

Evaluation Report

632



Cereal Implements 702 Pull-Type Windrower

A Co-operative Program Between



CEREAL IMPLEMENTS 702 PULL-TYPE WINDROWER

MANUFACTURER AND DISTRIBUTOR:

Vicon Manufacturing Inc.
1000 - 6th Avenue East
Portage la Prairie, Manitoba
R1N 3R3
Telephone: (204) 239-5544

RETAIL PRICE:

\$21,556.00 [April, 1990, f.o.b. Humboldt with 30 ft (9.1 m) double windrow header].

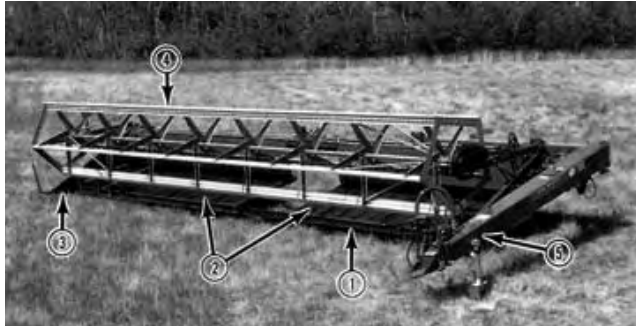


FIGURE 1. Cereal Implements 702: (1) Cutterbar, (2) Drapers, (3) Divider, (4) Reel, (5) Hitch.

SUMMARY AND CONCLUSIONS

Rate of Work: Typical speed for the Cereal Implements 702 ranged from 5 to 7 mph (8 to 11 km/h) with a maximum attained speed of 9 mph (14 km/h). Workrate varied from 17 to 24 ac/h (6.8 to 9.6 ha/h) in straight level fields with even crop stands. Workrates at the maximum speed of 9 mph (14 km/h) was 30 ac/h (11 ha/h).

Quality of Work: Crop dividing was good. The crop divider pushed some plants down. Most were cut on the next round but in short, lodged or tangled crop, some tramped crop was missed. The small draper at the right end of the header provided adequate clearance when laying double windrows.

Header flotation was good. The hydraulic accumulator when properly set, prevented damage to the cutterbar; however, the header bounced slightly on rough terrain.

Cutting ability was good. The knife had adequate power in most crops and left ideal stubble. As the knife sections under the pressure clips wore, clearance increased, cutting was reduced and plugging occurred in damp crop.

Crop handling was good. The reels worked well in most crops, moving the crop over the cutterbar with minimal threshing and crop loss. The draper angle was suitable for most crops when centre delivering the windrow. When end delivering, in short stands, crop tended to slide down and bunched windrows resulted. The draper had adequate power to convey all crops encountered and the speeds available were appropriate. The windrow opening was adequate in typical crop stands, but was marginal in heavy stands.

Windrow quality was good in average crop stands, windrows were uniform with the crop laid in a parallel pattern, in heavy stands of bushy crop some bunching occurred and the windrow formation changed to a fantail pattern. End delivering short crops resulted in slightly bunched windrows. Single windrow widths for cereal grains varied from 3 to 6 ft (0.9 to 1.8 m), while canola windrows were often 7 to 10 ft (2.1 to 3.0 m) wide.

Ease of Operation and Adjustment: Ease of operating the controls was very good. The windrower's control console provided fingertip selection and control of windrower functions. The tractor's hydraulics operated the reel lift, header lift, hitch swing and transport positioning. Once latched together the draper tables could be easily shifted from the cab for laying double windrows.

Adjustment was very good. Initial adjustments were not difficult although more precise instructions would have been helpful. Day-

to-day adjustments such as draper tensioning and setting reel position were quick and easy to do. Adjusting windrower opening was time consuming and shifting the rollers was difficult.

Handling was very good. The windrower was quick and easy to switch from transport to field position. The windrower tracked well and handled slopes up to about 14 degrees. The absence of a PTO drive enabled very tight cornering without driveline vibrations. The adjustable hitch angle was very convenient. The windrower quickly and easily swung into transport with a width of 11.8 ft (3.6 m). It towed well at speeds up to 20 mph (32 km/h). Caution was required when turning left as the hitch jack limited the turning angle.

Lighting was fair. Only one light was provided. It only shone on the cutting table. Extra lighting from the tractor was essential. Additional lighting was required to illuminate the windrow.

Ease of servicing was excellent. All grease fittings and maintenance points were easily accessed.

