Engineer: E. 0. Nyborg

Senior Engineer: E. H. Wiens

Project Engineer: M. V. Eliason

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. The jack will be relocated and provided with a larger base plate to avoid sinking.
2. A slow moving sign will be attached to all machines, effective immediately.
3. An operator's manual will be available for fall 1980.
4. Our firm will work with the industry to standardize hydraulic quick couplers and hose fitting threads.

MANUFACTURER'S ADDITIONAL COMMENTS

In the future all machines will have concrete slabs on the wings rather than weight boxes. This eliminates the removal of rocks when placing the machine in transport. This will be standard on all new units.

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

GENERAL DESCRIPTION

The Victory is a trailing, flexible, three-section heavy duty blade cultivator suitable for medium and heavy primary tillage operations. It is available in four basic widths, ranging from 8.1 to 16.3 m (26'.5 to 53.5 ft). The test machine was a 9.7 m (32 ft) model with a 4.5 m (14.8 ft) center frame and two 2.6 m (8.6 ft) wings. It was equipped with six shear-bolt-protected rigid shanks, laterally spaced at 1590 mm (63 in), arranged in two rows.

The center frame is carried on two dual wheel sets while each wing is supported by a single wheel. Tillage depth is controlled by a master cylinder through mechanical linkages to each wheel. Two hydraulic cylinders, connected in parallel, fold the wings into upright transport position. A tractor with dual remote hydraulic controls is needed to operate the Victory.

Detailed specifications are given in APPENDIX I while FIGURE 1 shows the location of major components.

SCOPE OF TEST

The Victory was operated in the field conditions shown in TABLE 1 for 225 hours while cultivating about 1426 ha (3520 ac). It was evaluated for quality of work, ease of operation and adjustment, power requirements, safety and suitability of the operator's manual.

TABLE 1. Operating Conditions.

FIELD CONDITION	HOURS	AREA (ha)
Soil Type		
- sand	22	139
- loam	165	1046
- clay loam	31	197
- clay	7	44
TOTAL	225	1426
Stony Phase		
- stone free	82	520
- occasional stones	137	868
- very stony	6	38
TOTAL	225	1426

RESULTS AND DISCUSSION

QUALITY OF WORK

Shank and Blade Characteristics: The Victory was equipped with 1.72 m (5.6 ft) wide blades with a 90° nose angle and a lift of 90 mm (3.5 in) (FIGURE 2). Blades with a 75° nose angle were also available. A shear bolt near the top of each shank was provided for blade protection.

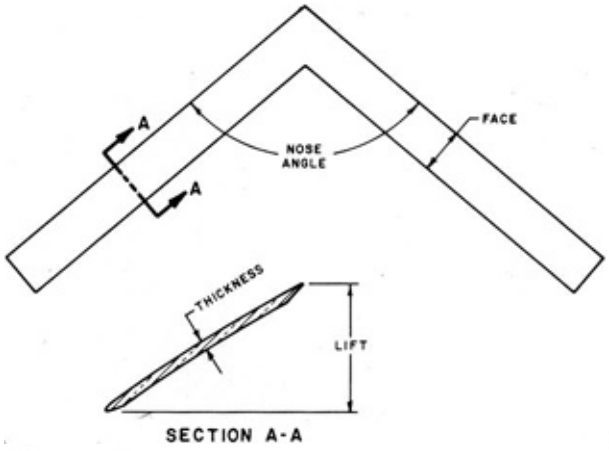


FIGURE 2. Blade Terminology.

FIGURE 3 shows the lifting pattern when a shank encounters a stone or field obstruction large enough to cause the shear bolt to fail. Maximum lift height was only 75 mm (3 in). Although the shank assemblies performed well, with no shank damage during the test, the shank lift height of only 75 mm (3 in) resulted in many stones being pulled out or the frame having to lift to clear stones. From FIGURE 3 it can be seen that as the shank and blade assembly pivoted rearward, the blade nose had to move 150 mm (6 in) downward. This forced the frame to be lifted in hard soil conditions.

