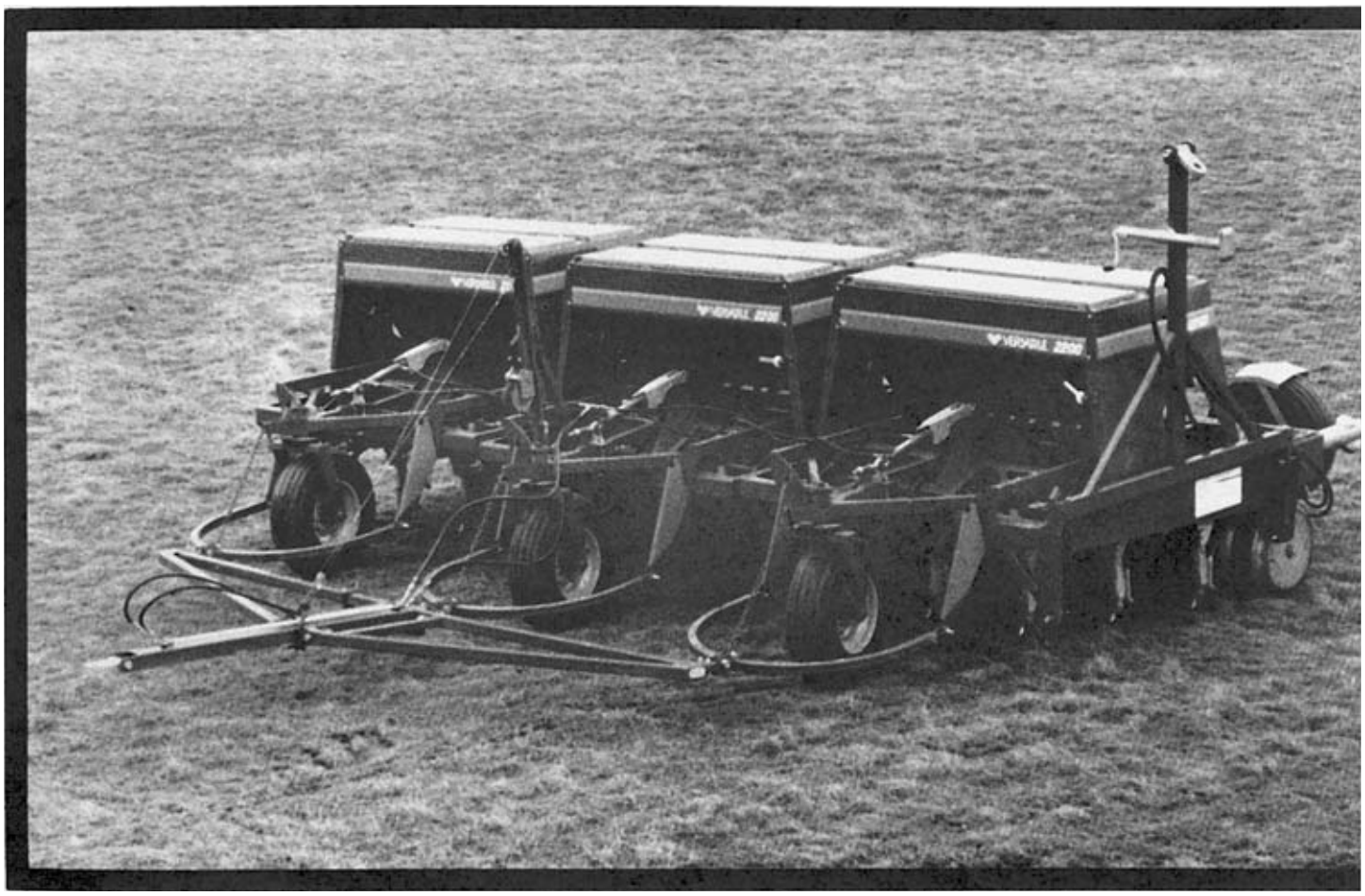
Printed: August 1986
Tested at: Lethbridge
ISSN 0383-3445
Group 9(a)

Evaluation Report 504



Versatile (1985 Model) 2200 Seed Drill

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

VERSATILE (1985 MODEL) 2200 SEED DRILL

MANUFACTURER AND DISTRIBUTOR:

Versatile Farm Equipment Company
1260 Clarence Avenue
Winnipeg, Manitoba
R3T 1T3

RETAIL PRICE:

$ 9,623.00 7 ft (2.1 m) basic unit equipped with hoe openers and fertilizer banding attachments.

