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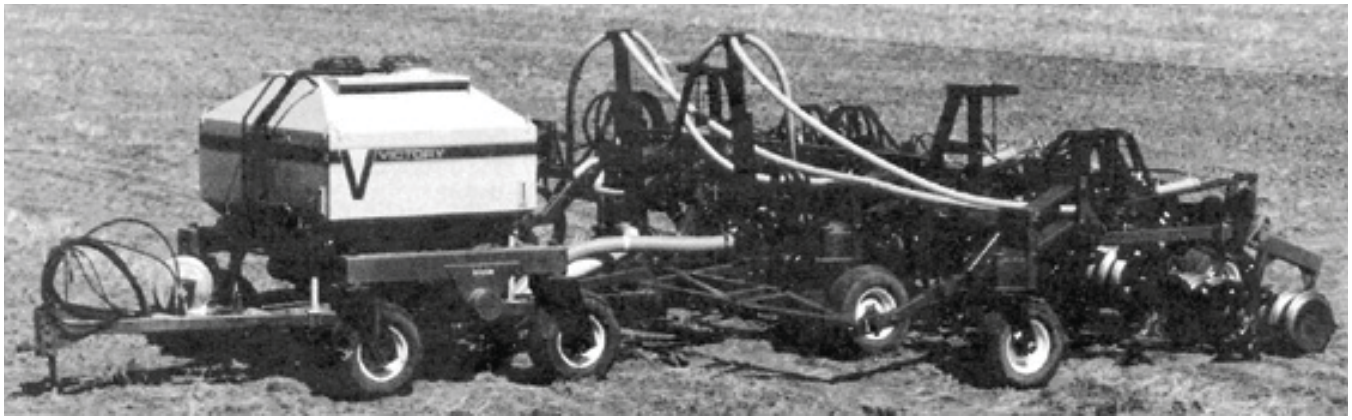

Victory Seed-O-Vator

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

VICTORY SEED-O-VATOR

MANUFACTURER AND DISTRIBUTOR:
Victory Equipment Limited
510 - 36 Street North
Lethbridge, Alberta
T1H 5H9
Phone (403) 327-4389

RETAIL PRICE: $62,000 (June 1989 f.o.b. Lethbridge, Alberta) 28 foot machine with a Victory 200 bushel triple shoot air tank and dual air on the Seed-O-Vator

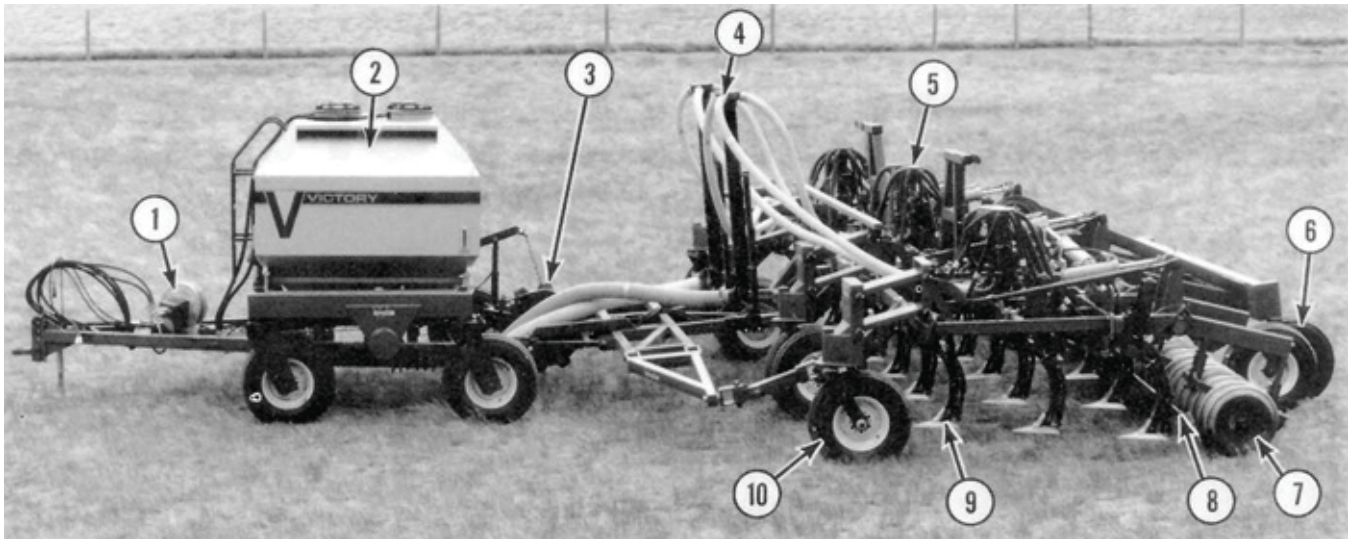

FIGURE 1. Victory Seed-o-Vator: (1) Centrifugal Fan, (2) Tanks, (3) Ground Engaging Meter Drive Wheel, (4) Primary Header, (5) Secondary Header, (6) Transport Wheels, (7) Steel Press Wheels, (8) Rod Weeder, (9) Shank Opener, (10) Cultivator Castor Gauge Wheel.

SUMMARY AND CONCLUSIONS

QUALITY OF WORK

Penetrating ability was very good in all the test field conditions.

Seed and fertilizer placements were good. At reasonable travel and fan speeds, the seed was placed in distinct paired rows 5 in (127 mm) apart. The fertilizer was placed between the paired rows of seed and at the same depth as the seed,

Soil finishing was very good. When seeding into an untilled stubble field, the majority of the straw was left on the surface with some of it standing. The packing force was adequate for the soils and conditions encountered during the test.

Trash clearance was good. Plugging would occur at the rod weeder and packers if the tillage depth was not deep enough to hold the rod weeder in the ground.

Operation in stony conditions was good, Maximum lift height of the shanks supplied was 6.5 in (165 mm).

Metering accuracy in wheat, canola and fertilizer were good. The manufacturer did not supply a chart for barley. Differences between the manufacturer's and AFMRC's metering calibrations were attributed to the difference in seed size and density. Left and right sideslopes increased the rates by 13% and decreased the rates by 12% with wheat and 11-51-00 fertilizer, respectively.

The distribution uniformity was fair. The distribution uniformity was within the acceptable limits for wheat, barley and canola but not for lower rates of 11-51-00 fertilizer. A 15 degree slope in wheat and fertilizer gave unacceptable distribution uniformities.

EASE OF OPERATION AND ADJUSTMENT

Ease of performing routine maintenance was good. Most of the 46 grease fittings were accessible without much difficulty.

Ease of filling and cleaning was fair. No auger was supplied. Small tank openings made fillings difficult and messy. Cleaning large amounts of material out of the tanks was difficult. Moisture infiltrated the fertilizer tank during the test.

Ease of transporting was fair. The rod weeder had to be disassembled in two places to put the wings in transport position. No transport lock was provided for the ground engaging metering. drive wheel. The unit required the use of a tractor with four sets of remote hydraulics. Caution had to be used when transporting the unit because of the wide transport width. Maneuverability in the field was hampered by the long hitch length.

Monitoring was good. An acremeter was supplied, but did not read directly in acres. There was no monitor for rod weeder speed.

Ease of changing the seed and fertilizer rates was fair. Removing and installing the sprockets was difficult because of the tight fit on the shafts. Ease of setting the seeding depth was good.

POWER REQUIREMENTS

Power take-off horsepower draft requirements varied from 145 hp (109 kW) to 187 hp (140 kW). Power take-off horsepower requirements to run the rod weeder and the centrifugal fan were 3.1 hp (2.3 kW) and 17.7 hp (13.2 kW), respectively. The overall tractor size needed to operate the test unit varied from 166 PTO hp (124.5 kW) to 208 PTO hp (156 kW).

OPERATOR SAFETY

The unit was safe to operate but precautions had to be taken to ensure operator safety as no railing was provided on the applicator tank.

OPERATOR'S MANUAL

A general operator's manual was not provided but one was provided for the rod weeder.