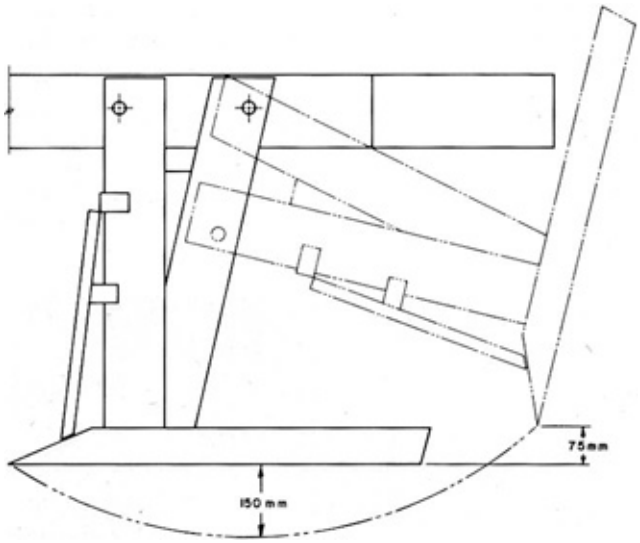


FIGURE 3. Blade lifting Pattern.

Penetration: Penetration was good in most soil conditions. In hard dry soil, weight had to be added to the weight boxes to obtain acceptable penetration. In primary tillage up to 700 kg (1540 lb) was added. In secondary tillage little or no additional weight was needed.

Penetration was uniform across the cultivator width, provided all depth control linkages were properly set. Tires were adequately sized to provide good flotation in all soil conditions. The wheels were positioned so that each of the four center section wheels (FIGURE 4) supported about 17% of the total cultivator weight while each wing wheel supported about 10%. In addition, each center section wheel supported about 16% of the total tillage suction force while each wing

