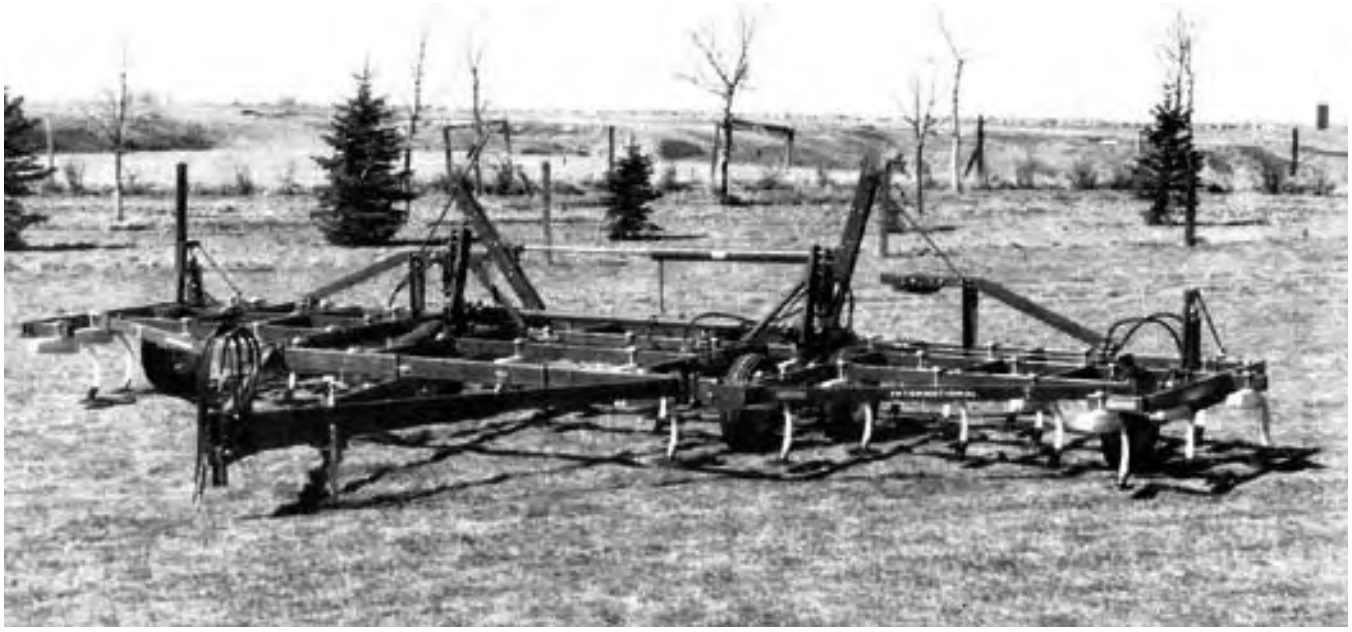
Evaluation Report No. E1277C
Printed: April, 1979
Tested at: Lethbridge
ISSN 0383-3445

Evaluation Report 59



International 645 (10.2 m) Vibra-Chisel

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

INTERNATIONAL 645 VIBRA-CHISEL

MANUFACTURER:

International Harvester Company of Canada, Ltd.
208 Hillyard Street
Hamilton, Ontario

DISTRIBUTOR:

International Harvester Company of Canada, Ltd.
660 Wall Street
Winnipeg, Manitoba
R3C 2W8

RETAIL PRICE

$10,354.00 (April, 1979, f.o.b. Lethbridge, 10.2 m width, with optional finishing harrows).

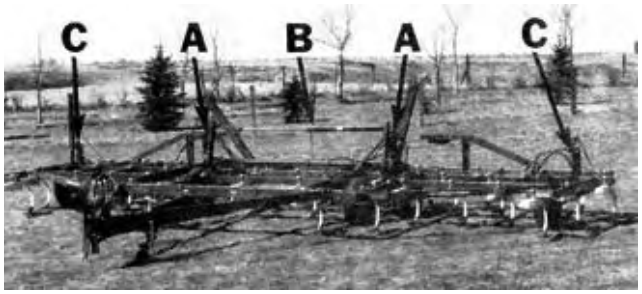


FIGURE 1. International 645: (A) Master Cylinders, (B) Wing Lift Cylinder, (C) Slave Cylinders.

SUMMARY AND CONCLUSIONS

Overall functional performance of the International 645 Vibra-chisel was very good for light secondary tillage such as seedbed preparation and herbicide incorporation, providing mounted finishing harrows were used. Its performance in heavy secondary tillage and light to intermediate primary tillage was very good. Weed kill was very good if 254 mm, or larger sweeps were used. It was unsuitable for heavy primary tillage, very hard soil or very heavy trash.