$10,871.00 7 ft (2.1 m) basic unit equipped with double disc openers. (August, 1986, f.o.b. Lethbridge, Alberta.)

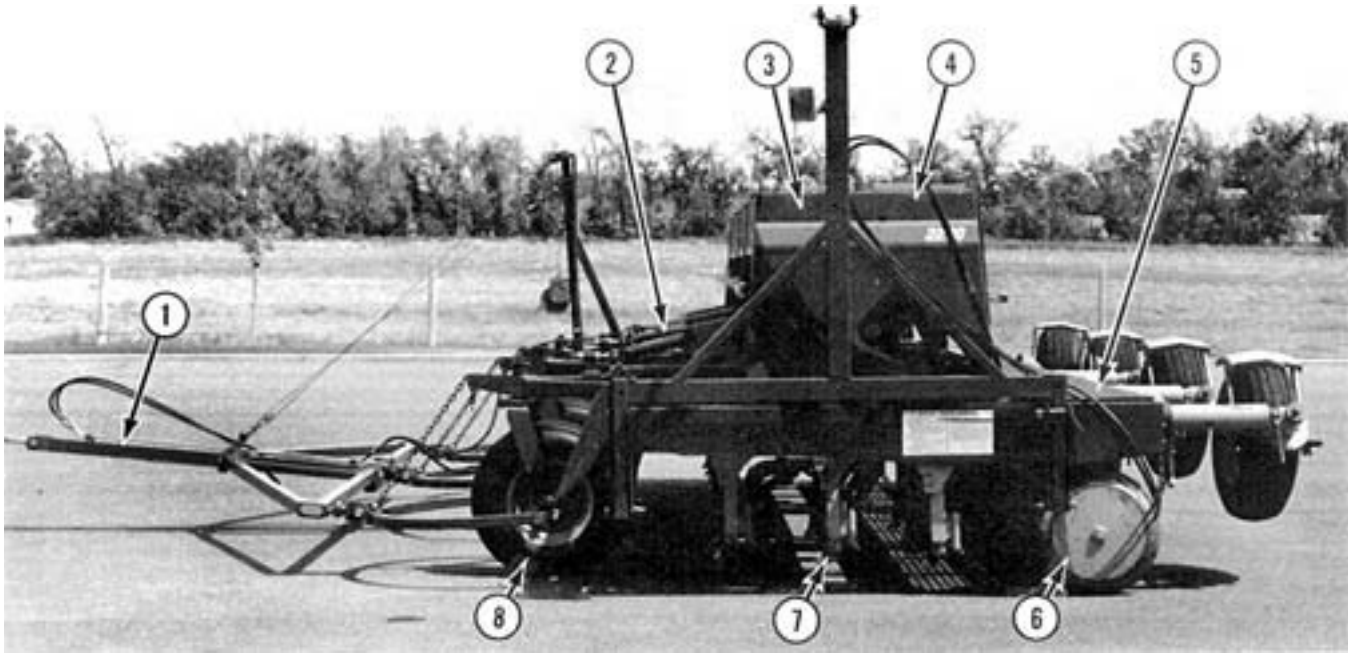


FIGURE 1. Schematic of Versatile 2200 Seed Drill: (1) Hitch, (2) Hydraulic Lift Cylinder, (3) Grain Box, (4) Fertilizer Box, (5) Rear Walkway, (6) Press Wheels (7) Hoe Openers, (8) Castor Wheels.

SUMMARY

Quality of Work: Penetration of the Versatile hoe opener was very good in a wide variety of field conditions including stubble fields. Penetration of the Versatile double disc opener was good in all field conditions including stubble fields.

The hoe opener normally placed seed and fertilizer within a 1.1 in (28 mm) wide band with most seeds within 0.4 in (10 mm) of the average seed depth in uniform soil conditions. The double disc opener normally placed seed and fertilizer within a 1.3 in (33 mm) wide band with most seeds within 0.5 in (13 mm) of the average seed depth.

The optional banding attachments were field tested at the 1.25 in (32 mm) depth setting, at 5 mph (8 km/h) and in silt loam soil. Actual depth between the seed and fertilizer was 0.7 in (18 mm) at an average seeding depth of 1.3 in (33 mm). In very moist soil the banding attachments would occasionally plug.