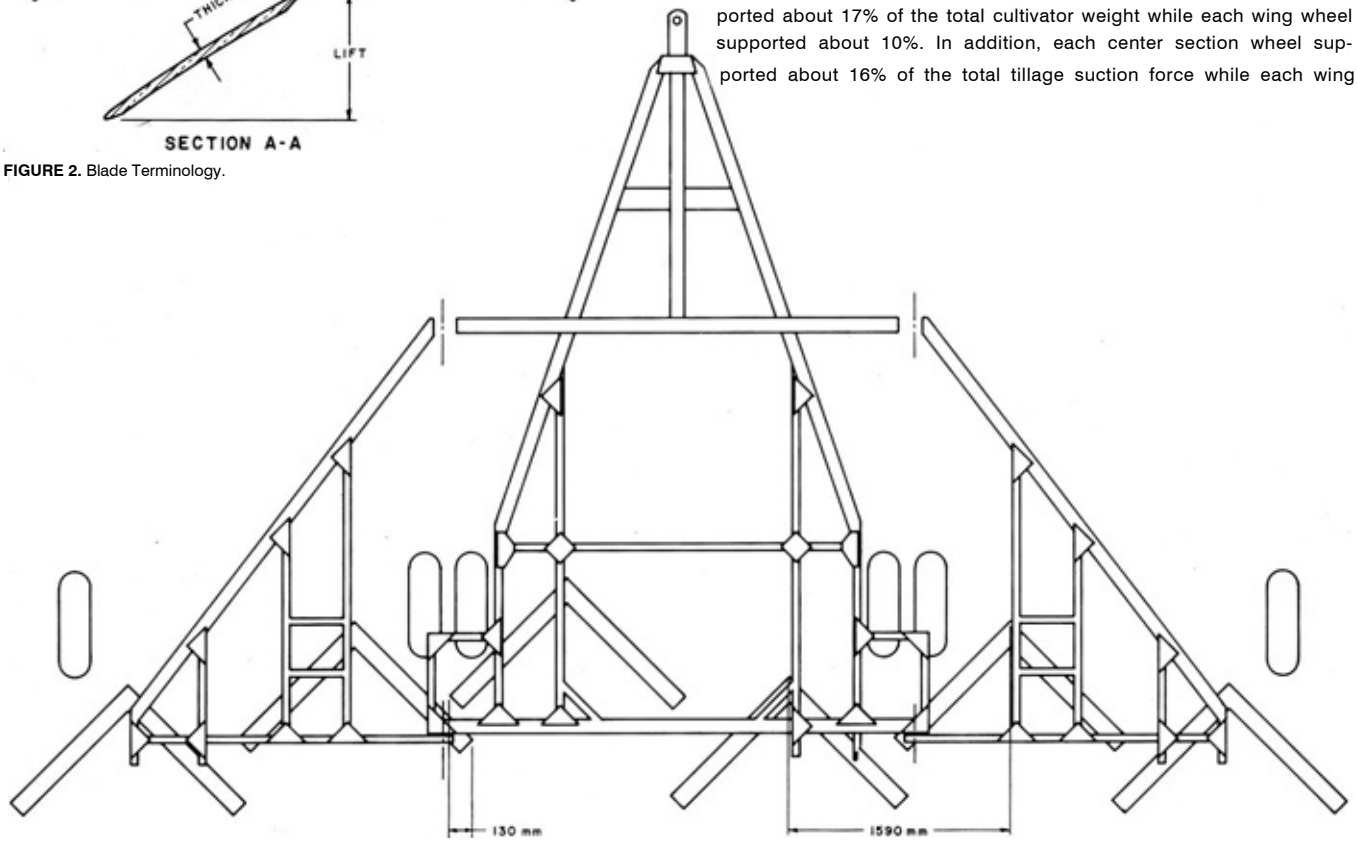


FIGURE 4. Blade Pattern Showing Wheel Locations, Shank Spacing and Blade Overlap.

wheel supported about 18%. For good flotation and uniform tillage depth across the width, it is desirable to have wheels sized and positioned so that each supports equivalent weight and a similar tillage suction force.

Depth difference between front and rear blades were slight once the frame had been propedy levelled. In all conditions, the frame remained relatively level with very little twisting of the wing frames. The Victory followed gently rolling field contours very well, maintaining a uniform depth across its width. All sections were narrow enough to result in even penetration. As with most wing cultivators, large variations in tillage depth occurred in fields with abrupt contour changes.

Plugging: Trash clearance was very good. The Victory blade was capable of cleadng large amounts of trash. Minimum plugging occurred at the shanks next to the wheels in heavy, damp trash and in heavily buckwheat infested areas. The adjustable sloping trash guard in front of each shank (FIGURE 5) was helpful in lifting trash and reducing plugging.

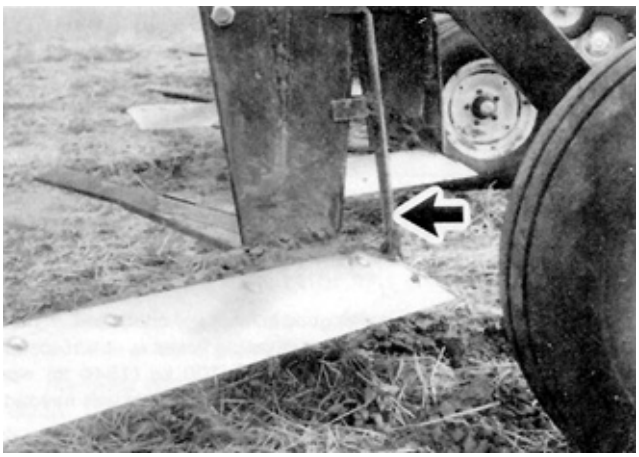


FIGURE 5. Adjustable Sloping Trash Guard.