The spring cushioned shanks could lift 330 mm (13 in) to clear stones. Shanks were sufficiently rigid to be suitable for all secondary tillage as well as light to intermediate primary tillage. When equipped with recommended sweeps, having a 47 degree sweep stem angle, sweep pitch varied from 7 to 10 degrees over the range of normal secondary tillage draft. With 248 mm (9.75 in) shank spacing, shank cushioning spring preload was exceeded at drafts greater than 4.1 kN/m (290 lb/ft), occurring well within the primary tillage draft range. Furrow bottom ridging occurred only in hard soils. Penetration was very good in soft soils, good in moderately firm to hard soils and poor in very hard soils. Plugging occurred in very heavy or damp trash. The International 645 buried less trash than most heavy duty cultivators but buried slightly more than most light field cultivators. The sweep pattern was symmetrical and sideways skewing was evident only in very hilly conditions and was never severe enough to affect weed kill. Weed kill was good as long as sweeps with adequate overlap were used.

The International 645 could be conveniently placed in transport position in less than five minutes. The 248 mm (9.75 in) sweep to ground clearance, in transport position, was adequate. Due to its large transport width and height, transporting on public roads had to be with extreme caution and the manufacturer's maximum recommended transport speed of 32 km/h (20 mph) should not be exceeded. The 10.2 m (33.25 ft) wide test machine had a transport height of 4 m (13.1 ft), permitting safe transport under power lines in the three prairie provinces. Transport height of the 12.6 m (41.5 ft) wide model of the International 645 is 5.3 m. (17.5 ft) which is higher than minimum power line heights in all three provinces.

When equipped with optional finishing harrows, hitch weight was negative, making hitching inconvenient. Adequate adjustment was provided for both lateral and fore-and-aft levelling. Tillage depth was uniform across the width of the cultivator as long as the centre frame and wing section hydraulic cylinders were kept synchronized and the hydraulic stop collars were used on the master cylinders.

Average draft for the 10.2 m (33.25 ft) wide test machine in light secondary tillage, at 8 km/h (5 mph), varied from 8 kN (1760 lb) at 40 mm (1.5 in) depth to 20 kN (4400 lb) at 100 mm (4 in) depth. In heavy secondary and light primary tillage, at 8 km/h (5 mph), average draft varied from 14 kN (3080 lb) at 40 mm (1.5 in) to 38 kN (8360 lb) at 125 mm (5 in). In heavy primary tillage, at 8 km/h (5 mph), average draft varied from 18 kN (3960 lb) at 50 mm (2 in) to 50 kN (11,000 lb) at 100 mm (4 in).

In light secondary tillage, at 10 km/h (6.2 mph) and 75 mm (3 in) depth, a tractor with 84 kW (113 hp) maximum power take-off rating will have sufficient power reserve to operate a 10.2 m (33.25 ft) wide International 645. In heavy secondary or light primary tillage at the same depth and speed, a 122 kW (163 hp) tractor is needed while in heavy primary tillage a 149 kW (200 hp) tractor is required.

The International 645 was equipped with wing transport locks, a slow moving vehicle sign, and reflective tape on the wing frames, to aid in transport safety. No mechanical transport locks were provided for the master depth control cylinders. The operator's manual was clear, concise and well illustrated.

Only minor mechanical problems occurred during the 204 hours of field operation, none of which seriously affected cultivator operation.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying a mechanical transport lock for the centre frame depth control cylinders to aid in transport safety.
2. Providing an alternate location for the hitch jack for use at the rear of the cultivator to facilitate hitching when equipped with mounted harrows.
3. Providing some means of holding the hitch link in the horizontal position to facilitate one-man hitching.
4. Working with the agricultural equipment industry to standardize hydraulic quick couplers and hydraulic hose fitting threads.
5. Working with the agricultural equipment industry to standardize shank and sweep stem angles, and sweep fastener spacings and sizes.

Chief Engineer: E. O. Nyborg
Senior Engineer: E. H. Wiens

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Transporting instructions in the operator's manual state the following "Extend the depth control cylinders fully, then move the stop collars against the stop pins on the master cylinders." This puts the piston rod under compression. Hose pressure can then be relieved for transport, eliminating any safety problem connected with hydraulic failures.
2. For machines equipped with mounted harrows, the operator's manual recommends that the sweeps be on the ground before the hitch pin is removed. When hitching, if the hydraulics are hooked up first, hitch height can be varied. !f the sweeps are raised without the hitch connected, the jack should be down as a safety precaution. This will be clarified in the operator's manual.
3. We are considering a solid hitch bar that does not pivot.
4. We would support an industry wide attempt to standardize hydraulic quick couplers and hydraulic hose fitting threads.
5. Our designs were established prior to the current ASAE STANDARD. We would support updating this standard and in any future design, we would seriously consider following the standard.