Each press wheel exerted a packing force of at least 253 lb (1126 N), which effectively packed the soil around the seed and fertilizer. In moist packed soils, such as tire tracks, the double disc openers tended to rip and throw lumps of soil leaving little soil for packing.

Trash clearance with the hoe openers was adequate in all test conditions except in summerfallow with long wheat straw where occasional plugging occurred and in wet wheat stubble where the drill easily plugged. The double disc openers tended to hairpin the straw into the furrow in tough straw conditions.

The spring cushion hoe assemblies provided adequate protection from stones in normal field conditions but in excessively stony conditions damage did occur to the hoe assemblies. Maximum lift height of the hoe opener was 5.75 in (146 mm).

The spring trip double disc assemblies provided adequate protection from stones in all conditions. Maximum lift height of the double disc opener was 6.25 in (159 mm).

Grain Metering System: Metering calibrations in wheat and barley were accurate. Differences between the manufacturer's and PAMI's metering calibrations were attributed to the difference in seed size and density. The manufacturer's calibration was low when seeding canola using the fast speed drive but was accurate when using the slow speed drive at rates below 5 lb/ac (5.6 kg/ha).

Variation in seeding rates among seed runs across the width of the machine was insignificant when seeding wheat and barley. Variation among seed runs when seeding canola was high at low seeding rates. The seed cups should be zeroed to their respective fluted rollers before seeding canola. The seeding rates in all crops were unaffected by level of seed in the box, variations in ground speed and field roughness. Travelling up a 15° slope caused a 13% increase, while travelling down a 15°e slope caused a 7% decrease in seeding rate. Seeding on a side slope did not affect seeding rate.

Fertilizer Metering System: Fertilizer metering calibration was accurate when density and particle size differences were considered. Variation in application rate among runs across the width of the machine was low. The application rate was not significantly affected by level of fertilizer in the box, ground speed or by field vibrations. The application rate was, however, affected by field slope. For example, when applying 11-51-00 fertilizer at a setting of 22, travelling up a 15° slope caused a 25% decrease while travelling down a 15° slope caused a 28% increase in application rate. Seeding on a side slope caused a 7% change in application rate.

The split seed cup adaptor allowed a certain percentage of fertilizer to be placed with the seed when using the banding attachment. PAMI calibrations showed the split seed cup adaptor to be inaccurate at two of the settings.

Ease of Operation and Adjustment: Hitching in transport and field position was convenient and the optional transport package enabled the drill to be placed in transport position in 5 to 10 minutes for quick and easy transporting.

The seed and fertilizer rates were easy to adjust. Adjusting the seed rate became more difficult when the seed box was full. The fertilizer rate was difficult to increase when the boxes were full. Changing to the slow speed kit was time consuming and difficult.

Seeding depth was adjusted with the hydraulic lift cylinder. The large rear walkway and wide box openings made filling the grain and fertilizer boxes safe and convenient. The partition in the grain box could be set in two positions to suit application rates but was difficult to move. The fertilizer hopper bottom could swing downward to permit easy cleaning.

The area counter read 12% low. Lubrication was easy with good access to most grease fittings.

Power Requirements: Tractor size depended on field conditions, soil type, seeding depth, ground speed and drill width. In silt loam soil, seeding at a normal seeding depth at 5 mph (8 km/h), a 50 hp (38 kW) tractor was needed to operate one 7 ft (2.1 m) hoe opener section and a 30 hp (23 kW) tractor was needed to operate one 7 ft (2.1 m) double disc opener section.

Operator Safety: The Versatile 2200 seed drill was safe to operate if normal safety precautions were observed. A slow moving vehicle sign was provided.

Operator's Manual: The operator's manual was very good, containing useful information on adjustments, maintenance, operation and assembly, as well as a complete parts list.

Mechanical History: Due to poor penetration the hoe points were replaced after seeding 21 ac (8 ha) each. Replacement of the points was difficult. The adjusting nuts on the double disc openers loosened throughout the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying the banding attachment to prevent plugging in moist soils.
2. Improving the calibration of the split seed cup adaptor.
3. Modifying the grain box partition to make changing position of the partition easier.
4. Modifying the hoe boot and opener assembly to make replacement of the point easier.