Trash Burial and Field Surface: The Victory buried very little trash. The majority of the stubble was left standing and anchored to the soil, resulting in very little difference in field appearance before and after tillage (FIGURE 6). Some trash was buried in the small furrows left by the shanks. The amount of trash buried in the furrows depended on the depth and speed of tillage and soil conditions.

FIGURE 6. Trash Cover Before (left) and After (right) Tillage at 75 mm Depth and 8 km/h.

Ridging: Surface ridging usually was slight and depended on the size of the furrows left by the shanks. Furrow size increased with soil moisture content and occasionally was quite large when the soil was moist and damp trash was present. Damp trash, particularly wild buckwheat, collected on the shanks and increased the size of the furrows behind each shank. The furrow bottom was always smooth and level.

Skewing and Stability: The Victory blade was very stable and did not skew sideways in normal field conditions. Momentary skewing occurred in stony fields when shanks sometimes skewed sideways to bypass stones. Askewness did not cause weeds to be missed.

Weed Kill: Weed kill was good. The shank spacing of 1590 mm (63 in) resulted in a 130 mm (5 in) sweep overlap (FIGURE 4). Sweep wear did not cause'weeds to be missed. Weed kill was occasionally inadequate when soil moisture was high following tillage. When the top layer of soil remained moist, small lateral roots continued to grow. In moist soil, shallow tillage depth increased soil disturbance and produced a better weed kill.

EASE OF OPERATION AND ADJUSTMENT

Transporting: The Victory was easily placed in transport position (FIGURE 7) using the hydraulic wing lift system supplied as standard equipment. Two pins, which had to be inserted by hand, were provided to lock the wings during transport. Raising or lowering time depended on the tractor hydraulic system but usually took one man less than five minutes, providing there were no weights in the weight boxes. Weights had to be removed before raising the wings. A mechanical lock was also provided to lock the depth control cylinder.

Transport width was 5.2 m (17 ft) while transport height was 4.1 m (13.5 ft). The Victory towed well at transport speeds up to 32 km/h (20 mph). Hitch weight, in transport position, was 355 kg (780 lb), making the Victory very stable during towing. Blade-to-ground clearance in transport position was 230 mm (9 in) while transport wheel tread was 3.7 m (12 ft). This provided ample ground clearance.

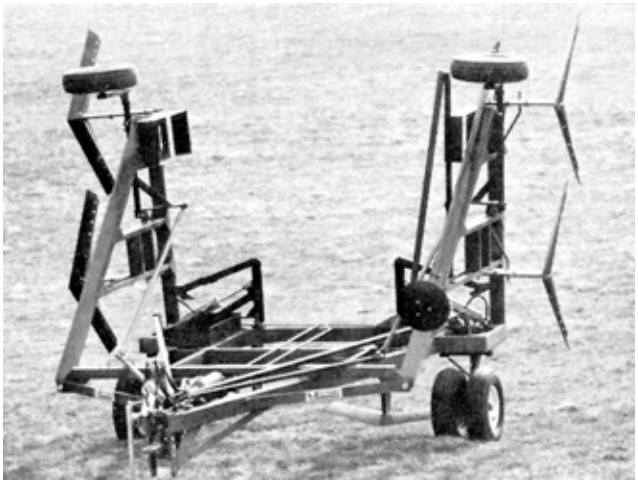


FIGURE 7. Transport Position.

Hitching: The hitch weight was 355 kg (780 lb) in both transport and field positions. The hitch jack had insufficient lift for some tractors, especially in soft fields. Hitching the Victory was sometimes inconvenient as the hitch jack was located on the right side of the hitch tongue. Most tractors with cabs are dismounted from the left side, making it necessary to climbover the hitch to raise or lower the jack. It is recommended that the manufacturer modify the hitch jack and its location to facilitate easier hitching.

Hitching to a tractor could be accomplished by one man since the cushioned hitch link remained level when unhitched.