GENERAL DESCRIPTION

The International 645 is a trailing, flexible, three-section intermediate cultivator suitable for light or medium tillage such as seedbed preparation and herbicide incorporation, heavy secondary summerfallow and light primary summerfallow. It is available in six widths ranging from 9.7 to 12.6 m. The test machine was a 10.2 m model, with a 4.0 m centre frame and two 3.1 m wings. It was equipped with 41 spring cushioned shanks, laterally spaced at

248 mm, arranged in three rows on the wings and in four rows on the centre section.

The centre frame is carded on two tandem wheel sets, while each wing is supported by a single wheel. Four hydraulic cylinders control the tillage depth. Two master cylinders, connected in parallel, control the centre frame wheels, while each wing wheel is controlled with a slave cylinder, connected in series to the master cylinder on its side. The wings fold into upright transport position with a single hydraulic cylinder. A tractor with dual remote hydraulic controls is needed to operate the International 645.

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

SCOPE OF TEST

The International 645 was operated in the field conditions shown in TABLE 1, for 204 hours, while cultivating about 1830 ha. It was evaluated for quality of work, ease of operation and adjustment, power requirements, safety and suitability of the operator's manual. Optional attached finishing harrows were used dudng most of the test.

TABLE 1. Operating Conditions

FIELD CONDITIONS	HOURS	FIELD AREA (ha)
Soil Type		
- loam	104	933
- clay loam	67	601
- clay	33	295
TOTAL	204	1830
Stoney Phase		
- stone free	57	511
- occasional stones	116	1041
- moderately stony	31	278
- vey stony	0	0
TOTAL	204	1830

RESULTS AND DISCUSSION

QUAUTY OF WORK

Shank Characteristics: There is a large variation in shank and sweep stem angles (FIGURE 2) on cultivators from different manufacturers. Sweeps and shanks must be matched to obtain sufficient sweep pitch to achieve and maintain penetration. Usually manufacturers recommend sweeps with a stem angle from 0 to 5 degrees less than the shank stem angle to result in a slightly positive no-load sweep pitch. Sweep pitch increases in proportion to draft due to shank flexing and, depending on shank stiffness and cushioning spring preload, may become excessive in normal tillage, on some cultivators. A slightly positive sweep pitch results in uniform tillage depth and a smooth furrow bottom while excessive sweep pitch causes furrow bottom ridging and rapid sweep tip wear. Shanks which maintain a relatively constant sweep pitch, over the normal range of tillage forces, are desirable. The International 645 was equipped with spring cushioned shank holders. Cushioning spring preload was not adjustable. During the test, the International 645 was used with 305 mm wide International sweeps with 47 degree stem angle, giving a no. load sweep pitch of 7 degrees.

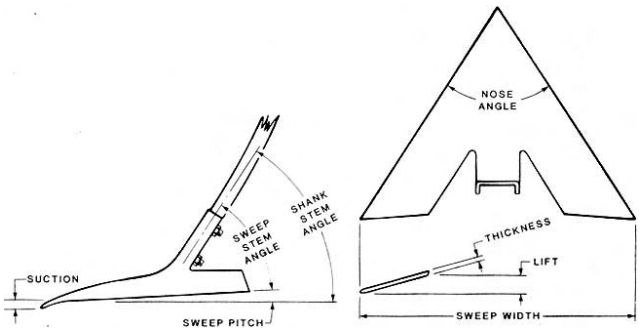


FIGURE 2. Shank end Sweep Terminology.

FIGURE 3 shows pitch characteristics of the International 645 shank assembly. The low end of the pitch curve results from shank flexing, while the steeper upper part of the curve occurs when draft is large enough to overcome cushioning spring preload. Sweep pitch varied 3 degrees over the full range of draft normally occurring in secondary tillage. When equipped with 47 degree sweeps, as used during the test, sweep pitch varied from 7 to 10 degrees over this draft range. Cushioning spring preload was exceeded at drafts greater than 4.1 kN/m, occurring well within the range of normal primary tillage drafts. This shows that the International 645 is suitable both for secondary and light to intermediate primary tillage, but is not intended for heavy primary tillage.