Project Manager: R. P. Atkins

Project Engineer: L. W. Papworth

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. An optional mud deflector is now available for the banding attachment to prevent plugging in moist soils.
2. For proper calibration and distribution of the split cup adaptor, particularly at the higher settings, the rubber fertilizer tube (part number 89173 - item 40 on page 80 of the manual) must be positioned all the way to the back of the top opening in the split cup. A note will be made of this in future operator's manuals and service personnel will be advised.
3. A handle is being considered on future models to facilitate moving the partition. Production toolage and fixturing will be corrected to ensure proper hole alignment.
4. A new hoe boot and point design was released for the 1986 season. It is not only stronger for applications in severe rock but has only one fastener to remove when changing points.

MANUFACTURER'S ADDITIONAL COMMENTS

1. In the report there is reference made to a loosening of the jam nut and adjustment nut for the spring tension on the double disc opener. It should be possible with the two nuts provided to jam the nuts sufficiently so that they won't work loose. A self locking nut will be considered if necessary.
2. Hoe point wear is a function of soil type and soil conditions. In dry, hard soil conditions, point wear is accelerated. These types of conditions may dictate premature hoe point replacement due to a decrease in penetration ability. The new hoe point/boot introduced for the 1986 season is designed such that greater penetration characteristics are maintained throughout the wear life of the point.

GENERAL DESCRIPTION

The Versatile (1985 Model) 2200 is a basic 7 ft (2.1 m) three-row hoe drill with either 8, 9, 10, 12 or 13.5 in (203, 229, 254, 305 or 343 mm) spacing. Optional double disc openers 15 in (381 mm) in diameter are also available for the Model 2200 in the same spacings. The double discs are mounted in two rows. Hitches are available for hitching up to eight basic drill units together. Seeding depth is controlled by a hydraulic cylinder equipped with an adjustable stop. A baffle in the combination grain and fertilizer box may be opened to allow filling the entire box with grain. The box is capable of holding 13.5 bu (490 L) of grain with 681 lb (309 kg) of fertilizer or 20.4 bu (743 L) of grain only.

Grain is metered by externally fluted feed rolls while fertilizer is metered with star-shaped traction wheels. A shear pin is provided on the metering system as a safety device. A motion indicator is provided to indicate rotation of the grain metering system. Flexible plastic hoses deliver the seed and fertilizer to the openers. One gang of 22 in (559 mm) diameter press wheels pack the soil directly behind the openers. Semi-pneumatic packer wheels are available but the test unit was equipped with steel packer wheels.

The test machine consisted of three basic drill units - one equipped with double disc openers spaced at 8 in (203 mm) and two equipped with hoe openers spaced at 8 in (203 mm). Optional equipment included on the test machine consisted of an acre tally, seed box covers, seed shaft speed reducers, fertilizer banding attachments and a transport system along with mechanical hitch lifter.

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

SCOPE OF TEST

The three unit 21 ft (6.4 m) Versatile 2200 seed drill was operated in the conditions shown in TABLE 1 for 108 hours while seeding about 958 ac (383 ha). It was evaluated for quality of work, ease of operation, ease of adjustment, power requirements, operator safety and suitability of the operator's manual. In addition, the seed and fertilizer metering systems were calibrated in the laboratory.

TABLE 1. Operating Conditions

Crop	Soil	Stone Conditions	Field Area		Hours
			ac	ha	
Oats on wheat stubble	Silty loam	Occasional stones	34	13	3
Spring wheat on summerfallow	Silty loam	Occasional stones	323	129	35
Barley on summerfallow	Silty loam	Occasional stones	54	22	6
Barley on tilled barley stubble	Silty loam	Occasional stones	54	22	6
Spring wheat on summerfallow	Silty loam	Occasional stones	116	46	12
Spring wheat on summerfallow	Silty loam	Very stony	54	22	8
Rye on summerfallow	Fine sand	Occasional stones	163	65	22
Winter Wheat on summerfallow	Sandy loam	Occasional stones	102	41	10
Winter wheat on wheat stubble	Sandy loam	Occasional stone	58	23	6
Total			958	383	108

RESULTS AND DISCUSSION

QUALITY OF WORK

Penetration: Penetration of the Versatile hoe opener was very good in a wide variety of field conditions including stubble fields. Proper pre-seeding tillage and soil moisture content did, however, improve penetration. The depth of the hoe openers could not be individually adjusted, resulting in variation of seed depth in tractor wheel tracks.

The hoe assemblies (FIGURE 2) were equipped with a spring cushioned trip and a 0.75 in (19 mm) wide opener. Spring tension could be regulated by adjusting the spring compression jam nuts. The manufacturer recommends the jam nuts be adjusted so the spring preload is approximately 1 in (25 mm) for normal soil conditions.