The hitch height could be adjusted 230 mm (9 in) in three increments by removing 6 bolts. This range was adequate to allow fore-and-aft frame levelling with all tractors used during testing.

Frame Levelling: Adequate lateral levelling adjustment was provided. All frame sections were levelled by adjusting the threaded linkages from the master cylinder to the wheels.

Depth of Tillage: Tillage depth was controlled with one hydraulic cylinder, mounted near the front of the hitch pole, and connected through a sliding sleeve and linkage bars to each section wheel. A depth stop positioned in an appropriate hole in the sliding sleeve (FIGURE 8) provided depth adjustment. The position of the sliding

sleeve could be adjusted without wrenches. Uniform tillage depth across the cultivator width could usually be obtained with the tractor hydraulics, without using the depth control stop.

FIGURE 8. Sliding Depth Control Sleeve.

Blade Installation: It took one man about 2 hours to remove and replace the 6 blades on the Victory. The blade bolts were short enough to have their ends protected by the nuts, preventing thread damage during tillage when blades were new. However, if the blade face wore to less than 115 mm (4.5 in), considerable wear to both the retaining nuts and bolts occurred, making removal difficult.

Shank Installation: Individual shanks could be replaced in about 15 minutes by removing three bolts.

POWER REQUIREMENTS

Draft Characteristics: FIGURE 9 shows draft requirements for blade cultivators in typical primary and secondary tillage, at a speed of 8 km/h (5 mph). This figure gives average requirements based on tests in 10 different field conditions. Attempting to compare draft requirements of different makes of blade cultivators is usually unrealistic. Draft requirements for the same blade cultivator, in the same field, may vary significantly due to changes in soil conditions. Variation in soil conditions affect draft much more than variation in machine make, usually making it impossible to measure any significant draft difference between different makes of blade cultivators.

In primary tillage, average draft per metre of width, at 8 km/h (5 mph), varied from 2.9 kN (640 lb) at 50 mm (2 in) depth to 5.0 kN (1100 lb) at 125 mm (5 in) depth. For the 9.7 m (32 ft) wide Victory, this corresponds to a total draft ranging from 28.1 to 48.5 kN (6200 to 10 670 lb).

In secondary tillage, average draft per metre of width at 8 km/h (5 mph), varied from 1.9 kN (420 lb) at 50 mm (2 in) depth to 4.7 kN/m (1030 lb) at 125 mm (5 in) depth, corresponding to a total draft from 18.4 to 45.6 kN (4050 to 10 030 lb) for the 9.7 m (32 ft) test machine.

Increasing speed by 1 km/h (0.6 mph), increased draft by about 90 N (20 lb) per metre of width. For the 9.7 m (32 ft) wide test machine, this represents a draft increase of about 0.9 kN (200 lb) for a 1 km/h (0.6 mph) speed increase.

Tractor Size: TABLES 2 and 3 show tractor sizes needed to operate the 9.7 m (32 ft) wide' Victory in primary and secondary tillage. Tractor sizes have been adjusted to include tractive efficiency and represent a tractor operating at 80% of maximum power on a level field. The sizes presented in the tables are the maximum power take-off rating, as determined by Nebraska tests or as presented by the tractor manufacturer. Selected tractor sizes will have ample power reserve to operate the Victory in the stated conditions.