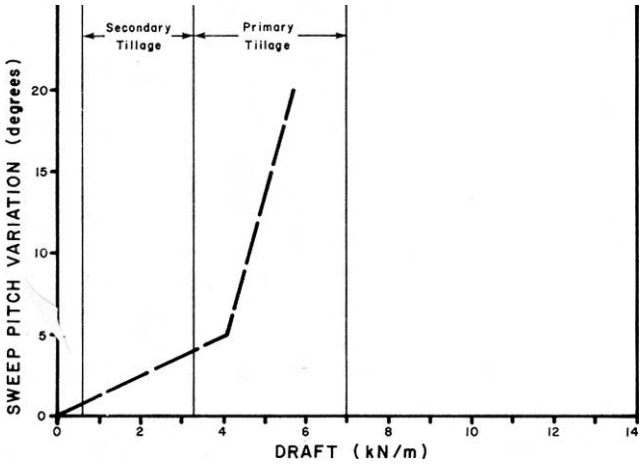


FIGURE 3. Sweep Pitch Variation over a Normal Range of Draft (248 mm shank spacing).

FIGURE 4 shows the lifting pattern when shanks encounter stones or field obstructions. Maximum lift height was 330 mm. The shank assemblies performed well throughout the test. No shank or sweep damage occurred.

Penetration: Penetration was very good in soft soils and was good in moderately firm to hard soil. Penetration was poor in very hard soils.

Penetration was uniform across the cultivator width provided that depth control stops were used on the hydraulic cylinders. Without depth control stops, the cultivator could not be kept level. Tires were adequately sized to provide good flotation in most soil conditions. The wheels were positioned so that each centre section wheel supported about 18% of the cultivator weight while each wing wheel supported about 14%. In addition, each centre section wheel supported about 15% of the total tillage suction force while each wing supported about 20%. For good flotation, it is desirable to have wheels sized and positioned so that each supports equivalent weight and a similar tillage suction force.

Depth differences between the front and rear rows of shanks were slight, once the frame' had been properly levelled. In secondary and light to intermediate primary tillage, the frame remained relatively level with little twisting of the wing frames.

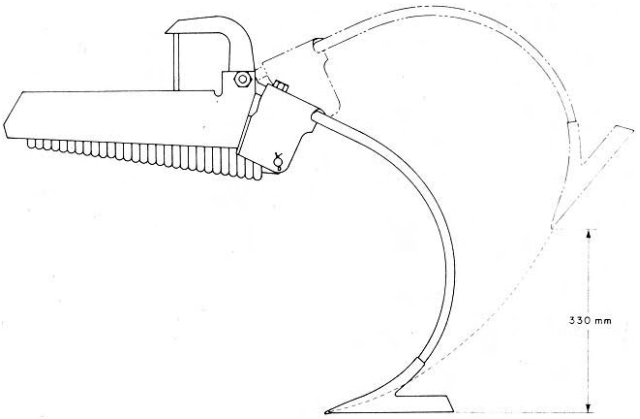


FIGURE 4. Shank Lifting Pattern.

The International 645 followed gently rolling field contours very well, maintaining quite uniform depth across its width. Ail 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: No plugging occurred in moderate trash and weeds. In dry conditions the International 645 cleared large amounts of trash. In very heavy or damp trash, plugging usually occurred at the rear centre shanks and at the inner sides of the main frame wheels. In heavy trash, the harrows also plugged. Harrow plugging could be alleviated by reducing the downward spring pressure on the harrows or by placing them in the raised position.

Trash Burial and Field Surface: The International 645 buried less trash than most heavy duty cultivators and slightly more than most light field cultivators. With the optional harrows, fields were left with a smooth, unridged surface (FIGURE 5). With the harrows raised, the surface was left with 30 to 45 mm deep ridges (FIGURE 6).

Furrow Bottom Ridging: In soft soil, furrow bottom ridging was between 10 and 20 mm. Furrow bottom ridging increased to 25 mm (FIGURE 7) in hard soil, due to increased sweep pitch at high draft.

Skewing and Stability: The International 645 was very stable and sideways skewing occurred only in very hilly conditions. Skewing never was severe enough to affect weed kill. The shank pattern (FIGURE 8) Was symmetrical and did not impose any side forces on the cultivator during normal tillage. When equipped with 305 mm sweeps, weeds would be missed if the cultivator skewed more than 1.5 degrees (FIGURE 8).