MECHANICAL HISTORY

Several rod weeder bearings and universal joint connectors and two drives were replaced during the test. The fasteners used required tightening during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Providing a transport lock for the ground engaging meter drive wheel.
2. Providing railing on the applicator to increase operator safety when filling the tanks.
3. Providing guidelines for initial fan speed settings.
4. Modifying the fertilizer distribution system so the uniformity of distribution is acceptable for all application rates.
5. Enlarging the tank openings to allow for easier filling of the tanks.
6. Providing a more convenient way to clean large amounts of material from the tanks.
7. Improving the applicator tank seals to prevent moisture seepage into the tank.
8. Modifying the rear frame hinge to prevent the wings from jamming against the lock pins.
9. Modifying the center castor wheels of the cultivator to prevent oscillation during field operation.
10. Supplying a conversion factor with the acremeter.
11. Providing a monitor for the rod weeder speed.
12. Making the metering sprockets easier to change.
13. Modifying the metering system to eliminate changing more than two sprockets when metering small seeds.
14. Providing a more convenient method for calibrating the metering rate.
15. Supplying an operator's manual with the Victory Seed-o-Vator and rate charts in SI units as well as in Imperial units.
16. Using a fastener which is more vibration resistant than the free spinning nuts with serrated faces.
17. Providing a way to shut off material from entering the meter augers so they can be easily removed.
18. Providing shear pin protection for the meter augers.

Station Manager: R. P. Atkins

Project Engineer: L. W. Papworth

THE MANUFACTURER STATES THAT

The test unit used a modified Prasco air tank. Since the test and based on Research Centre recommendations, we have developed a Victory air tank (see photo below). The Victory air tank is a 200 bushel, two compartment tank with double shoot or triple shoot capabilities it can be pulled in between or behind the Seed-o-Vator. The shank assemblies have also been modified so that maximum trip height is at least 9 inches.

With regard to recommendation number:

1. On the Victory tank we do not use a ground engaging meter drive wheel. The drive is provided by one of the rear wheels and an electric clutch is used to engage the metering devices.
2. The Victory air tank has a catwalk and railing for filling. All filling operations can be done from the catwalk.
3. Guidelines will be provided for fan speed settings.
4. The fertilizer distribution system has been modified to provide more uniform distribution.
5. The Victory air tank has 30" by 40" openings with screens.
6. The Victory air tank has 2 cleanout doors and an optional 8" auger, which can be used to clean both tanks.
7. The Victory air tank is provided with excellent seals and an over centre lock to avoid moisture infiltration.
8. The rear frame hinge has been completely redesigned with a new wing lift system. The cylinder pushes the wings in the transport position. It now only requires 1200 lbs of pressure to lift the wings of a 42 ft machine.
9. The centre castor wheels have been modified to prevent oscillation.
10. The Victory air tank has an acremeter which reads actual acres seeded.
11. We are investigating a monitor, which will indicate rod speed.
12. The metering sprockets on the Victory air seeder are much easier to change.
13. The metering system now requires only two sprocket changes for metering small seeds.
14. The new chart has been designed for calibration. The Victory air tank can also be calibrated by turning a hand crank and collecting a sample directly from the seed metering device. A fairgrade scale is also provided with each machine.
15. An operator's manual will be provided with the Victory Seed-o-Vator with rate charts in SI units as well as imperial units.
16. We will be going to regular nuts with lockwashers.
17. The Victory tank has shutoff slides to shutoff the material so that the meter augers can be removed.
18. With the Victory air tank, the electric clutches will act as shear protectors.

GENERAL DESCRIPTION

The Victory Seed-o-Vator is an air drill which consists of a pneumatic seed and fertilizer applicator connected to the front of a three row cultivator of varying widths. The applicator is supported by four castor wheels. The unit can be used for seeding, combined seeding and fertilizing (double shoot) or fertilizing.

The cultivator comes with 14 inch (356 mm) spacing, three or five sections and heavy-duty spring trip shanks. The depth is controlled by hydraulic cylinders and set with spacer plates. Castor wheels support the front of the cultivator. Gangs of 24 inch (610 mm) steel press wheels support the back of the cultivator and pack the seed behind the openers. A hydraulically driven rod weeder is attached to the last row of shanks and in front of the packers.

Seed and fertilizer are metered through two variable speed metering augers mounted below each tank. The metering augers are ground driven through a series of chains and sprockets by a ground engaging wheel at the rear of the tank. The wheel is hydraulically lowered and raised.

The seed and fertilizer are each pneumatically distributed through a primary header and a varying number of secondary headers to the seed and fertilizer boots on the cultivator shanks. The seed boot divides the seed into a paired row. The fertilizer boot delivers the fertilizer between the paired row of seed.

A centrifugal fan conveys the metered material through the distribution system. The fan also pressurizes the tanks to equalize the pressure across the meter. Power to the fan is provided by the tractor hydraulics. A tractor with four sets of hydraulics is needed to operate the Victory Seed-o-Vator. The test machine is a 28 ft (8.5 m) three section cultivator. The center section is 14 ft (4.3 m) wide and the wings are 7 ft (2.1 m) wide. Seed boots with a 5 in (127 mm) paired row spacing and conventional 16 in (406 mm) sweeps were used with the unit.

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

SCOPE OF TEST

The Victory Seed-o-Vator was operated in the conditions shown in TABLE 1 for 106 hours while seeding 1110 ac (444 ha). The crops were sown under dry conditions. The Alberta Farm Machinery Research Centre (AFMRC) evaluated the Victory Seed-o-Vator for quality of work, ease of operation and adjustment, power requirements and operator safety. In addition, the seed and fertilizer metering systems were calibrated in the laboratory.

TABLE 1. Operating Conditions.

MATERIAL	SOIL TYPE AND CONDITION	STONE CONDITIONS	FIELD AREA		HOURS
			ac	ha	
Wheat	Silt Loam to Silty Clay Loam - Primary	Moderately Stony	380	152	36
Wheat	Silt Loam to Silty Clay Loam - Secondary	Moderately Stony	260	104	20
Canola	Clay Loam - Secondary	Moderately Stony	275	110	29
Canola	Silt Loam - Secondary	Occasional Stones	120	46	13
Canola	Silt Loam - Primary	Occasional Stones	75	30	8
TOTAL			1110	444	106

RESULTS AND DISCUSSION

QUALITY OF WORK

Penetration: Penetration ability of the Victory Seed-o-Vator was very good in all the test field conditions. Individual openers could not be set deeper in the tractor tire tracks.

Penetration was uniform across the entire width provided the three sections of the unit were properly levelled. The front castor wheels and packers provided adequate support for the cultivator frame. The unit followed rolling field contours very well.

The sweep pitch characteristics of the Seed-o-Vator shank are shown in FIGURE 2. The shank assemblies (FIGURE 3) were equipped with a spring trip assembly. The trip force could be adjusted by the manufacturer but was not easily adjustable by the operator. The average trip force on the test machine was 850 lbs (3.8 kN). The no-load sweep pitch was 2 degrees and the sweep pitch at tripping was 5 degrees. This range is within the acceptable working pitch of 2 to 7 degrees for chisel plow sweeps.

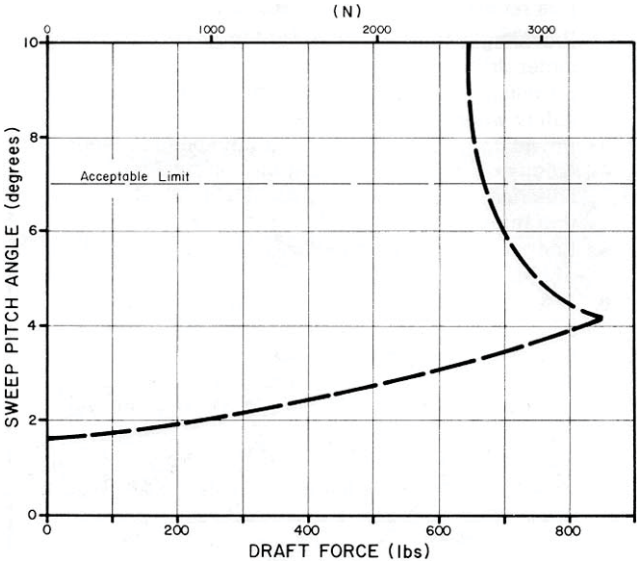

FIGURE 2. Sweep Pitch for the Victory Seed-o-Vator Shank.