Penetration of the Versatile double disc openers was good in a wide variety of field conditions provided the openers were properly adjusted and adequate pre-seeding tillage had been performed. Penetration was good when seeding directly into stubble fields provided the soil contained adequate moisture. The depth of the double disc openers could not be individually adjusted, resulting in variation of seed depth in tractor wheel tracks.

The double disc assemblies (FIGURE 3) were equipped with a spring trip release and 15 in (381 mm) diameter pans with 8.5° between pans. Trip-out force of the opener was set by adjusting the spring length using the adjusting nuts on the spring rod. Increasing the spring length increased the trip force. Maximum spring length was determined when the mounting link just touched the stop on

the frame mounts. The operator's manual recommended the length of the spring be 11.25 in (286 mm). During field testing of the double disc openers several of the adjusting nuts on the spring rods loosened, letting the spring go to maximum length.

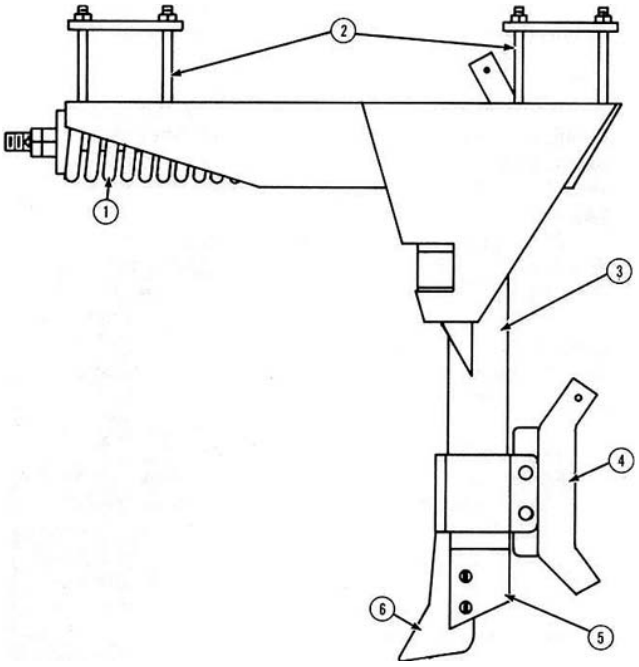


FIGURE 2. Hoe Assembly: (1) Cushion Spring, (2) Frame Mounts, (3) Shank, (4) Banding Attachment, (5) Boot, (6) Hoe Opener.

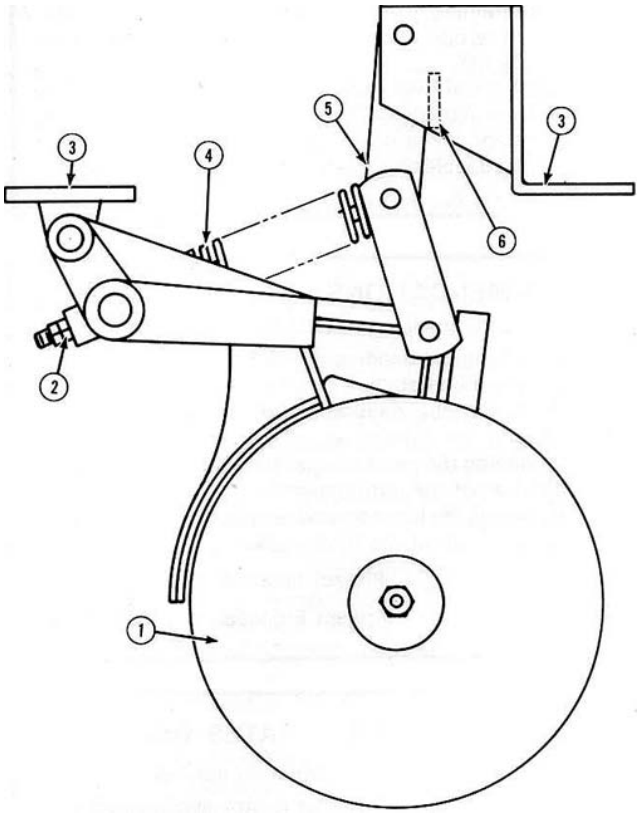


FIGURE 3. Double Disc Assembly: (1) Disc, (2) Adjusting Nut, (3) Frame Mounts, (4) Spring, (5) Link, (6) Stop.