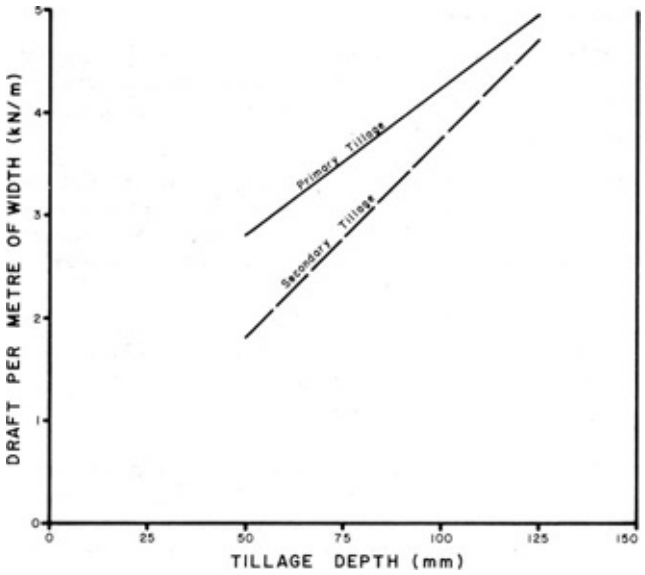


FIGURE 9. Average Draft Requirements for Blade Cultivators at 8 km/h.

Tractor size may be determined by selecting the desired tillage depth and speed from the appropriate table. For example, in primary tillage at 75 mm (3 in) depth and 8 km/h (5 mph) a 115 kW (154 hp) tractor is needed to operate the Victory. In secondary tillage, at the same depth and speed, a 105 kW (141 hp) tractor is needed.

TABLE 2. Tractor Size (Maximum Power Take-off Rating, kW) to Operate the 9.7 m Wide Victory Blade in Primary Tillage.

DEPTH (mm)	SPEED (km/h)					
	7	8	9	10	11	12
50	79	93	108	123	139	156
75	98	115	132	151	170	189
100	117	137	157	178	200	222
125	137	159	182	206	230	255

TABLE 3. Tractor Size (Maximum Power Take-off Rating, kW) to Operate the 9.7m Wide.

DEPTH (mm)	SPEED (km/h)					
	7	8	9	10	11	12
50	59	71	83	97	111	126
75	89	105	122	140	159	178
100	120	140	161	189	207	231
125	150	175	200	227	254	283

OPERATOR SAFETY

Extreme caution is needed in transporting most folding cultivators to avoid contacting power lines. Minimum power line heights vary in the three prairie provinces. In Saskatchewan, the energized line may be as low as 5.2 m (17 ft) over farm land or over secondary roads. In Alberta and Manitoba, the neutral ground wire may be as low as 4.8 m (15.8 ft) over farm land. In all three provinces, lines in farmyards may be as low as 4.6 m (15 ft).

Transport height of the 9.7 m (32 ft) wide test machines was 4.1 m (13.5 ft), permitting safe transport under prairie power lines. On the other hand, transport height of the 16.3 m (53.5 ft) wide model of the Victory blade is 5.3 m (17.4 ft) which is high enough for contact with many prairie power lines. The legal responsibility for safe passage under utility lines rests with the machinery operator and not with the power utility or the machinery manufacturer. All provinces have regulations governing maximum permissible equipment heights on various types of public roads. If height limits are exceeded, the operator must contact power and telephone utilities before moving.

The Victory was 5.2 m (17 ft) wide in transport position. This necessitated caution when towing on public roads, over bridges and through gates.

No slow moving vehicle sign or mounting bracket were provided. It is recommended that a slow moving vehicle sign be supplied as standard equipment.

Pins were provided to lock beth the centre depth control cylinder and the wings in transport position.,

The four tires supporting the main frame were adequately sized for transporting the cultivator. Individual fire loads did not exceed the Tire and Rim Association maximum rating for 9.5L x 15, 6-ply tires.

STANDARDIZATION

Hydraulics: During the test, considerable difficulty was encountered due to differences in hydraulic couplers on various tractors. The difficulty was in the lack of standardization both in couplers and in hose threads. More standardization is needed in this area.

OPERATOR'S MANUAL

No operator's manual was supplied. It is recommended that a suitable operator's manual be provided.

DURABILITY RESULTS

TABLE 4 outlines the mechanical history of the Victory blade cultivator during 225 hours of field operation while tilling about 1426 ha (3520 ac). The intent of the test was evaluation of functional performance. The following mechanical problems represent those which occurred during the functional testing. An extended durability evaluation was not conducted.