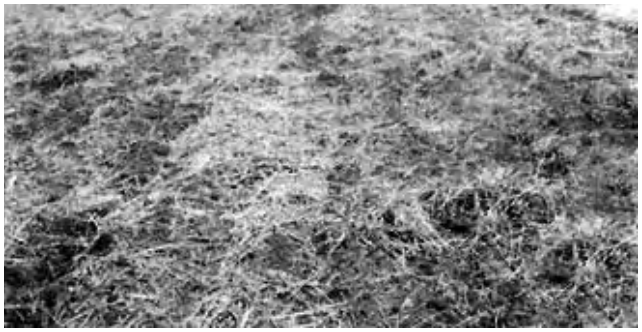


FIGURE 5. Smooth, Unridged Surface Created with Mounted Harrows.

shank spacing was 248 mm, resulting in 57 mm overlap. When sweeps had worn to less than 255 mm width, a significant number of heavy stalked weeds remained rooted, due to lateral shank movement when sweeps contacted the weeds. Sweeps should be replaced before they wear to less than 255 mm width.

FIGURE 6. Ridged Surface when Harrows Not Used.

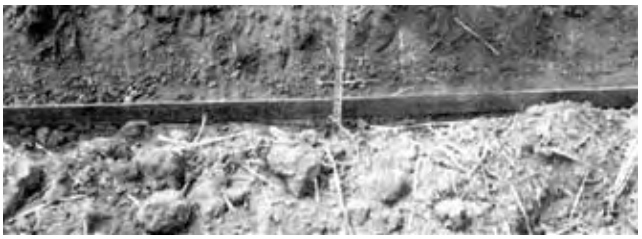


FIGURE 7. Furrow Bottom Ridging.

EASE OF OPERATION AND ADJUSTMENT

Transporting: The International 645 was easily placed in transport position (FIGURE 9) 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, which depended on the tractor hydraulic system, took one man less than five minutes. There was no mechanical means of