Tractor Power Requirements: The manufacturer's recommendations for tractor size were found to be appropriate. On a level field in a moderately heavy crop stand of wheat, drawbar power was about 17 hp (12.7 kW) and an additional 21 PTO hp (15.7 kW) was required to operate the windrower for a total of 38 hp (28.4 kW).

Operator Safety: The Cereal Implements 702 windrower was safe to operate if the safety precautions laid out in the manual were followed and normal caution was used. The drives were shielded and warning decals identified dangerous areas. A slow moving vehicle sign was provided but not a hitch safety chain. The front wheel of the windrower was overloaded while in transport position according to the Tire and Rim Association Guidelines.

Operator's Manual: The operator's manual was very good. It was well organized and illustrated. It contained much useful information although some instructions were incomplete and unclear.

Mechanical History: Only a few mechanical problems were encountered. The knife sections supplied wore rapidly which meant the pressure clips had to be adjusted often or cutting was affected. As well, the wear life was short.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Improving the divider to reduce loss.
2. Modifications to reduce rapid knife section wear.
3. Modification to improve crop flow on the drapers when double windrowing.
4. Modifications that enable the windrow opening to handle heavy crop stands.
5. Providing more complete instruction in the operator's manual on the proper adjustment of the header flotation system.
6. Improving the ease of changing the windrow opening.
7. Supplying an alternate mounting bracket for hitch jack storage while transporting.
8. Providing adjustable lights for lighting the windrow behind the header.
9. Supplying a front tire that complies with the loads recommended by the Tire and Rim Association Guidelines.
10. Supplying a hitch safety chain.

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Project Technologist: A.R. Boyden

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Crop dividers in general are very sensitive to specific crops and conditions in particular areas. Since no all purpose divider has been found, the general purpose divider point on the 702 windrower has been designed for quick, easy removal. This allows the farmer to operate with or without it or replace it with a preferred design. Vicon Manufacturing Inc. will adopt new designs as they are proven to be superior.

2. In the interest of extended wear Vicon Manufacturing Inc. has re-specified certain cutterbar components. The OEM knife sections will be harder and the hold downs will be cast iron.
3. Vicon Manufacturing Inc. considers the 702's 16 degree draper angle as optimum for the wide range of crops windrowed. Although a lower draper angle may help in stunted cereal crops, it is likely that windrow formation may be adversely affected in heavy, bushy crops.
4. Future design will consider wider windrow openings on the wider swathers.
5. The operator's manual will be modified in the future.
6. This will be considered in conjunction with recommendation four.
7. An alternate location will be considered.
8. Vicon Manufacturing Inc. is not considering mounting a second light on the 702.
9. In future the guidelines will be met.
10. In future a hitch safety chain will be standard equipment.

GENERAL DESCRIPTION

The Cereal Implements 702 (FIGURE 1) is a pull-type windrower capable of centre, left or right end crop delivery for laying either single or double windrows. The test machine is a 30 ft (9.1 m) wide model.

The knife, reel, and sliding drapers are driven hydraulically from a pump mounted on the PTO shaft of the tractor. Hydraulic cylinders control reel height, header height, hitch angle and transport position. They are operated using two of the tractor's remote hydraulic circuits. A control console mounts in the tractor cab and contains separate switches to set reel and draper speeds, adjust draper delivery position, and illuminate the field light. A multi-position switch on the console selects control of header height, hitch swing, or transport position, which is then operated using one tractor hydraulic control lever.

The two wheels of the windrower are cambered and adjustable for proper tracking. The hitch pole can be extended for greater windrow clearance beside the tractor. Header skid plates and windrow opening width are also adjustable.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The machine evaluated by PAMI was 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 or after the PAMI tests. Therefore, when using this report, check that the machine under consideration is the same as the one reported here. If differences exist, assistance can be obtained from PAMI or the manufacturer to determine changes in performance.

The Cereal Implements 702 windrower was operated for 117 hours while cutting 2105 ac (842 ha) of various crops as shown in TABLE 1. During this time observations and measurements were made to evaluate the windrower for rate of work, quality of work, ease of operation and adjustment, power requirements, operator safety and the suitability of the operator's manual. The purpose of the evaluation was to determine functional performance characteristics. Extended durability testing was not conducted; however, mechanical failures, which occurred during the test, were recorded.