Seed Placement: The seed placement of the Victory Seed-o-Vator was good. The Seed-o-Vator was equipped with a Y-shaped seed boot (FIGURE 4) to place material behind the cultivator sweep. Seed placement horizontally depended on travel speed and fan speed. When the travel speed and the fan speed were high, the rows were not distinct. When the travel speed and the fan speed were at a reasonable level, the two rows were distinct and 5.0 in (127 mm) apart as shown in FIGURE 5. Band widths of the rows were an average of 3 in (76 mm).

Variation in seed depth was uniform when seeding in both primary and secondary soil if a reasonable fan speed was used. For example, at an average seed depth of 2.5 in (64 mm), most of the seeds were placed within 0.5 in (13 mm) of the average seed depth. Guidelines for initial fan speed settings with various seeds and application rates were not provided. It is recommended that the manufacturer consider providing guidelines for initial fan speed settings.

Fertilizer Placement: The fertilizer placement of the Victory Seed-o-Vator was good. The fertilizer was placed between the paired rows of seed and at the same depth as the seed. Band widths of the fertilizer depended on the travel speed and fan speed. Average band width of the fertilizer was 2.5 in (64 mm).

Variation in the depth of the fertilizer was uniform. Most of the fertilizer was placed within 0.5 in (13 mm) of the average fertilizer depth.

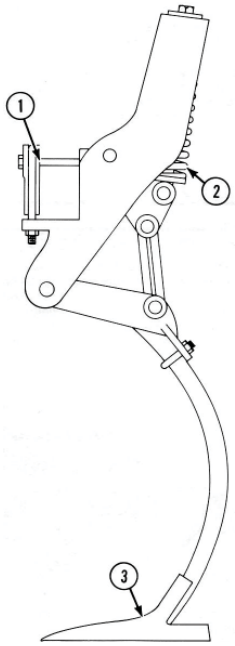

FIGURE 3. Shank Assembly: (1) Frame Mounts, (2) Trip Spring, (3) Sweep.

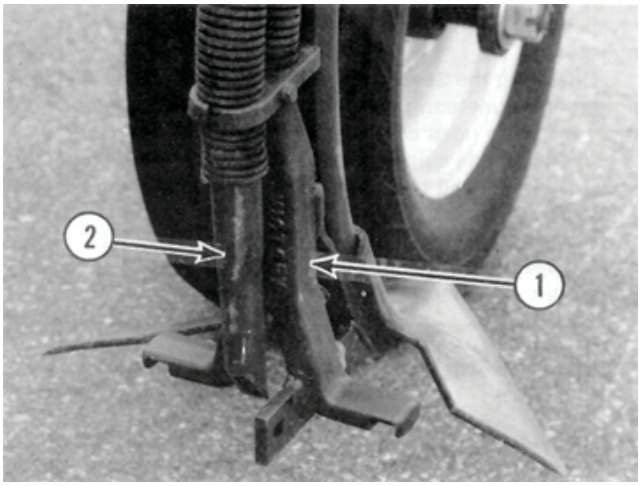

FIGURE 4. Victory Seed-o-Vator Delivery Boots: (1) Seed boot, (2) Fertilizer Boot.

FIGURE 5. Emergence pattern of wheat.

Soil Finishing: Soil finishing of the Victory Seed-o-Vator was very good. FIGURE 6 shows the soil surface after seeding into an

untilled wheat stubble field. The majority of the straw was left on the surface with some of it standing. FIGURE 7 shows the soil surface after seeding into a previously tilled wheat field. Ridge depths left by the press wheels ranged from 2.0 to 3.0 in (51 to 76 mm), depending on soil conditions. The packing force was adequate for the soils and conditions encountered during the test.

FIGURE 6. Soil Surface After Seeding into a Wheat Stubble Field.

FIGURE 7. Soil Surface After Seeding into a Tilled Wheat Stubble Field.

Trash Clearance: Trash clearance of the Victory Seed-o-Vator was good. The three rows of cultivator shanks allowed good trash flow but plugging would occur at the rod weeder and packers if the tillage depth was not deep enough to hold the rod weeder in the ground. The dry seeding conditions during the test alleviated this trash clearance problem. Shortening the rod weeder chains helped to keep the rod in the ground during the test. The Seed-o-Vator would clear a large amount of trash in stubble conditions if the rod weeder was under the level of the surface trash.

Plugging also occurred when operating at depths below normal seeding depths in summerfallow conditions. The rod weeder and packers could not handle the large amount of dry loose soil. This was caused by the soil travelling over the rod weeder and hitting the packers.

Stony Conditions: Operation of the Victory Seed-o-Vator in stony conditions was good. One shovel was broke by a large rock during the test. Maximum lift height of the shanks supplied was only 6.5 in (165 mm). Late models may have as much as 9 in (229 mm).

Metering Accuracy: Metering accuracy of the Victory Seed-o-Vator was good. The metering rate was varied by changing the sprocket ratio for the metering augers. The calibration curves obtained by the AFMRC and the manufacturer for the Seed-o-Vator in wheat, barley, canola and fertilizer are given in FIGURES 8 to 11. The manufacturer did not supply a chart for barley. Any differences between the calibration curves obtained by AFMRC and those given by the manufacturer are probably due to different seed size, density and moisture content. The densities obtained by AFMRC and the manufacturer are indicated on the graphs.

Level of material in the tank, field roughness, variations in fan speed and variations in ground speed had no effect on metering rates.

Operating the Seed-o-Vator on uphill and downhill slopes did not affect metering rates but operating on sideslopes did affect metering rates as shown in FIGURE 12. Travelling on a 15 degree left side slope caused a 13% increase in the metering rate of wheat and 11-51-00 fertilizer. Travelling on a 15 degree right side slope caused a 12% decrease in the metering rate of wheat and 11-51-00 fertilizer.

The maximum rate for 11-51-00 fertilizer was 251 lb/ac (281 kg/ha) from one meter.

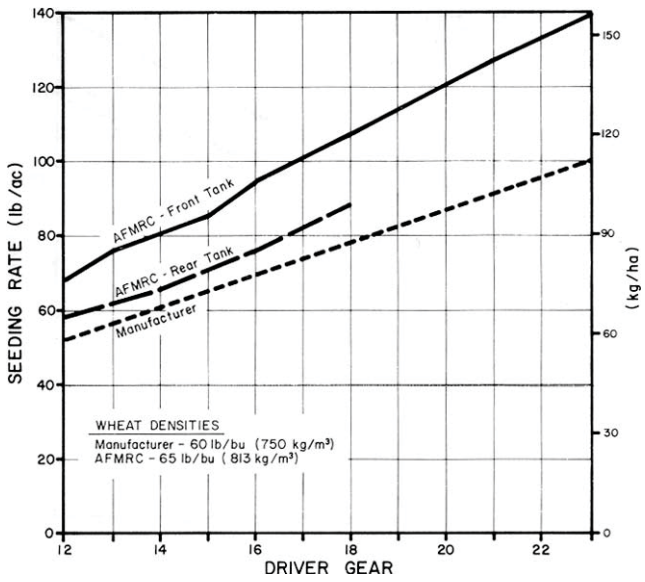

FIGURE 8. Metering Accuracy in Wheat.