TABLE 4. Mechanical History

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA (ha)
Sweeps and Shanks		
Many blade mounting bolts had loosenecl and were tightened at	71	450
- A trash guard was lost and replaced at	122	773
- A complete set of worn blades was replaced at	189	1198
- Several bolts attaching shanks to the frame had loosened and were tightened at	189	1198
Frame		
- The clevis holding the depth control link to the right wheel cracked and was rewelded at	beginning of test	
- The cotter p in on the marker wheel spindle sheared and was replaced at	179	1135
- Several bolts attaching the right center weight box to the frame were lost and replaced at	189	1198
- The hitch jack was torn off by the rear tractor wheel when turning too shard at	203	1287
Hydraulics		
- The hydraulic plumbing on the wing lift pipes began leaking and was tightened at	189	1198

DISCUSSION OF MECHANICAL PROBLEMS

BLADES AND SHANKS

Blade Wear: As is common with most cultivators, rapid non-uniform wear occurred on blades following the tractor wheel tracks. All blades were replaced when the sweep face was worn to 115 mm (4.5 in). A complete set of blades was replaced after 189 hours. Blade wear rate depends on the type and abrasiveness of the soil. Great variation can be expected.

APPENDIX I

SPECIFICATIONS

MAKE:	Victory Blade Cultivator
MODEL:	9.7 m (32 ft) size
MANUFACTURER:	Victory Equipment Ltd. 920 Second A Avenue North T1H 0E3

DIMENSIONS:

	RELD POSITION	TRANSPORT POSITION
- width	9700 mm	5150 mm
	5800 mm	5800 mm
	1900 mm	4120 mm
- maximum ground clearance	230 mm	230 mm
- wheel tread	8860 mm	3700 mm

SHANKS:

- number	6
- lateral	1590 mm
- trash clearance (frame to blade tip)	665 mm
- number of rows	2
- distance between rows	305 mm
- standard cross-section	30 x 199 mm

BLADE:

- number of mounting bolts	12
- bolt size	13 mm
- blade wing width	1720 mm
- blade nose angle	90°
- blade face width	165 mm

HITCH:

- vertical adjustment range	230 mm

DEPTH CONTROL:	hydraulic

FRAME:

- cross-section	152 x 47 mm channel

TIRES:

- centre section	4, 9.5L x 15, 6-ply
- wings	2, 9.5L x 15, 6-ply

NUMBER OF LUBRICATION POINTS:	6 wheel bearings, annual service 2 grease fittings, 10 hour service

HYDRAULIC CYLINDERS:

- main frame depth control	1, 127 x 305 mm
- wing lift	2, 127 x 305 mm

WEIGHTS (with marker):

	FIELD POSITION	TRANSPORT POSITION
- right wheel	332 kg	
- right center wheels	1213 kg	1545 kg
- left center wheels	1213 kg	1568 kg
- left wheel	355 kg	
- hitch	335 kg	355 kg
TOTAL	3468 kg	3468 kg

OPTIONAL EQUIPMENT:
- four width options from 8.1 to 16.3 m
- coulters
- field marker*

* supplied on test machine

APPENDIX II

MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

(a) excellent
(b) very good
(c) good
(d) fair
(e) poor
(f) unsatisfactory

APPENDIX III

CONVERSION TABLE

1 hectare (ha)	= 2.5 acres (ac)
1 kilometre/hour (km/h)	= 0.6 mile/hour (mph)
1 kilowatt (kW)	= 1.3 horsepower (hp)
1 kilogram (kg)	= 2.2 pounds mass (lb)
1 newton (N)	= 0.2 pounds force (lb)
1 kilonewton (kN)	= 220 pounds force (lb)
1 kilonewton/metre (kN/m)	= 70 pounds force/foot (lb/ft)
1 metre (m)	= 3.3 feet (ft)
1 millimetre (mm)	= 0.04 inches (in)

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