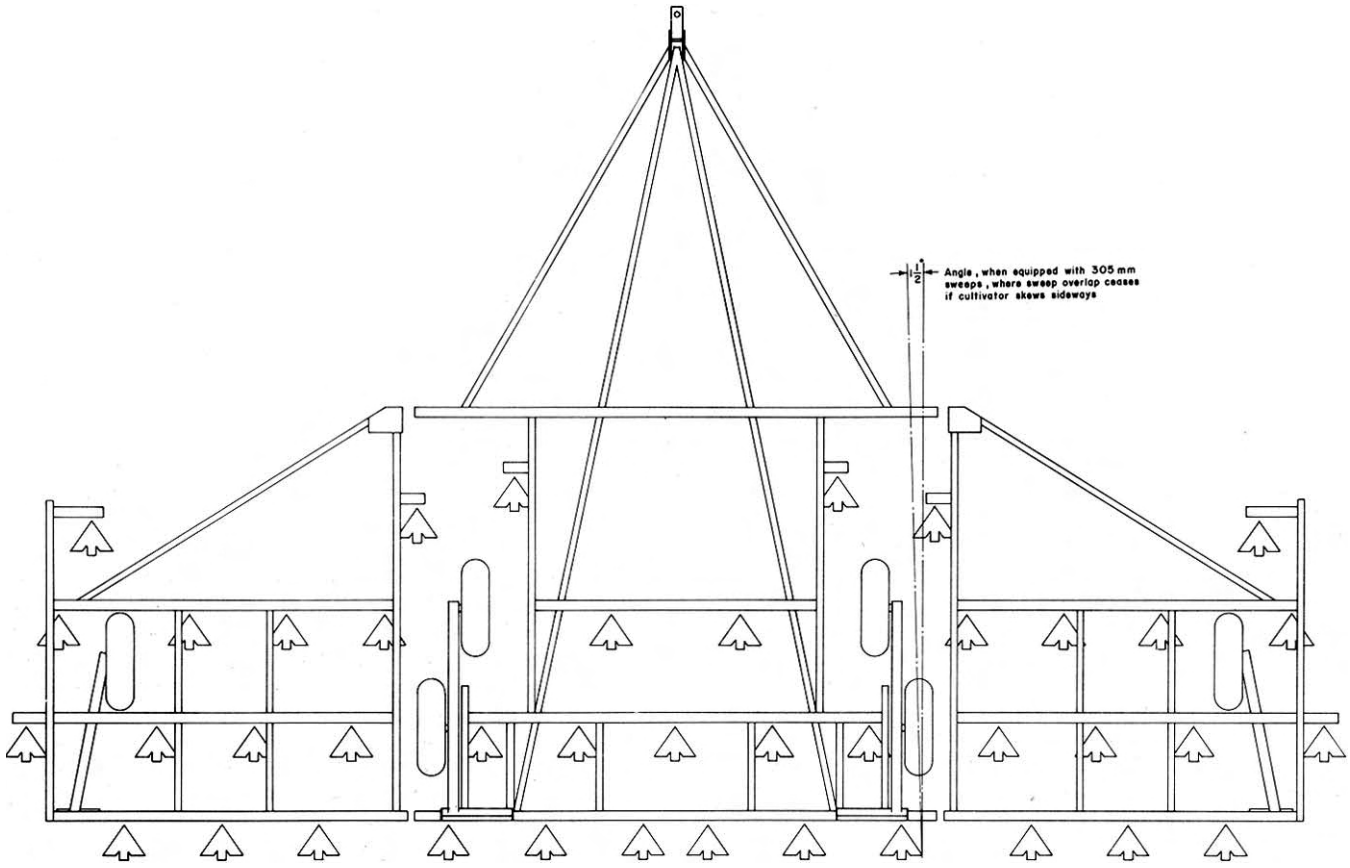


FIGURE 8. Sweep Pattern (305 mm shank spacing).

locking the two master depth control cylinders in transport position. Transport lock-up of the centre frame was accomplished by placing stop collars against the hydraulic stop pins on the master cylinders. Since this method provides no safeguard against hose failure during transport, it is recommended that a mechanical lock be provided to ensure transport safety. Transport width was 5.8 m while transport height was 4 m. Extreme care was needed when transporting on public roads, through gates, over bridges and beneath power or telephone lines. Hitch weight, without finishing harrows was about 212 kg while with attached finishing harrows, the hitch weight was minus 9 kg. Negative hitch weight caused a tendency for cultivator swaying at higher transport speeds. Swaying did not occur when transporting at the manufacturer's maximum recommended speed of 32 km/h. If a farm truck is used to transport the cultivator, sufficient weight should be added to the truck to ensure stability. Sweep to ground clearance during transport was 248 mm, while transport wheel tread was 3.4 m. This provided ample ground clearance.

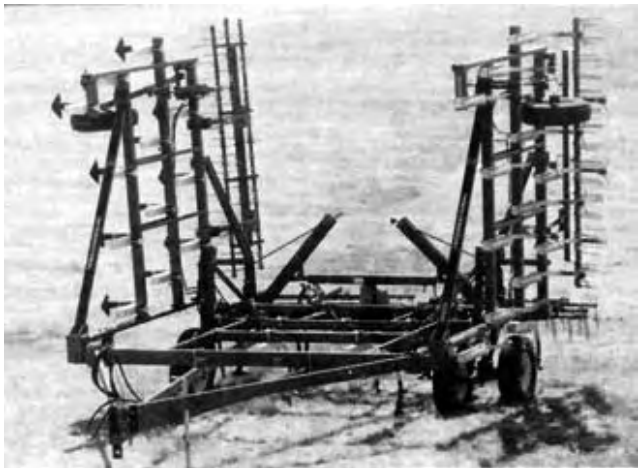


FIGURE 9. Transport Position.

Hitching: The International 645 was equipped with a hitch jack as standard equipment. The jack permitted easy hitching, only if the cultivator was not equipped with mounted harrows. When finishing harrows were attached, the resulting negative hitch weight made it difficult for one man to hitch the cultivator to a tractor. It i s recommended that an alternate location for the adjustable hitch jack be provided at the rear of the cultivator to facilitate hitching when equipped with finishing harrows.

The hitch link swivelled downward when not hitched to a tractor (FIGURE 10). One-man hitching would have been greatly facilitated if the link remained horizontal.

Hitch height could be adjusted 260 mm in six increments by removing one bolt. This range was adequate to allow fore-and-aft cultivator frame levelling with all tractors used during testing.

Frame Levelling: Adequate lateral levelling adjustments were provided for both the centre and wing sections. The centre frame was levelled by adjusting the depth control stops on the two master cylinders. Wing adjustment was by means of threaded connectors, attaching the tops of the wing cylinders to the frame.

Depth of Tillage: Tillage depth was controlled by four hydraulic cylinders; one master cylinder on each side of the main frame and a slave cylinder, in series with the master cylinder, on each wing. The master cylinders were attached to the main frame wheels while the wing cylinders were attached to the wing wheels.

Uniform tillage depth, across the cultivator width, could be obtained only by using the hydraulic depth control stop collars on the master cylinders. Attempting to set depth, only with the tractor hydraulics, without using the depth control stops caused the right side to operate lower than the left. As is common with series hydraulic systems, to maintain the centre and wing frames at the same height, periodic synchronization of the cylinders, by completely extending them to fully raised position, was necessary

Sweep Installation: It took one man about three hours to remove and replace the 41 sweeps on the International 645. The sweep bolts, which were installed with double nuts to reduce the possibility of sweep loss, were short enough to have their ends completely covered by the nuts, preventing thread damage during tillage.