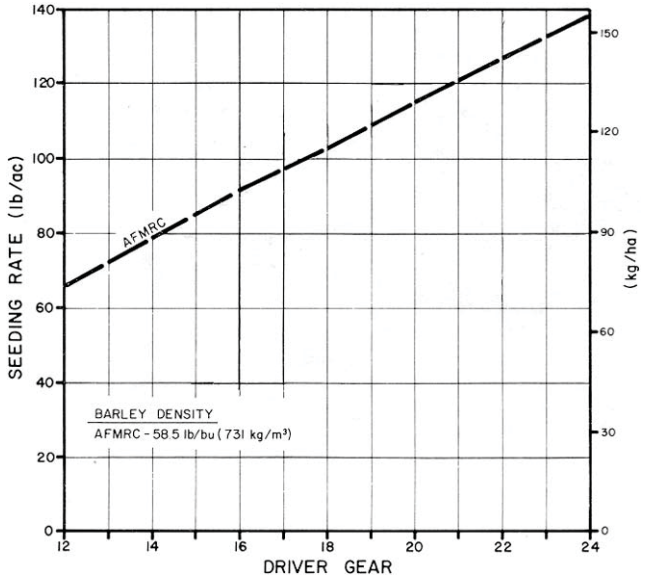

FIGURE 9. Metering Accuracy in Barley

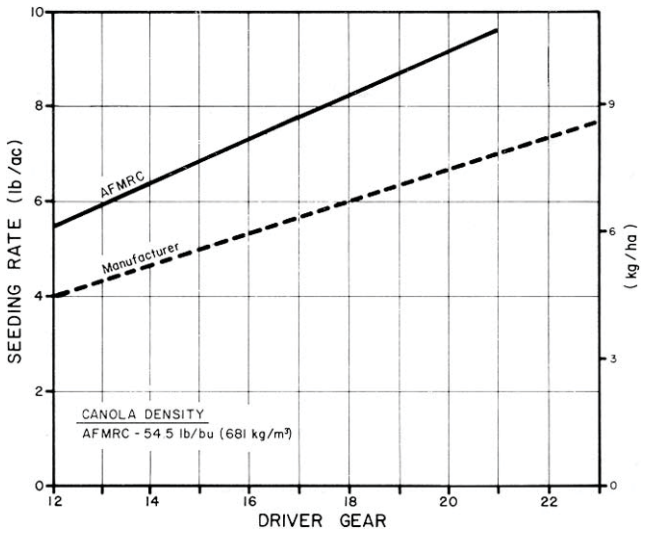

FIGURE 10. Metering Accuracy in Canola

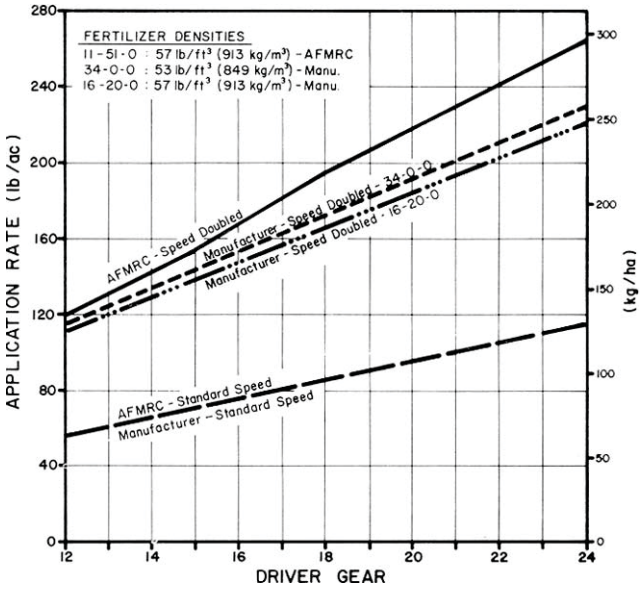

FIGURE 11. Metering Accuracy in Fertilizer

Level of material in the tank, field roughness, variations in fan speed and variations in ground speed had no effect on metering rates.

Operating the Seed-o-Vator on uphill and downhill slopes did not affect metering rates but operating on sideslopes did affect metering rates as shown in FIGURE 12. Travelling on a 15 degree left side slope caused a 13% increase in the metering rate of wheat and 11-51-00 fertilizer. Travelling on a 15 degree right side slope caused a 12% decrease in the metering rate of wheat and 11-51-00 fertilizer.

The maximum rate for 11-51-00 fertilizer was 251 lb/ac (281 kg/ha) from one meter.

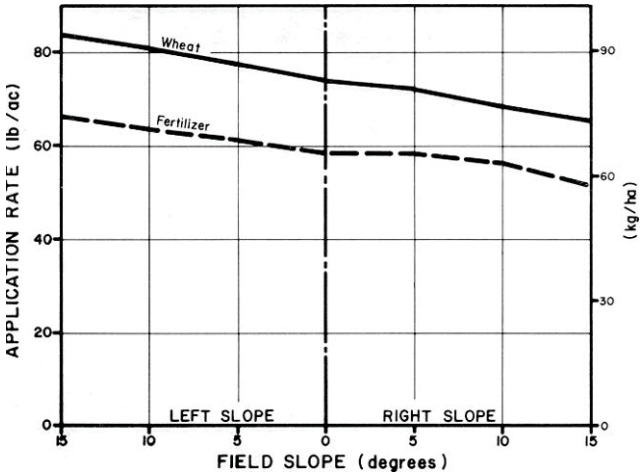

FIGURE 12. Variation in Fertilizer and Wheat Application Rate with a Change in Side Slope.

Distribution Uniformity: Uniformity of distribution of the application rate for the Victory Seed-o-Vator was fair. FIGURE 13 shows the seeding distribution uniformity for the Victory Seed-o-Vator in wheat and barley. Distribution was uniform over the full range of seeding rates. For example, at a seeding rate of 76.1 lb/ac (85.2 kg/ha), the coefficient of variation[1] (CV) was 9.4% for wheat, and at a seeding rate of 78.6 lb/ac (88.0 kg/ha), the CV was 9.1% for barley. FIGURE 14 shows a typical seeding distribution pattern obtained in wheat at a seeding rate of 76.1 lb/ac (85.2 kg/ha). The seeding rate for each opener across the width of the airseeder varied from 65.7 to 90.5 lb/ac (73.6 to 101.4 kg/ha). This resulted in acceptable distribution uniformity with a CV of 9.5%.

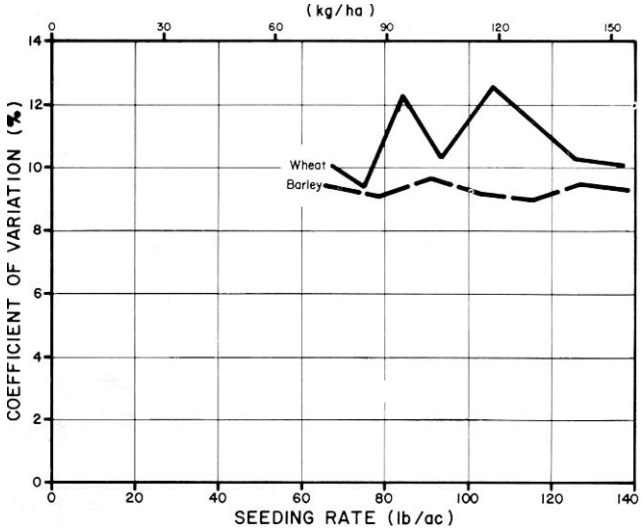

FIGURE 13. Distribution Uniformity in Wheat and Barley over a Range of Seeding Rates.

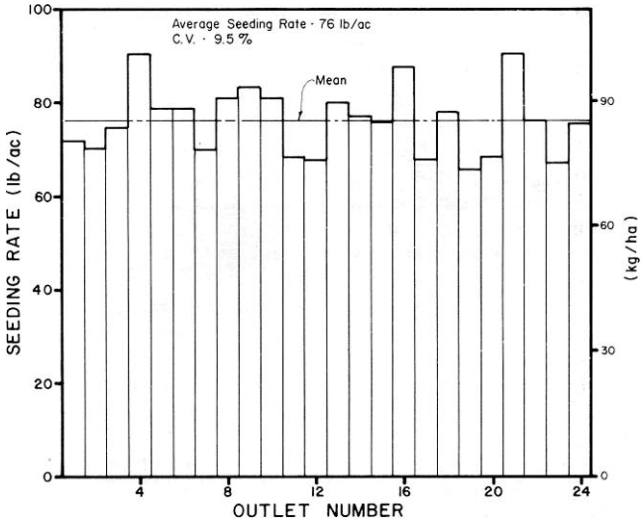

FIGURE 14. Distribution Uniformity Pattern in Wheat at 761 lb/ac (852 kg/ha).