RESULTS AND DISCUSSION

RATE OF WORK

Uniform windrows were formed at typical operating speeds of 5 to 7 mph (8 to 11 km/h). The slower speeds were required for good cutting and windrow formation in heavy, tangled, or leaning crops. Speeds of 9 mph (14 km/h) were possible in smooth straight fields, where the crop was an even but lighter stand. The knife had to be in good condition.

Workrates at the typical operating speeds varied from 17 to 24 ac/h (6.8 to 9.6 ha/h) when operating in straight fields with even crop stands. The maximum rate achieved was 30 ac/h (12.1 ha/h).

Table 1. Operating Conditions

Operation	Crop	Variety	Yield		Hours	Field Area	
			bu/ac	t/ha		ac	ha
Single and Double Windrows	Barley Wheat	Harrington HY 355	50 - 60	2.8 - 3.3	35	620	248
		Columbus Katepwa	20 - 45	1.4 - 3.0	36	670	268
	Flax	Norland	10 - 20	0.6 - 1.2	16	335	134
Single Windrows	Canola	Tobin Westar	20 - 35	1.1 - 2.0	26	400	160
	Canary Seed	Keet	20	1.6	34	80	32
Total					117	2105	842

QUALITY OF WORK

Dividing: Crop dividing was good.

When cutting at typical stubble height in most crops the plants at the edge of the standing crop were usually only bent slightly by the divider rod. The bent plants were usually cut on the next round and formed into the windrow. When cutting low in short, lodged or tangled crops, the divider trampled some crop, which could not be recovered on the next round. In some crops, removing the divider rod helped to eliminate this missed crop but caused more hairpinning around the dividers. It is recommended that the manufacturer consider improving the divider to reduce loss.

When double windrowing, the right margin draper laid the first windrow about 20 in (510 mm) from the standing crop. This provided adequate space for maneuvering on the next round, so that the left divider seldom snagged the windrow.

Header Flotation: Header flotation was good.

A nitrogen charged hydraulic accumulator plumbed into the supply line of the header lift cylinder, regulated the force required to lift the header over obstructions. Adjusting the accumulator to enable the header to lift easily resulted in noticeable header bounce on rough terrain. Adjusting the accumulator to reduce header bounce resulted in some guard and knife damage when a rock was encountered. It became evident that where rocks were a threat, an adjustment allowing some header bounce had to be made. This problem was due in part to the design of the header lift. The header pivoted about pins located on the rear support tube and hitch frame. The pivot was higher than the cutterbar. As a result, when the cutterbar hit a rock, for the header to rise it also had to move forward into the rock. This necessitated very light flotation settings to protect the cutterbar.

The skid plates adequately protected the cutterbar from contacting the ground in dry firm soils. When dragging the skid plates on damp soft ground, soil piled up in front of the skid plates, collected on the knife, and reduced cutting ability.

Cutting: Cutting ability was good.

FIGURE 2 shows three types of stubble condition after cutting. In most crops, the stubble was either ideal or undulating. The knife had adequate power and plugging seldom occurred when the knife clearance was properly adjusted. The undulating stubble pattern resulted in rougher fields when the header flotation was set to provide suitable cutterbar protection from stones.

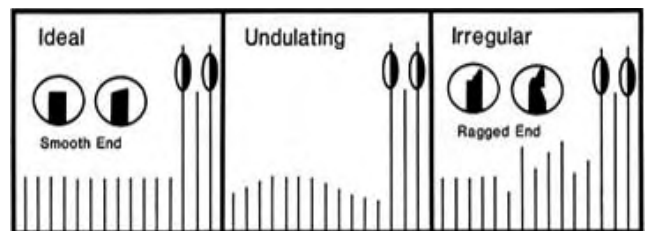


FIGURE 2. Types of stubble.

In tough damp crops, the stubble was often irregular and the knife plugged frequently if there was extra clearance between the knife and guards. Proper clearance was hard to maintain as the knife sections under the pressure clips wore rapidly. To reduce the knife clearance, shims had to be removed from under the pressure clips. This improved cutting in tough conditions. The wear on the knife sections was excessive and the clearance had to be adjusted several times during the test season. It is recommended that the manufacturer consider modifications to reduce rapid knife sections wear.

The cutterbar was adequately protected by a hydraulic pressure relief valve, which prevented excessive power demand and minimized damage if an object was caught in the knife.

Crop Handling: Crop handling was good.

In most crops when properly adjusted, the reel held the crop against the knife as it was being cut, then moved the cut crop over the cutterbar and helped lay it properly on the drapers.