Shank Installation: It took about 15 minutes to replace a shank. The complete shank holder assembly had to be removed from the frame to remove the shank.

POWER REQUIREMENTS

Draft Characteristics: FIGURE 11 shows draft requirements for intermediate cultivators in typical secondary and primary tillage, at a speed of 8 km/h. This figure gives average requirements based on tests of 16 makes of cultivators in 52 different field conditions. Attempting to compare draft requirements of different makes of cultivators usually is unrealistic. Draft requirements for the same cultivator, in the same field, may vary by as much as 30% in two different years, 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 differences between different makes of cultivators.

In light secondary tillage, such as herbicide incorporation or seedbed preparation, average draft per metre of width, at 8 km/h, varied from 0.8 kN at 40 mm depth to 2 kN at 100 mm depth. For the 10.2 m wide test machine, this corresponds to a total draft ranging from about 8 to 20 kN.

In heavy secondary, and light primary tillage, average draft per metre of width, at 8 km/h, varied from 1.4 kN at 40 mm depth to 3.7 kN at 125 mm depth, corresponding to a total variation from about 14 to 38 kN for the 10.2 m test machine.

In heavy primary tillage, average draft per metre of width, at 8 km/h, varied from 1.8 kN at 50 mm depth to 4.9 kN at 100 mm depth, corresponding to a total draft from about 18 to 50 kN for the 10. 2 m test machine.

Increasing speed by 1 km/h, increased draft by about 90 N per metre of width. For the 10.2 m wide test machine, this represents a draft increase of 0.9 kN for a 1 km/h speed increase.

Tractor Size: TABLES 2 to 4 show tractor sizes needed to operate the 10.2 m wide International 645 in light and heavy secondary tillage as well as in primary 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 International 645 in the stated conditions.

TABLE 2. Tractor Size (Maximum Power Take-off Rating, kW) to Operate the 10.2 m Wide International 645 in Light Secondary Tillage.

DEPTH mm	SPEED km/h					
	7	8	9	10	11	12
40	24	31	38	47	56	66
50	32	39	48	57	68	79
75	50	61	72	84	97	111
100	69	82	96	111	127	143

TABLE 3. Tractor Size (Maximum Power Take-off Rating, kW) to Operate the 10.2 m Wide International 645 in Heavy Secondary or Light Primary Tillage.

DEPTH mm	SPEED km/h					
	7	8	9	10	11	12
40	44	54	64	76	89	102
50	53	64	76	89	103	118
75	76	90	106	122	140	158
100	99	117	136	155	176	197
125	122	143	165	188	212	237

TABLE 4. Tractor Size (Maximum Power Take-off Rating, kW) to Operate the 10.2 m Wide International 645 in Heavy Primary Tillage.

DEPTH mm	SPEED km/h					
	7	8	9	10	11	12
50	50	60	71	83	96	110
75	96	113	131	149	169	189
100	142	156	190	216	242	268

Tractor size may be determined by selecting the desired tillage depth and speed from the appropriate table. For example, in light secondary tillage at 75 mm depth and 10 km/h, an 84 kW tractor is needed to operate the International 645. In heavy secondary or light

primary tillage at the same depth and speed, a 122 kW tractor is needed, while in heavy primary tillage a 149 kW tractor is required.

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 over farm land or over secondary roads. In Alberta and Manitoba, the neutral ground wire may be as low as 4.8 m over farm land. In all three provinces, feeder lines in farmyards may be as low as 4.6 m.

Transport height of the 10.2 m wide test machine was 4 m, permitting safe transport under prairie power lines. On the other hand, transport height of the 12.6 m wide model of the International 645 is 5.3 m, 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 public roads. If height limits are exceeded, the operator must contact power and telephone utilities before moving.

The International 645 was 5.8 m wide in transport position. This necessitated caution when towing on public roads, over bridges and through gates. The International 645 was equipped with a slow moving vehicle sign as well as reflective tape at the rear of both wings. The manufacturer recommends that transport speed should not exceed 32 km/h.

Pins were provided to lock the wings in transport position. A mechanical transport lock was not provided for the centre frame lift cylinders. It is recommended that a lift cylinder lock be supplied as standard equipment to provide for safer transport.

The four tires supporting the main frame were adequately sized for transporting the cultivator. Individual tire loads did not exceed the Tire and Rim Association maximum rating for 9.5L x 14, 6 ply tires. The operator's manual clearly outlined all safety precautions.