FIGURE 15 shows a typical distribution pattern obtained in canola at a seeding rate of 5.5 lb/ac (6.2 kg/ha). The application rate across the width of the airseeder varied from 4.5 to 6.6 lb/ac (5.0 to 7.4 kg/ha), which resulted in acceptable distribution uniformity with a CV of 10.9%. Distribution uniformity was acceptable over the full range of canola seeding rate with CV's ranging from 10.3 to 10.9% (FIGURE 16).

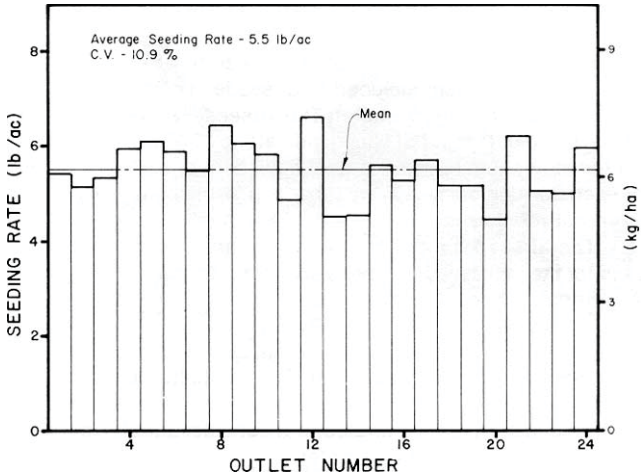

FIGURE 15. Distribution Uniformity Pattern in Canola at 55 lb/ac (62 kg/ha).

[1]The coefficient of variation (CV) is the standard deviation of seeding rates from individual shanks expressed as a percent of the average seeding rate An accepted variation for seeding grain or apply fertilizer is a CV value not greater than 15% if the CV is less than 15%, distribution is acceptably uniform, whereas if the CV is greater than 15%, the variation in application rate among individual shanks is excessive.

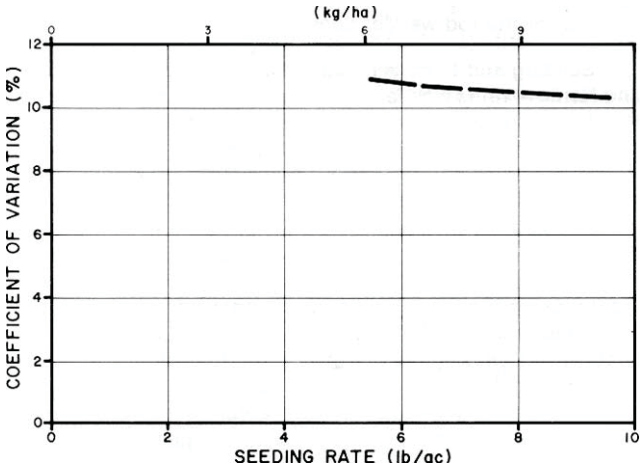

FIGURE 16. Distribution Uniformity in Canola over a Range of Seeding Rates.

Distribution uniformity in 11-51-00 fertilizer varied from unacceptable at low rates to acceptable at high rates as shown in FIGURE 17. The CV's varied from 17.2% to 10.2%. It is recommended that the manufacturer consider modifying the fertilizer distribution system so the uniformity of distribution is acceptable for all application rates.

Changes in fan speed had little effect on distribution uniformity. The uniformity was however, affected by slopes. A 15 degree slope raised the CV to 16% with wheat and to 22% with 11-51-00 fertilizer.

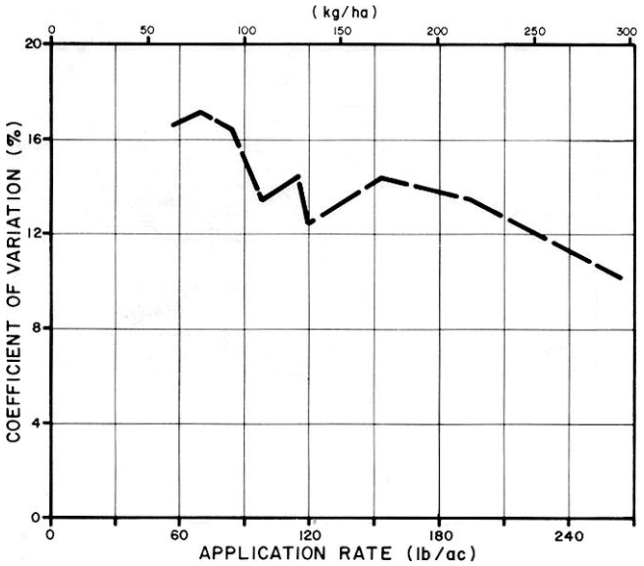

FIGURE 17. Distribution Uniformity in Fertilizer over a Range of Application Rates.

Grain Damage: Grain damage by the metering and distribution system was very good as little damage occurred if a proper fan speed and damper settings were used. For instance, canola damage decreased from 6.0% at a fan speed of 5000 rpm to 3.0% at a fan speed of 3000 rpm. Damage in wheat was less than 1.0%.

EASE OF OPERATION AND ADJUSTMENT

Maintenance: Ease of performing routine maintenance on the Seed-o-Vator was good. Most grease fittings were accessible without much difficulty. Grease fittings were provided for all the wheel hubs. A service schedule was not provided. Servicing all 46 grease fittings took one person about 30 minutes.

Filling/Cleaning: Ease of filling and cleaning the Seed-o-Vator was fair. The tank openings were located 8 ft (2.4 m) above the ground. No auger was supplied on the unit so a drill fill or grain auger was needed to fill the applicator tanks. The small 9.5 in (240 mm) diameter tank openings made fillings difficult and messy. It is recommended the manufacturer consider enlarging the tank openings to allow for easier filling of the tanks.

The filler lids were hinged and latched by a simple hinged friction lock. The front tank held 74 bu (2605 L) while the rear tank held 54 bu (1905 L).

Access to the meter augers required emptying the tanks. Each tank was equipped with a cleanout door as shown in FIGURE 18. Cleaning large amounts of material out of the tanks was difficult because an auger and hopper would not fit under the tank cleanout door. Small amounts of material could be cleaned out of the tanks by using a vacuum cleaner through one of the cleanout doors. It is recommended that the manufacturer consider providing a more convenient way to clean large amounts of material from the tanks.

The fertilizer meter auger seized once during the test due to moisture seeping into the tank during a rain. This caused some damage to the auger flighting. It is recommended that the manufacturer consider improving the applicator tank seals to prevent moisture seeping into the tank.

Transporting: Ease of transporting the Victory Seed-o-Vator was fair. It took 15 to 20 minutes to place the unit in transport position (FIGURE 19). The rod weeder had to be disassembled in two places to put the wings in transport position. Locks pins were provided for each wing, and were attached to each hold up arm with chains. Lock pins were also provided to lock the depth control in transport position. The locks were located on the rear transport axle and the pins were retained in holes located on the rocker arm.

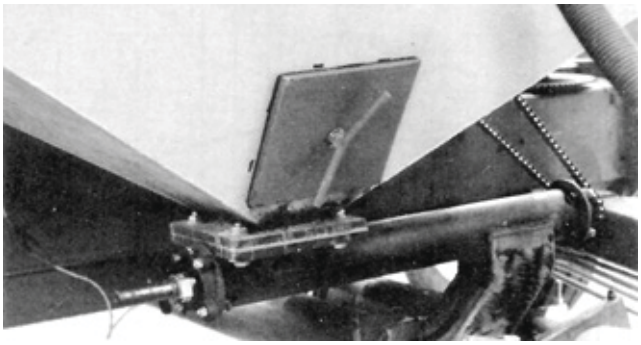

FIGURE 18. Tank Cleanout Door.