Seed Placement: In normal prairie conditions, the grain is ideally placed when it is in moist soil on a firm seedbed from 1 to 2 in (25 to 50 mm) deep with soil packed tightly around the seed for optimum moisture contact and minimum soil drying.

The Versatile 2200 hoe opener normally placed seed and fertilizer within a 1.1 (28 mm) wide band. When seeding in pre-tilled uniform soil conditions, variation in seed depth was quite uniform. For example, at an average seeding depth of 2.2 in (56 mm), although seeding depth across the width of the machine varied from 1.6 to 2.8 in (41 to 71 mm), most of the seeds were placed within 0.4 in (10 mm) of the average seed depth.

The double disc opener had similar seed and fertilizer placement to the hoe opener. Seed and fertilizer were normally placed within a 1.3 in (33 mm) wide band. When seeding in pre-tilled uniform soil conditions, variation in seed depth was also quite uniform. For example, at an average seeding depth of 2.2 in (56 mm), although seeding depth across the width of the machine varied from 1.6 to 3.0 in (41 to 76 mm), most of the seeds were placed within 0.5 in (13 mm) of the average seed depth.

With the optional banding attachment (FIGURE 2), the Versatile 2200 hoe opener had the capability of deep banding fertilizer while seeding. To operate the attachments the delivery tubes were switched so fertilizer would fall down the main shank and the seed would fall down the banding attachment. The banding attachment could be moved up or down the shank to allow for the placement of fertilizer at three different depths below the seed. The manufacturer listed the three different depths below the seed as 0.75 in (19 mm), 1.25 in (32 mm) and 1.75 in (45 mm) at a ground speed of 4.5 mph (7.2 km/h). Ground speed, soil type and soil moisture content affected the separation of the seed and fertilizer. The banding attachments were field tested at the 1.25 in (32 mm) setting, at 5 mph (8 km/h) and in silt loam soil. Separation of the seed and fertilizer was 0.7 in (18 mm) at an average seeding depth of 1.3 in (33 mm). The fertilizer was placed within a 1.1 in (28 mm) wide band and the seed within a 1.4 in (36 mm) wide band. Variation in seed and fertilizer depths was quite uniform. Most of the seeds were placed within 0.3 in (8 mm) of the average seed depth, and most of the fertilizer was placed within 0.4 in (10 mm) of the average fertilizer depth.

In very moist soil the banding attachments would occasionally plug with soil. It is recommended that the manufacturer consider modifying the banding attachments to prevent plugging in moist soils.

Soil Compaction: The V-shaped steel press wheels effectively pressed the soil about the seed and fertilizer behind the hoe openers, with and without the banding attachment in use. Average packing force exerted by each press wheel ranged from 253 lb (1126 N) with empty seed and fertilizer boxes to 339 lb (1508 N) with full boxes. Press wheel furrow depth ranged from 1.4 to 2.8 in (35 to 70 mm) depending on soil conditions. The right side of FIGURE 4 shows the soil surface after seeding into a summerfallow field with the hoe openers. In loose soils, high field speeds caused excessive soil disturbance with the hoe openers. The manufacturer recommends not to seed at speeds in excess of 4.5 mph (7 km/h) with the 8 in (203 mm) spacing.

FIGURE 4. Soil Surface after Seeding into Summerfallow. Double Disc on Left Side and Hoe Opener on Right.

Behind the double disc openers, the V-shaped steel press wheels also effectively pressed the soil about the seed and fertilizer in loose soils. Press wheel furrow depth ranged from 1.2 to 2.4 in (30 to 60 mm) depending on soil conditions. The left side of FIGURE 4 shows the soil surface after seeding into a summerfallow field with the double disc openers. However, in moist packed soils the double disc openers tended to rip and throw lumps of soil leaving little soil for packing. This problem was especially evident in tire tracks where the soil was well packed.

Trash Clearance: Trash clearance is dependent on field conditions and a number of drill design characteristics. Field conditions that affect trash clearance are soil type, soil and straw

moisture content, straw length and type, how the soil was tilled last and how the trash was managed. Hoe drill design characteristics that affect trash clearance are shank type, number of hoe rows, run spacing, distance between rows and the ground to frame clearance.