The reel had adequate vertical adjustment for all crops. Generally, it was run so the bats entered the crop to the depth of the heads. In very short crops, it was lowered to about 2 in (50 mm) from the cutterbar where it kept the cutterbar clear. However, in taller crops over 3.5 ft (1.1 m), the reel often had to be run at its highest position. An adjustment to raise the reel higher was available, but this also raised the reel's lowest position and reduced the ability to sweep the cutterbar.

The fore-and-aft adjustment was adequate for all crops encountered. Typically the reel was centered over the cutterbar. In lodged crops, the reel was moved forward slightly. However, in severely lodged and tangled crop, a pickup reel and lifter guards would be required. This is typical for all windrowers.

Reel speed adjustment was variable from the cab and was easily adjusted to suit all crops encountered. The reel speed range of 0 to 60 rpm resulted in reel bat tip speeds of up to 9.6 mph (15.4 km/h). In most crops, the reel was run at speeds where the reel bat tip speed was about 10 percent faster than ground speed. This minimized the grain threshed by the reels and very little crop was carried around with the reel bats.

The draper angle was not adjustable and formed about a 16 degree angle with the ground when cutting 6 in (15 mm) above the ground. The relatively steep draper angle was a problem when laying double windrows in short crop. Crop tended to slide down the drapers onto the cutterbar. Often the reel then had to be used to sweep it back onto the drapers. This resulted in bunched windrows. It is recommended that the manufacturer consider modifications to improve crop flow on the drapers when double windrowing.

The hydraulically driven drapers had adequate power to convey all material encountered for laying either single or double windrows. The draper speed could be varied from 0 to 850 ft/min (0 to 4.3 m/s). In most crops the drapers were run from 500 to 620 ft/min (2.5 to 3.1 m/s). These speeds were appropriate for ground speeds of 5 to 6.5 mph (8 to 10.4 km/h).

The windrow opening could be set at 36, 42 or 48 in (910, 1070 or 1220 mm). The smaller openings were adequate for most shorter and lighter stands of crop and no restriction was apparent. The wider opening had to be used for heavier crops. However, in higher yielding bushy crops such as canola or mature wheat even the 48 in (1220 mm) opening was barely adequate. The horizontal opening and the 37 in (940 mm) vertical opening under the main beam often restricted crop flow. The reel had to be adjusted to help push the crop through. In canola, this turned the crop to point in the wrong direction. In mature heavy stands of wheat, a bunched windrow was produced with the heads fanned out to the edges and pointing upward.

Although the 30 ft (9.1 m) Cereal Implements 702 easily handled light to average stands of crop, it is recommended that the manufacturer consider modifications that enable the windrow opening to handle heavy crop stands.

Windrow Quality: Windrow quality was good.

Windrow formation refers to the pattern formed by the plants laying in the windrow. There are four main types as shown in FIGURE 3. Windrow uniformity refers to variation in the density of the windrow which is seen as bunches or wads. FIGURES 4 to 7 show typical windrows laid by the Cereal Implements 702 windrower in four different crops.

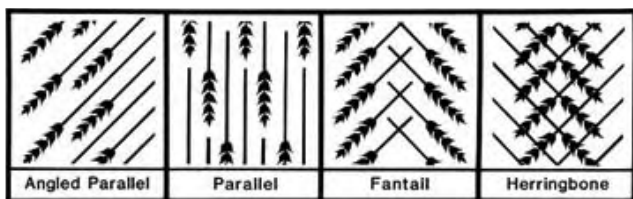


FIGURE 3. Windrow Formations.



FIGURE 4. Wheat, Double Windrow: 40 bu/ac (2.7 t/ha).



FIGURE 5. Canola, Single Windrow: 35 bu/ac (2 t/ha).



FIGURE 6. Barley, Double Windrow: 60 bu/ac (3.3 t/ha).



FIGURE 7. Flax, Single Windrow: 25 bu/ac (1.5 t/ha).

In most crops the windrows were uniform and laid in a parallel formation. However, in very heavy stands or bushy crops and in light crops, which were double windrowed, the quality of both windrow formation and uniformity was reduced.

Depending on the draper opening used, single centre delivered

windrows were normally 3 to 6 ft (0.9 to 1.8 m) wide. Single canola windrows were 7 to 10 ft (2.1 to 3.0 m) wide after they had been rolled into the stubble. Double windrowing produced a combined windrow width of at least twice that of a single windrow. The gap between windrows could be easily reduced from 20 in (510 mm) to almost zero by driving closer to the first windrow on the second pass. This reduced the width of cut of the second pass slightly.