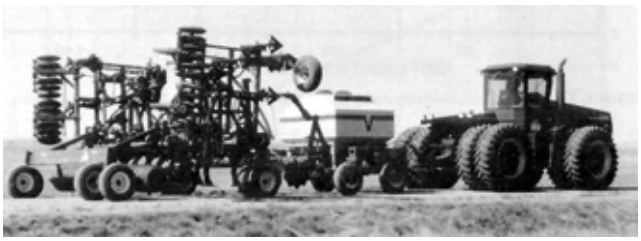

FIGURE 19. Transport Position.

A transport position was also provided for the rod weeder drive. A pin held the drive up on the shank. A field position was provided for the pin. The rods had to be secured with wire against the sweeps to prevent dragging on the ground and swinging on the wing sections during transport.

No transport lock was provided for the ground engaging meter drive wheel (FIGURE 20). An angle iron and wire was used during the test to secure the hydraulic cylinder in the extended position. It is recommended that the manufacturer consider providing a transport lock for the ground engaging meter drive wheel.

The wings would jam against their lock pins if the operator tried to lower the wings with the lock pins in place. This problem could only be overcome by using a winch to pull the wings together which would remove the pressure off the lock pins. It is recommended that the manufacturer consider modifying the rear frame hinge to prevent the wings from jamming against the lock pins.

The unit required the use of a tractor with four sets of remote hydraulics. Three sets were used for the depth, the ground engaging metering wheel and the centrifugal fan. The other set was shared between the wing lifts and hydraulically driven rod weeder by a direction valve. The direction valve was located on the rear frame of the unit.

Transport width was 23.5 ft (7.2 m) while transport height was 11.1 ft (3.4 m). Caution had to be used when transporting the unit because of the wide transport width. When transported above

15 mph (24 km/h) the castor wheels would oscillate. Sweep to ground clearance was 8.5 in (216 mm) and packer to ground clearance was 5.5 in (140 mm). This was adequate clearance during the test.

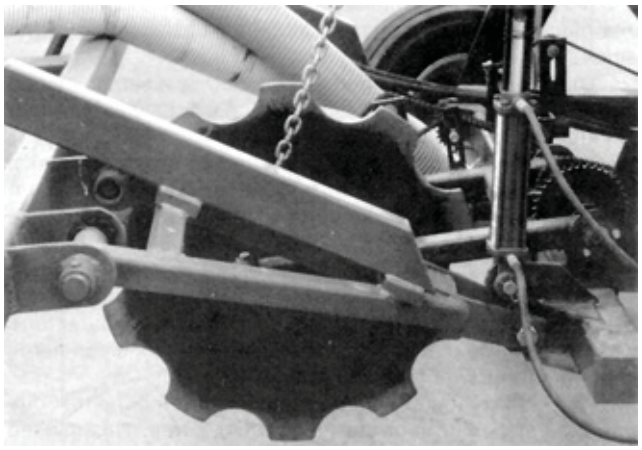

FIGURE 20. Ground Engaging Meter Drive Wheel.

Maneuverability of the unit in the field was hampered by the long hitch length. Caution had to be taken when turning corners to avoid rubbing the tractor tires on the hitch. Damage occurred to the hitch jack mount and hydraulic lines while trying to turn too sharp with the Seed-o-Vator during the test.

The applicator tank blocked the view of most of the 28 ft (8.5 m) cultivator in the field. This is a common problem with tow between air seeders and can only be rectified by using a tow behind air seeder. The two center castor wheels of the cultivator would oscillate continuously during field operation. It is recommended that the manufacturer consider modifying the center castor wheels of the cultivator to prevent oscillation during field operation.

Monitoring: Monitoring on the Seed-o-Vator was good. Monitoring equipment included an airseeder monitor, a material flow monitor and an acremeter. The airseeder monitor had low bin level indicators, a fan speed indicator and motion indicators for the meter augers. The material flow monitor sensed the flow of seed through each delivery tube. The fertilizer delivery tubes were not monitored.

The airseeder monitor was necessary during the test to monitor the tank level, fan speed and motion of the meter augers. A material flow monitor was not supplied with the machine. The seed boots did not plug throughout the test.

The unit was not originally supplied with an acremeter, but the manufacturer installed one during the test. It did not read acres directly and a conversion factor was not supplied. It is recommended that the manufacturer consider supplying a conversion factor with the acremeter.

The rod weeder speed was not monitored and it was difficult and unsafe to check the speed of it in the field. It is recommended that the manufacturer consider providing a monitor for the rod weeder speed.

Seeding and Fertilizer Rates: Ease of changing the seed and fertilizer rates was fair. The rates were changed by removing the meter drive chain and changing the sprocket on the jackshaft. The sprockets were held on by a pin and clip as shown in FIGURE 21. One set of sprockets (FIGURE 21) ranging from 13 to 24 teeth were given to set the rates for both tanks. Removing and installing these sprockets was difficult because of their tight fit on the shafts. A gear puller was usually used to change the sprockets. It is recommended that the manufacturer consider making the metering sprockets easier to change.

Additional sprockets were also provided for doubling the auger speed when applying high fertilizer rates and slowing the auger meters down when seeding small seeds. These sprockets were changed with the ones on the meter augers. To obtain a low enough metering rate in canola, the gear on the first jackshaft from the metering wheel also had to be changed. Access to this gear was difficult and time consuming. It is recommended that the manufacturer consider modifying the metering system to eliminate changing more than two gears when metering small seeds.

Air velocity from the fan was varied by changing the fan speed and moving the dampers (FIGURE 22) located near the fan. The manufacturer recommended changing the fan speed whenever possible and use the dampers only to vary the air velocity between the seed and fertilizer. Changing the metering system from double to single shoot required mounting a Y-connector in the primary hose line just past the meters. A Y-connector was not provided with the test unit.

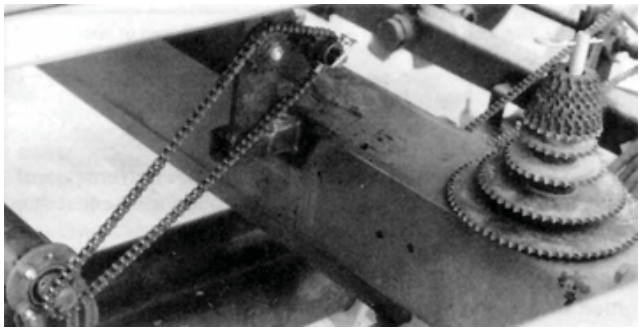

FIGURE 21. Metering Sprockets.

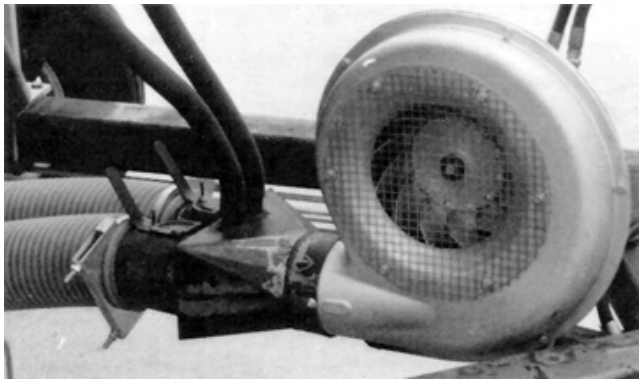

FIGURE 22. Centrifugal Fan and Fan Dampers.

The Seed-o-Vator was calibrated during the test by removing the primary hose and collecting the material with a sack. The ground engaging metering wheel was turned a certain number of turns and the sample weighed. It is recommended that the manufacturer consider providing a more convenient method for calibrating the metering rate.