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. Sweep Bolt Holes: The bolt hole size and spacing on cultivator sweeps and shanks, as well as stem angles, should similarly be standardized to provide some degree of interchangeability of sweeps.

OPERATOR'S MANUAL

The operator's manual was very good, containing useful information on safety, operation, maintenance and assembly. It was clear, concise and well illustrated.

DURABILITY RESULTS

TABLE 5 outlines the mechanical history of the International 645 during 204 hours of field operation while tilling about 1830 ha. 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 5. Mechanical History

ITEMS	OPERATING HOURS	EQUIVALENT FIELD AREA ha
Sweeps and Shanks		
- Most shanks had loosened in their holders and were tightened at	87	780
- New sweeps were installed at	90	807
Hydraulics		
- The right wing cylinder hose clamp was lost, due to inadequate tightening, and replaced at	72	646
- The right depth control stop collar was over tightened and broke at	170, 185	1525, 1660
Miscellaneous		
- The hitch jack handle broke at	180	1615

DISCUSSION OF MECHANICAL PROBLEMS

Shanks: Most shank attaching bolts loosened during the test due to inadequate bolt torquing during assembly. No further loosening occurred after the bolts were properly torqued. Sweep Wear: As is common with most cultivators, rapid, nonuniform wear occurred on sweeps following the cultivator and tractor wheel tracks. The front row of sweeps also wore faster than the rear rows. When replaced at 90 hours, the front sweeps were only 250 mm wide while the rear sweeps were 270 mm wide. Sweep wear rate depends on the type and abrasiveness of the soil. Great variation can be expected. Depth Stop Collar: Failure of the master cylinder hydraulic depth stop collar was the result of over tightening by an operator.

APPENDIX I

SPECIFICATIONS

MACHINE RATINGS
MAKE: International Vibra-Chisel
MODEL: 645 (10.2 m size)
MANUFACTURER: International Harvester Company of Canada, Ltd.
208 Hillyard Street
Hamilton, Ontario

DIMENSIONS	FIELD POSITION	TRANSPORT POSITION
- width	10,168 mm	5830 mm
- length	6630 mm	6630 mm
- height	2180 mm	4000 mm
- maximum ground clearance	248 mm	248 mm
- wheel tread	8535 mm	3350 mm

SHANKS:	
- number	41
- lateral spacing	248 mm
- trash clearance (frame to sweep tip)	430 mm
- number of shank rows	
-centre section	4
- wings	3
- distance between rows	1473, 850 and 750 mm
- shank cross section	19 x 44.5 mm
- shank stem angle	54°
- sweep hole spacing	60 mm
- sweep bolt size	13 mm
HITCH:	
- vertical adjustment range	260 mm (10.2 in)
DEPTH CONTROL:	hydraulic
FRAME:	
- cross section	76.2 x 101.6 mm.tubing
TIRES:	
- centre section	4, 9.5L x 14, 6 ply
- wings	2, 9.5L x 14, 6 ply
NUMBER OF LUBRICATION POINTS:	4 grease fittings, 30 hour service 4 wheal bearings, 30 hour Service
HYDRAULIC CYLINDERS:	
- main frame, depth control masters	2, 89 x 203 mm
- wings, depth control slaves	2, 89 x 203 mm
- wing lift cylinder	1, 102 x 1422 mm

WEIGHTS: (Without Harrows)	FIELD POSITION	TRANSPORT POSITION
- right wheel	445 kg	
- right centre wheels	1063 kg	1472 kg
- left centre wheels	1063 kg	1472 kg
- left wheel	445 kg	
- hitch	140 kg	212 kg
TOTAL	13,156 kg	3156 kg

WEIGHTS: (With Mounted Harrows)	FIELD POSITION	TRANSPORT POSITION
- right wheel	518 kg	
- right centre wheels	1260 kg	1766 kg
- left centre wheels	1260 kg	1766 kg
- left wheel	518 kg	
- hitch	-33 kg	-9 kg
TOTAL	3523 kg	3523 kg

OPTIONAL EQUIPMENT:
- six width options from 9.7 to 12.6 m
- 330 mm shank spacing
- mounted finishing harrows*

* supplied on test machine

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 mile/hour (mph)
1000 millimetres (mm) = 1 metre (m)	= 39.37 inches (in)
1 kilowatt (kW)	= 1.34 horsepower (hp)
1 kilogram (kg)	= 2.20 pounds mass (lb)
1 newton (N)	= 0.22 pounds force (lb)
1 kilonewton (kN)	= 220 pounds force (lb)
1 kilonewton/metre (kN/m)	= 70 pounds force/foot (lb/ft)

ALBERTA FARM MACHINERY RESEARCH CENTRE

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