Windrow formation was adversely affected by over dry crop. The plants did not lay flat on the drapers, which resulted in fluffy angled parallel or fantail windrows. Heavy stands of dry cereal crops or bushy canola crops also affected windrow formation and uniformity as high draper speed had to be used along with the reels to force the crop through the restricted windrow opening. The resultant windrow was fantailed or the direction completely reversed with slight bunches. Bunchy windrows were also common when double windrowing short dry crops, which tended to slide down the drapers to the cutterbar.

Generally acceptable windrow quality could be obtained over a fairly wide range of reel and draper speeds. The settings had to be either excessively fast or slow to cause a noticeable adverse effect in windrow formation or uniformity. Very slow reel speeds caused bunchy windrows and excessive draper speed caused angled paralleled windrows when laying double windrows.

EASE OF OPERATION AND ADJUSTMENT

Controls: Ease of operating the controls was very good. The Cereal Implements 702 windrower came with a control console, which was mounted in the tractor cab (FIGURE 8).



FIGURE 8. Console Controls.

The console controlled reel and draper speed and selected the hydraulic circuits for table height control hitch angle or placing the windrower in transport. It also controlled draper direction and table shift for double windrowing. A light switch was located on the console, as was a light to indicate high oil temperature. The tractor remote hydraulics controlled reel and header height, or hitch angle or transport positioning according to the selector switch position on the control box. PTO speed controlled knife speed.

The console was compact and easy to install in the tractor cab for convenient access. The switches were clearly identified and easy to use. The controls worked properly and were easy to adjust on-the-go which enabled controlling windrow formation for most conditions. Since reel and draper speeds were controlled by rocker switches, their speed could only be visually estimated on-the-go. Although not essential, a speed indicator would have been useful.

The tractor hydraulics adjusted table and reel height very abruptly. The windrower's hydraulic cylinders were appropriately sized therefore orifices had to be installed in the hydraulic lines to provide smoother operation. Many newer tractors have flow control valves, which would eliminate the need for orifices.

Adjustments: Ease of adjustment was very good.

Initial adjustments included header levelling, setting reel to cutterbar clearance, header flotation and wheel tracking adjustment. Levelling the header from side-to-side was easy. The operator's manual instructions were clear and the adjustments were accessible and easy to make using common wrenches. The reel clearance adjustment was straight forward, and accomplished by adjusting the free length at the cylinder rod ends. Header flotation was not as clear.

Although the adjustment was not difficult, the operator's manual did not specify how much force should be required to lift the header in order to prevent knife damage. Finding an appropriate setting was by trial and error. It is recommended that the manufacturer consider providing more complete instruction in the operator's manual on the proper adjustment of the header flotation system. Wheel tracking adjustment was not difficult but the operator's manual did not explain the effects of changing the adjustment.

Day-to-day adjustment included draper tensioning, reel fore and aft positioning and selecting windrow opening size. The draper tension adjustment was quick and easy. A wrench was used to turn a cogged wheel on the end of the tightening mechanism and a small lever (or dawg) locked into the cogs to maintain the tension. The reel could be slid along the reel arm by loosening two bolts on each end. The slots provided about 7 in (180 mm) of travel, which was adequate for most conditions and were reasonably easy and fast to adjust.

Adjusting the windrow opening was time consuming. However, most farmers would not likely change the windrow opening very often. Increasing the windrow opening required shortening one or both of the main drapers and moving the drive rollers. These rollers were hard to move as the weight of the entire draper deck rested on them. Moving the rollers was found to be easier if the rear of the draper deck was shimmed with a screwdriver. This was also a useful procedure when aligning the drapers. The operator's manual did not suggest ways to ease adjustment. It is recommended that the manufacturer consider improving the ease of changing the windrow opening.

Handling: Handling characteristics were very good.

The windrower was easy to put into field position. Three transport lock pins were removed, the function selector switch was moved to the appropriate position and the tractor's hydraulics swung the windrower into position. For added stability and extra reach, the hitch pole could be extended about 65 in (165 mm).

The wheels were cambered to counteract skewing. This was effective in most fields with slopes up to about 14 degrees, which was quite severe. In fact, for slopes this steep, the 100 hp (75 kW) tractor used had difficulty tracking straight.