Depth Adjustment: Ease of setting the seeding depth was good. The seeding depth was adjusted by removing or adding spacer plates (FIGURE 23) in four places on the cultivator. Two were for the center section and one for each wing. Access to the two center spacer plates required climbing on the hitch frame between the tank and the cultivator. The center section of the cultivator could be set deeper for tractor tire tracks but individual shanks could not be set deeper.

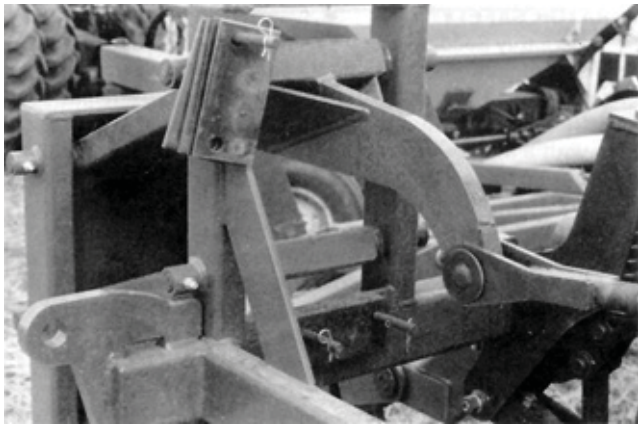

FIGURE 23. Depth Adjustment Spacer Plates and Adjustment Rod for Frame Levelling.

Front to back levelling of the cultivator was made by changing the lengths of the four adjustment rods (FIGURE 23) on the cultivator frame. There are two adjustment rods for the center section and one for each wing. Access to the adjustment rods for the center section

required climbing on the hitch frame between the tank and the cultivator.

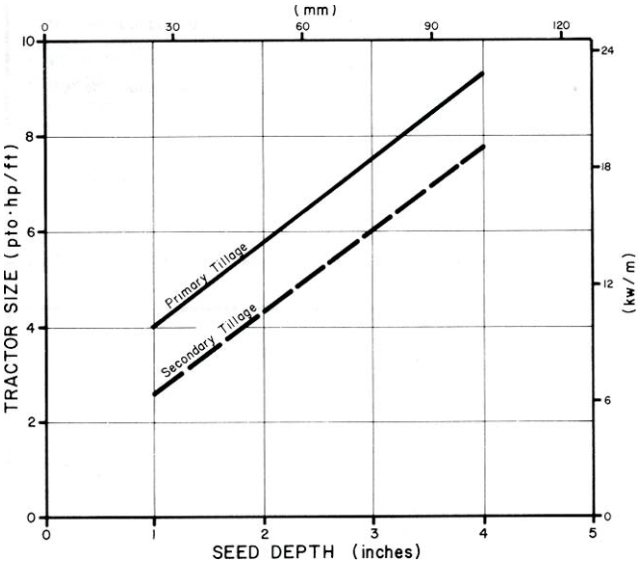

FIGURE 24. Average Horsepower Requirements at 5 mph (8 km/h).

POWER REQUIREMENTS

Draft Characteristics: Attempting to compare draft (drawbar pull) requirements of different tillage units is usually unrealistic. Draft requirements for the same implement, in the same field, may vary by as much as 30 percent in two different years, due to changes in soil conditions. Variations in soil conditions affect draft much more than variation in machine make, usually making it impossible to measure any significant draft difference between makes of implements. Average draft, at a normal seeding depth and at 5 mph (8 km/h), in silt loam soil for the 28 ft (8.5 m) unit tested, ranged from 6000 lb (26.7 KN) to 7800 lb (34.7 KN).

Hydraulic: Average hydraulic flow requirement for the rod weeder was 7.0 gal/min (31.9 L/min) at 500 psi (3450 kPa). This was measured at a rod speed of 150 rpm.

Maximum hydraulic flow requirement for the centrifugal fan was 11.9 gal/min (54.1 L/min) at 1700 psi (11,710 kPa). This was measured at a fan speed of 5300 rpm. Flow requirements for the centrifugal fan varied according to the fan speed. At an average fan speed of 4000 rpm the hydraulic flow requirement was 7.6 gal/min (34.6 L/min) at 1100 psi (7850 kPa).

Tractor Size: The power take-off horsepower draft requirements per foot of drill width for primary and secondary conditions and varying seed depths are given in FIGURE 24. Requirements varied from 2.6 hp/ft (6.4 kW/m) at a 1.0 in (25 mm) seeding depth in secondary conditions to 9.3 hp/ft (22.9 kW/m) at a 4.0 in (102 mm) seeding depth in primary conditions. Therefore, power take-off horsepower requirements needed to pull the Victory Seed-o-Vator 28 ft (8.5 m) test unit at a normal seeding depth varied from 145 hp (109 kW) to 187 hp (140 kW).

Average power take-off horsepower requirements to run the rod weeder was 3.1 hp (2.3 kW). Average and maximum power take-off requirements for the centrifugal fan were 7.3 hp (5.4 kW) and 17.7 hp (13.2 kW), respectively.

The overall tractor size needed to operate the Victory Seed-o-Vator test unit varied from 166 PTO hp (125.5 kW) to 208 PTO hp (156 kW) at a normal seeding depth. These tractor sizes have been adjusted to include tractive efficiency and represent a tractor operating at 80% of maximum power take-off ratings as determined by Nebraska tests or as presented by the tractor manufacturer. The tractor sizes given will have ample power reserve to operate in the stated conditions.

OPERATOR SAFETY

The Victory Seed-o-Vator was safe to operate but some added safety precautions had to be taken to ensure operator safety. As mentioned before, no transport lock was provided for the ground engaging metering wheel. Checking the rod weeder speed with a manual rpm counter was very unsafe. No railing was provided on the applicator tank so extreme caution had to be taken when filling the tanks. It is recommended that the manufacturer consider providing railing on the applicator tank to increase operator safety when filling the tanks.

Tire loads could exceed the “Tire and Rim Association” maximum load rating if the applicator tires were not inflated to a pressure of at least 44 psi (303 kPa).

OPERATOR’S MANUAL

A general operator’s manual was not provided but an operator’s manual was provided for the rod weeder. It included a parts list and information on assembly and operation. Calibration charts were provided for wheat, canola, 34-0-0 and 16-20-0 fertilizers. Application rates were only expressed in Imperial units (lb/ac). It is recommended that the manufacturer consider supplying an operator’s manual with the Victory Seed-o-Vator and rate charts in SI units as well as in Imperial units.

MECHANICAL HISTORY

The Victory Seed-o-Vator was operated for 106 hours while seeding about 1110 ac (444 ha). The intent of the test was evaluation of functional performance and an extended durability evaluation was not conducted. TABLE 2 outlines the mechanical problems that did occur during the functional testing.

TABLE 2. Mechanical History

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA ac	(ha)
-replaced several rod weeder bearings and universal joint connectors		throughout the test	
-tightened numerous nuts on the unit		throughout the test	
-repaired or replaced several delivery hoses pinched by the shank spring assembly		throughout the test	
-rod weeder drive failed. Replaced the drive and one section of rod at	44	485	(194)
-universal joint on rod weeder broke causing damage to the rod drive. Replaced rod drive, one section of rod and two chains at	90	965	(386)
-cut monitor wires and damaged hydraulic hoses by turning too sharp. Replaced wires and hoses at	98	1035	(414)
-rod weeder drive detached from shank. Replaced one hydraulic line, one section of rod and several bent seed boots. Reattached drive at	101	1065	(426)
-seal came off one of the auger bearings. Replaced bearing		end of test	
-arm assembly to lift metering wheel bent. Repaired at		end of test	
-hose to pressurize front tank wore on tank. Replaced at		end of test	
-top bolt for hitch tongue broke. Replaced at		end of test	
-meter auger flighting bent. Removed flighting and reinstalled at		end of test	
-bolts missing from fan mounting assembly. Replaced at		end of test	
-bent hitch jack mount while turning too sharp. Repaired at		end of test	

DISCUSSION OF MECHANICAL PROBLEMS

Rod Weeder: The rod weeder bearings and universal joint connectors were replaced continuously throughout the test due to wear and damage.