The Versatile 2200 was operated in four different types of trash conditions; summerfallow with long wheat straw, pre-tilled heavy barley stubble, wet wheat stubble and dry wheat stubble. The Versatile 2200 with hoe openers cleared trash adequately in the tilled heavy barley stubble and the dry wheat stubble conditions, but performance was reduced in summerfallow with long wheat straw and wet wheat stubble conditions. In the summerfallow with long wheat straw condition, the slightly bur, led straw tended to wrap around the shank as shown in FIGURE 5 and eventually plug up the machine. In the wet wheat stubble condition the unit plugged easily as shown in FIGURE 6. The shanks would not easily shed the soil so the drill would eventually plug under the frame.

The Versatile 2200 with double disc openers cleared trash by either cutting through the straw or by hairpinning the straw into the furrow. When operated in tough straw conditions, like the wet wheat stubble, the double disc openers tended to hairpin the straw as shown in FIGURE 7. This has a negative effect on seed growth and germination. In dry straw conditions, like the dry wheat stubble, the double disc openers effectively cut through straw.

FIGURE 5. Straw Wrapped Around Hoe Opener.

FIGURE 6. Plugged Hoe Opener Drill in Wet Wheat Stubble Condition.

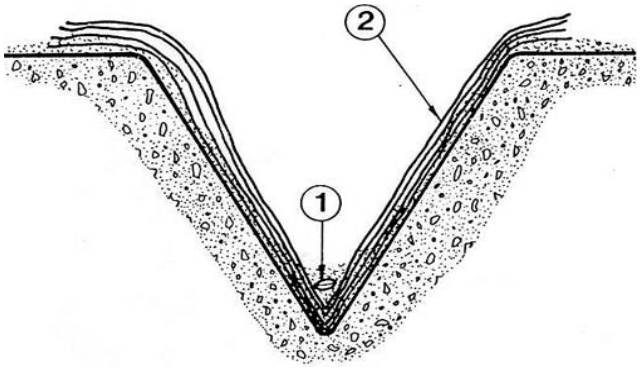


FIGURE 7. Schematic Representation of Hairpinning in Soft Moist Conditions: (1) Seed, (2) Uncut Straw.

Operation in Stony Fields: The spring cushion hoe opener assembly provided adequate protection from stones encountered in normal field conditions. However, in excessively stony conditions damage was done on the assemblies. During the testing, three boots were bent, one shank was bent and two banding attachments were broken. Caution should be exercised when operating the Versatile 2200 hoe drill in stony conditions. FIGURE 8 shows a boot bent during operation in stony conditions. Maximum lift height of the hoe opener was 5.75 in (146 mm).

The spring trip double disc openers provided adequate protection in stony conditions. No damage was done to the double discs from excessively stony field conditions during the testing. Maximum lift height of the double disc opener was 6.25 in (159 mm).

FIGURE 8. Opener Boot Bent During Operation in Stony Conditions.

Plant Emergence: As with most drills, plant emergence depended primarily upon seedbed preparation and soil moisture. FIGURE 9 illustrates good emergence in a pre-tilled summerfallow field seeded to barley with the hoe openers and FIGURE 10 illustrates good emergence in a pre-tilled summerfallow field seeded to barley with the double disc openers.

FIGURE 9. Barley Emergence on Summerfallow with Hoe Openers.

FIGURE 10. Barley Emergence on Summerfallow with Double Disc Openers.

Metering Accuracy: The grain and fertilizer metering systems (FIGURE 11) were calibrated in the laboratory and compared with the manufacturer's calibrations. Since the actual application

for certain settings depends on factors such as size, density and moisture content of seeds and fertilizer particles, it is not possible for a manufacturer to present charts to include all the variations of seed and fertilizer used. Field calibrations may be necessary for seed and fertilizer with properties differing from those indicated in the manufacturer's table. Research has shown, however, that small variations in seed or fertilizer application rates will not significantly affect grain crop yields.