While laying single, centre delivered windrows, the space left between the windrow and the edge of standing crop varied from about 11.5 to 15 ft (3.5 to 4.6 m). This was adequate for single wheeled tractors. Following the crop edge was convenient since the hitch angle could be varied on-the-go allowing the driver to position the tractor to driving preference. The absence of a PTO drive line enabled making sharp corners without driving over the outer windrow, however, this made a windrow corner too sharp for most combines to pick around. Larger radius corners could be made but required driving over the previous windrow.

When double windrowing the adjustable hitch angle also enabled the tractor to operate to the outside of the first windrow. Since the right divider draper laid the first windrow away from the standing crop, there was adequate room to follow the edge without missing crop or snagging the windrow. Corners were easily made by re-entering the standing crop after turning with the right end at least one header width away from the corner. This placed the windrow well away from the corner to allow clearance for the header while laying the second windrow. This did require driving over previously laid windrows. This is a typical cornering procedure used for double windrowing by many other windrowers.

In most fields, with the header flotation set for adequate cutterbar protection, going across small working ridges caused the header to bounce resulting in undulating stubble but did not affect handling.

Putting the windrower into transport was simple and easy. If the hitch pole was extended, it had to be slid back into the retracted position. It was found that the hitch pole slid in easier if the header was lowered to the ground to take weight off the hitch. Care was required to ensure proper tractor alignment while backing up. The tractor hydraulics moved the hitch and wheel into position, then the three safety pins could be installed. The entire operation took only a few minutes.

The transport width was 11.8 ft (3.6 m) and the windrower trailed behind the tractor. As a result the windrower could be transported on most roads (FIGURE 9). The windrower towed very well at speeds up to 20 mph (32 km/h). However, extreme caution was required

when turning left. The left rear tractor tire would contact the hitch jack even on moderately sharp turns such as when entering an approach to a field off a road. Removing the hitch jack increased clearance. It is recommended that the manufacturer consider supplying an alternate mounting bracket for hitch jack storage while transporting.

Lighting: Lighting was fair.

Lighting of the windrower for night operation depended mostly on tractor lighting. Only one light was provided on the windrower, which helped illuminate the crop in front of the windrower and the crop on the drapers. No lighting was provided for the windrow or area behind the windrower. PAMI installed a light over the centre delivery opening shining rearward. This helped show what the quality of the windrow was at night when laying single windrows. It is recommended that the manufacturer consider providing adjustable lights for lighting the windrow behind the header.

Servicing: Ease of servicing was excellent.

Lubrication was quick and easy. The operator's manual contained a handy lubrication chart. Oiling the knife, except in abrasive sandy soils, and checking oil level in the knife gearbox was recommended every 10 hours. Lubrication of the frame and wheel pivots and the reel drive chain was required every 50 hours. All grease fittings were easily accessed. Most routine maintenance such as tensioning the reel drive chain, and changing guards and knife sections was easily performed.



FIGURE 9. Full Transport.

TRACTOR REQUIREMENTS

The tractor used to power the Cereal Implements 702 must have dual remote hydraulics, a 1000 rpm PTO, and a 12 volt negative ground electrical system.

The manufacturer recommends using a tractor with a minimum of 65 PTO hp (49 kW). They also suggest using a larger tractor for added stability on hilly land.

Average power required to operate the windrower on a level field in moderate crop stands was 17 hp (12.7 kW) at the drawbar, and 21 hp (15.7 kW) for the PTO, for a total power requirement of 38 hp (28.4 kW). This confirms that the manufacturer's recommended tractor size would be ample for operating the Cereal Implements 702 windrower in most conditions on even terrain.

PAMI used a 100 hp (75 kW) tractor throughout the test and found it suitable for most conditions although in severe hills, an even larger tractor would have been desirable.

OPERATOR SAFETY

Normal safety precautions were required while operating the Cereal Implements 702 windrower. The operator's manual emphasized operator safety, and warning decals were mounted on the windrower to point out precautions for safe operation. Adequate shields were provided. Safety locks for transport were provided for the header table, right wheel, and hitch. The operator's manual recommends that the reel and header should be lowered or securely blocked when working near the header or when the windrower is left unattended. No safety locks were provided to lock the reel in a raised position.

Full transport width was 11.8 ft (3.6 m), and care was required when transporting on narrow roadways to allow safe passage of traffic. A slow moving vehicle sign was provided.