The rod weeder drive assembly was replaced twice during the test because the adjustment bolt on the top of the drive to tighten the chain broke off. The chain could not be tightened in the drive so it loosened and eventually damaged the drive bearings. The adjustment bolt broke from hitting a brace when the shank tripped. The manufacturer removed the brace and the adjustment bolt was not damaged on the third rod weeder drive.

Loose Fasteners: The fasteners used on many areas of the Seed-o-Vator were free spinning nuts with serrated faces. These fasteners are not very vibration resistant and required a few tightenings through the test. It is recommended that the manufacturer consider using a fastener which is more vibration resistant than the free spinning nuts with serrated faces.

Auger Flighting: The meter augers were removed at the end of the test. The ends of the flighting on the fertilizer auger were bent due to caked fertilizer. The meter auger could not be removed without emptying the tank. It is recommended that the manufacturer consider providing a way to shut off material from entering the meter

augers so they can be easily removed.

The damage to the fertilizer meter auger flighting might not have occurred if the meter auger was shear pin protected. It is recommended that the manufacturer consider providing shear pin protection for the meter augers.

APPENDIX

SPECIFICATIONS

MAKE:	Victory
MODEL:	Seed-o-Vator
SERIAL NUMBER:	
MANUFACTURER:	Victory Equipment Limited 510 36 Street North Lethbridge, Alberta T1H 5H6 (469) 3274389

DIMENSIONS OF TEST UNIT:	**Field Position**	**Transport Position**
-height	8.2 ft (2.5 m)	11.1 ft (3.4 m)
-length	36.5 ft (11.1 m)	36.1 ft (11.0 m)
-width	28.3 ft (8.6 m)	23.5 ft (7.2 m)
-effective seeding width	28.0 ft (8.5 m)	
-ground clearance	8.5 in (216 mm) Shovels 5.5 in (140 mm) Packers	8.5 in (216 mm) Shovels 5.5 in (140 mm) Packers

METERING SYSTEM:	
-type	auger
-number of meters	2
-drive	chain driven from ground engaging wheel
-adjustment	sprocket combinations
-airstream loading	pressurized tanks
-transfer to openers	pneumatic conveyance through divider headers and plastic tubes
FAN:	
-type	centrifugal with forward curved blades
-make	REM
-model	33
-maximum operating speed	6000 rpm
-drive	hydraulic from tractor remote
SHANKS:	
-number	24
-spacing	14 in (356 mm)
-vertical clearance	27.8 in (706 mm) frame to sweep 25.0 in (635 mm) shank to sweep
-number of rows	3
-distance between rows	28 in (711 mm)
-shank cross section	1.3 x 2 in (33 x 51 mm)
-shank stem angle	52 degrees
-sweep hole spacing	2.25 in (57 mm)
-sweep bolt size	0.5 x 2 in (12 x 51 mm)
RODS:	
-number of rods to each section	
-centre section	2
-wing sections	1
-diameter	1 in (25 mm)
-drive type	hydraulic from tractor remote
-attachment	by chain to back row of shanks
PRESS WHEELS:	
-type	V-shaped, formed steel
-diameter	24 in (610 mm)
-width	4 in (102 mm)
-number	48, 8 per gang on centre section, 6 per gang on wings
-spacing	5 in (127 mm) on 14 in (356 mm) centres
-number of gangs	7
HITCH:	
-vertical adjustment range	85 in (216 mm)
DEPTH CONTROL:	4 manually adjusted sets of flat metal spacers
FRAME:	
-number of sections	3
CASTOR WHEELS:	
-number	2, single 2, dual
-tire size	11L-15
TANK WHEELS:	
-single wheels	four, 11L-15
-meter drive wheel	27 in (685 mm) diameter steel wheel with traction tips
TANK CAPACITIES:	
-front tank	74 bu (2694 L)
-rear tank	54 bu (1966 L)

WEIGHTS (field position):	**TANKS EMPTY**	**TANKS FULL OF WHEAT**
APPLICATOR:		
-hitch	-125 lb (55 kg)	375 lb (170 kg)
-left front castor	1370 lb (615 kg)	3509 lb (1575 kg)
-left rear castor	1210 lb (545 kg)	3010 lb (1355 kg)
-right front castor	1230 lb (555 kg)	3360 lb (1510 kg)
-right rear castor	980 lb (440 kg)	2780 lb (1250 kg)
Cultivator		
-left castor	1690 lb (760 kg)	1690 lb (760 kg)
-left centre tandem castor	1820 lb (820 kg)	1820 lb (820 kg)
-right centre tandem castor	1380 lb (620 kg)	1380 lb (620 kg)
-right castor	1610 lb (725 kg)	1610 lb (725 kg)
-left wing of packers	1910 lb (860kg)	1910 lb (860 kg]
-centre section of packers	5140 lb (2315 kg)	5140 lb (2315 kg)
-right wing of packers	1925 lb (865 kg)	1925 lb (865 kg)
Total	20140 lb (9065 kg)	28500 lb (12825 kg)
WEIGHTS (transport position):		
Applicator		
-hitch	190 lb (85 kg)	6901b (310 kg)
-left front castor	1130 lb (510 kg)	3260 lb (1470 kg)
-left rear castor	990 lb (445 kg)	2790 lb (1255 kg)
-right front castor	1140 lb (515 kg)	3270 lb (1470 kg)
-right rear castor	970 lb (435 kg)	2770 lb (1245 kg)
Cultivator		
-left centre tandem -castor	5320 lb (2395 kg)	5320 lb (2395 kg)
-right centre tandem -castor	4330 lb (1950 kg)	4330 lb (1950 kg)
-left transport -wheels	2760 lb (1240 kg)	2760 lb (1240 kg)
-right transport -wheels	3310 lb (1490 kg)	3310 lb (1490 kg)
Total	20140 lb (9065 kg)	28500 lb (12825 kg)

NUMBER OF CHAIN DRIVES:	5, metering system 1, rod weeder drive
NUMBER OF LUBRICATION POINTS:	46
NUMBER OF HYDRAULIC LIFTS:	4, depth 2, wing lift 1, metering wheel
NUMBER OF SEALED BEARINGS:	30
OPTIONS INCLUDED ON TEST MACHINE:	rock guards, 5 in (127 mm) paired row spacing
OTHER AVAILABLE OPTIONS:	7 in (178 mm) paired row spacings, dual wheel castors on tank, various widths

APPENDIX II

MACHINE RATINGS

The following rating scale is used:

Excellent	Very Good
Good	Fair
Poor	Unsatisfactory

SUMMARY CHART
VICTORY SEED-O-VATOR

RETAIL PRICE:	$62,000.00 (June, 1989, f.o.b. Lethbridge, Alberta) 28 ft unit complete with 200 bushel Victory tank and dual air package
QUALITY OF WORK:	
Penetration:	**very good**
Seed Placement:	**good;** depended on travel speed and fan speed
Fertilizer Placement:	**good;** placed between paired rows
Soil Finishing:	**very good;** left majority of stubble standing in primary conditions
Trash Clearance:	**good;** rod weeder would plug at shallow depths
Metering Accuracy:	**good;** chart not supplied for barley
Distribution Uniformity:	**fair;** unacceptable at low rates of 11-51-00 fertilizer
EASE OF OPERATION AND ADJUSTMENT:	
Maintenance:	**good;** most grease fittings accessible
Filling/Cleaning:	**fair;** small tank openings; difficult to clean out large amounts
Transporting	**fair;** had to disassemble rod weeder; wide transport width
Monitoring:	**good;** rod weeder speed not monitored
Seeding and Fertilizer Rates:	**fair;** sprockets difficult to remove and install
Depth Adjustment:	**good;** spacer plates
POWER REQUIREMENTS:	varied from 166 PTO hp (124.5 kW) to 208 PTO hp (156 kW)
OPERATOR SAFETY:	safe; no railing provided on tank
OPERATOR'S MANUAL:	not provided; rod weeder manual and calibration charts provided
MECHANICAL HISTORY:	replaced several rod weeder bearings, universal joint connectors and two drives

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