According to the Tire and Rim Association Guidelines, the front wheel of the windrower was overloaded by 24% when in transport position. It is recommended that the manufacturer consider

supplying a front tire that complies with the loads recommended by the Tire and Rim Association Guidelines.

No hitch safety chain was provided. It is recommended that the manufacturer consider supplying a hitch safety chain.

OPERATOR'S MANUAL

The operator's manual was very good.

The information provided was very useful and aided in the ease of adjustment, lubrication, maintenance, and operation of the windrower. The information was easy to follow and well illustrated. More information for adjusting the windrow opening width would make the adjustment easier. Also, more information on how heavy the header flotation system should be set would insure proper adjustment in stony conditions. Recommendations regarding these concerns have been made.

MECHANICAL HISTORY

TABLE 2 outlines the mechanical history of the Cereal Implements 702 windrower during 117 hours of field operation while windrowing about 2105 ac (842 ha). The intent of the test was functional performance evaluation. Extended durability testing was not conducted.

TABLE 2. Mechanical History

Item	Operating Hours	Equivalent Area ac (ha)	
-The hydraulic oil filter had a small puncture and leaked, so it was replaced at	22	410	(164)
-The left wheel support was modified at	35	650	(260)
-The knife clearance was adjusted by removing shims under the pressure clips at	61, 87, 112	1085, 1540, 2050	(434, 616, 820)
-A bend in a frame member under the right draper deck was noticed at		1245	(498)
-One hydraulic hose in the hitch leaked and was replaced at	69 100	1810	(724)
-18 knife sections were replaced			During the Test
-9 knife guards were replaced			During the Test

Wheel Support: The left wheel support was modified by adding extra steel tubing to increase its strength and prevent failure. The modification was a temporary measure recommended by the manufacturer. A stronger wheel support is being manufactured for existing machines and new production models.

Frame: The frame member under the draper deck in front of the right wheel was bent. The cause was attributed to shipping and handling of the windrower prior to field use. Transporting may have increased the bend.

Hydraulic Hose: To allow for extending the hitch, the hoses within the hitch pole are long and must flex and fold within the hitch tube to allow the hitch to slide in and out. One hydraulic hose located in the hitch pole was kinked from sliding the hitch in and out. Eventually the hose began to leak. The hose was likely twisted upon installation reducing its flexibility, resulting in it being bent too sharply, and damaging it.

Knife Sections: The knife sections under the knife pressure plates wore considerably. To maintain effective cutting, pressure had to be maintained on the knife to keep clearance between the knife and guards within specified guidelines. However, the knife was very worn at the end of the test and was replaced.

Many knife sections were replaced. They were usually bent from operating in stony conditions. Normally, knife sections do not bend, however, these sections were soft and bent easily. A recommendation has been previously made in this report.

Knife Guards: The guards that were bent or broken while operating in stony conditions resulted from the header flotation being set too heavy. The operator's manual did not specify a weight setting for the header flotation. As a result, the header flotation was set to suit the condition through trial and error.

**APPENDIX I
SPECIFICATIONS**

MAKE: Cereal Implements Pull-type Windrower
MODEL: 702
SERIAL NUMBER: 39005-00032
MANUFACTURER: Vicon Manufacturing Inc.
 1000 - 6th Avenue East
 Portage la Prairie, Manitoba
 R1N 3R3

CUTTERBAR:
 -- width of cut (divider points) 30.7 ft (9.36 m)
 -- effective cut (inside dividers) 30.6 ft (9.34 m)
 -- minimum cutting height 2 in (50 mm)
 -- guard spacing 3 in (75 mm)
 -- knife section(under serrated)
 -width 3 in (75 mm)
 -full depth 3.25 in (83 mm)
 -cutting length 2.5 in (64 mm)
 -- knife stroke 3.1 in (79 mm)
 -- knife speed 792 cycles/min

HEADER:
 -- platform angle
 -fully raised 41° above horizontal
 -fully lowered 19° below horizontal
 -- number of drapers 3
 -- draper width 41 in (1040 mm)
 -- draper lengths
 -left 1 1.6 ft (3.54 m) or 12.1 ft (3.69 m)
 -right 11.6 ft (3.54 m) or 12.1 ft (3.69 m)
 -right extension draper 1.9 ft (0.58 m)
 -- draper material rubberized polyester with fiberglass slats.
 -- draper speed range 0 to 850 ft/min (0 to 4.3 m/s)
 -- draper roller diameter 2.5 in (64 mm)
 -- height of windrow opening 37 in (940 mm)
 -- widths of windrow opening
 (between rollers) 36, 42, 48 in (914, 1067, 1219 mm)
 -- raising time 2 s
 -- lowering time 2 s

REEL:
 -- number of bats 5
 -- number of arms per bat 8
 -- diameter 54 in (1372 mm)
 -- speed range 0 to 60 rpm
 -- range of adjustment
 -fore-and-aft 7 in (178 mm)
 -height above cutterbar 26 in (660 mm)
 -- raising time 1 s
 -- lowering time 1 s

HYDRAULIC SYSTEM:
 -- knife, reel and drapers hydraulic motors driven by PTO mounted pump reel and draper speed controlled by electric flow control valves
 -- reel lift 2 cylinders in series, single acting
 -- header lift 1 cylinder, single acting
 -- transport wheel 1 double acting cylinder
 -- hitch swing 1 double acting cylinder
 header lift, transport wheel, and hitch swing are controlled by 1 two way and 1 three way solenoid control valve

NO. OF CHAIN DRIVES: 1 on reel drive

LUBRICATION POINTS:
 -- pressure grease fittings 10
 -- gearboxes 1

NO. OF PRELUBRICATED BEARINGS: 13

TIRES:
 -- number 2
 -- size 9.5 L x 15, 6 ply ribbed implement

OVERALL DIMENSIONS:	FIELD	TRANSPORT
-- width	41 ft (12.5 m)	11.8 ft (3.6 m)
-- length	23 ft (7.0 m)	43.8 ft (13.4 m)
-- height	11.7 ft (3.6 m)	11.7 ft (3.6 m)
-- wheel tread	17.3 ft (5.3 m)	16.7 ft (5.1 m)
-- wheel base	6.3 ft (1.9 m)	
-- wheel hubs to hitch point	14.3 ft (4.4 m)	
WEIGHTS:	FIELD	TRANSPORT
-- hitch	1135 lb (515 kg)	805 lb (365 kg)
-- left wheel	2285 lb (1036 kg)	2445 lb (1109 kg)
-- right wheel	<u>1465 lb (665 kg)</u>	<u>1635 lb (742 kg)</u>
TOTAL	4885 lb (2216 kg)	4885 lb (2216 kg)
OPTIONS AND ATTACHMENTS:		
-- header is available in 22, 26 and 30 ft (6.7, 7.9 and 9.1 m) widths		
-- pickup reel		

**APPENDIX II
MACHINE RATINGS**

The following rating scale is used in PAMI Evaluation Reports:
 Excellent Fair
 Very Good Poor
 Good Unsatisfactory

SUMMARY CHART

CEREAL IMPLEMENTS 702 PULL-TYPE WINDROWER

RETAIL PRICE	\$21,556.00 (April 1989, f.o.b. Humboldt SK)
RATE OF WORK	
Average Speed	5 to 7 mph (8 to 11 km/h)
Average Workrate	17 to 24 ac/h (6.8 to 9.6 ha/h)
QUALITY OF WORK	
Dividing	Good; Divided most crops, some crop trampling but cut on next round
Header Flotation	Good; When set for cutterbar protection, header bounced on rough ground
Cutting	Good; Cut all crops when knife clearance proper but wear resulted in plugging
Crop Handling	Good; Carried all crops but short crops slid down draper and windrow opening marginal for heavy crops
Windrow Quality	Good; Most windrows uniform with parallel configuration in average crop stands
EASE OF OPERATION AND ADJUSTMENT	
Controls	Very Good; Cab mounted console very convenient
Adjustment	Very Good; Most adjustments quick and easy
Handling	Very Good; Turned sharp and had little skewing on slopes up to 14 degrees
Lighting	Fair; Only one light provided, none for behind windrower
Servicing	Excellent; Only a few easy to get at lubrication points, no interference to do routine maintenance
TRACTOR AND POWER REQUIREMENTS	
Tractor Min	65 hp (49 kW), 1000 rpm PTO, 2 remote hydraulic circuits and 12 v negative ground electrical system
Power	38 hp (28.4 kW) total
OPERATOR SAFETY	Well shielded, no safety chain, front wheel over recommended load
OPERATOR'S MANUAL	Very Good; Well organized and illustrated
MECHANICAL HISTORY	A few minor failures



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