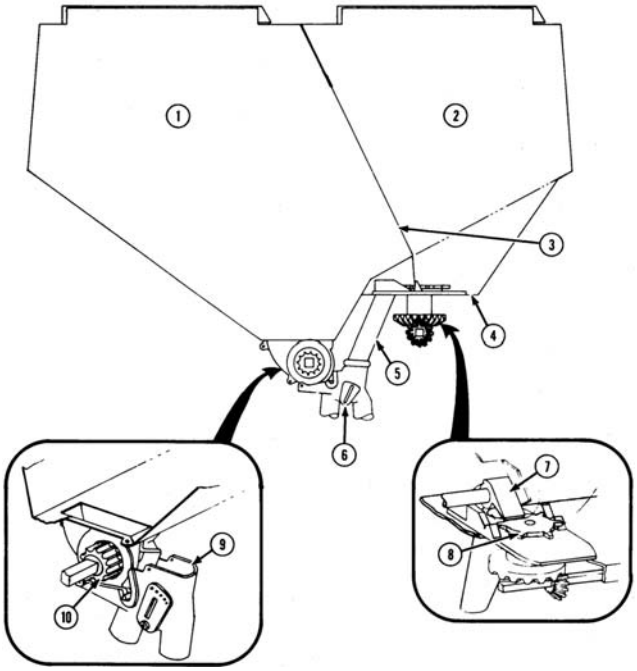


FIGURE 11. Grain and Fertilizer Metering Systems: (1) Grain Box, (2) Fertilizer Box, (3) Seed Box Partition, (4) Fertilizer Hopper Drop Bottom, (5) Fertilizer Spout, (6) Grain and Fertilizer Delivery Tube (7) Adjustable Fertilizer Feed Gate, (8) Star-Shaped Feed Wheel, (9) Split Seed Cup Adaptor, (10) Externally Fluted Feed Roll.

Grain Metering System: FIGURES 12 and 13 show the calibration curves obtained by PAMI and the manufacturer for the Versatile 2200 in wheat and barley using the fast speed drive. Both calibration curves were accurate. The difference between calibration curves obtained by PAMI and those given by the manufacturer are probably due to different seed size, density and moisture content. The seed densities (bushel weights) used by PAMI are indicated on the graphs. FIGURE 14 shows the calibration for canola using the fast and slow speed grain drives. When using the fast speed drive, the manufacturer's calibration was 2 lb/ac (2.2 kg/ha) lower than that obtained by PAMI. When using the slow speed drive the manufacturer's calibration was accurate below a setting of 5 lb/ac (5.6 kg/ha). Therefore, the slow speed drive should be used when seeding at the low rates.

Level of seed in the grain box, variation in ground speed, and field roughness did not affect the seeding rate of either large or small seeds. FIGURE 15 shows the variation in seed application rates as affected by field slope. Travelling up a 15° slope caused a 13% increase in seeding rate and travelling down a 15° slope caused a 7% decrease. Seeding on a side slope did not affect seeding rate.

The coefficient of variation (CV)[1] is commonly used to describe the variation of application rate among individual seed cups across the width of the machine. An accepted variation for grain or fertilizer is a CV value not greater than 15%. If the CV is less than 15%, seeding is acceptable, whereas if the CV is much greater than 15%, the variation among individual seed cups is excessive.

The seeding rate, across the width of the machine for wheat and barley was uniform with CV's of 2 to 10%. The CV, when seeding canola with the slow speed drive, varied from 40% at 2.5 lb/ac (2.8 kg/ha) to 9% at 14 lb/ac (15.7 kg/ha). It was found that the uniformity improved considerably if the seed cups were properly zeroed to their respective fluted roller.

Grain crackage through the grain metering system was negligible for both small and large seeds.

[1]*The coefficient of variation is the standard deviation of application rates from individual seed cups, expressed as a percent of the mean application rate.*

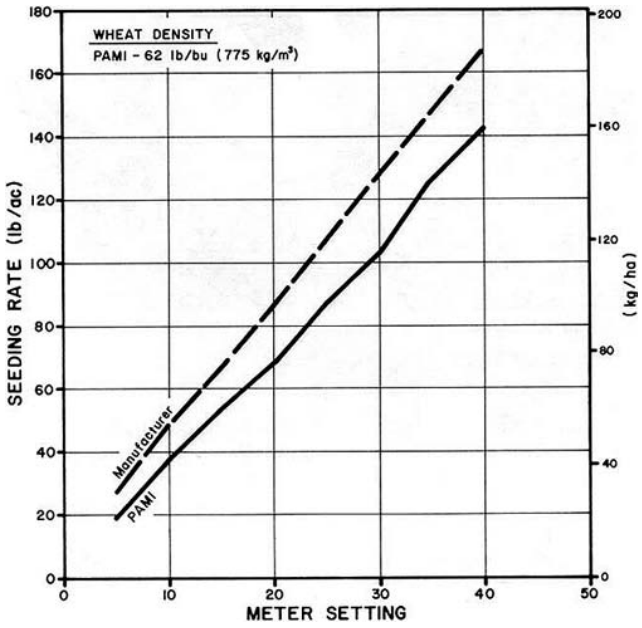


FIGURE 12. Metering Accuracy in Wheat.

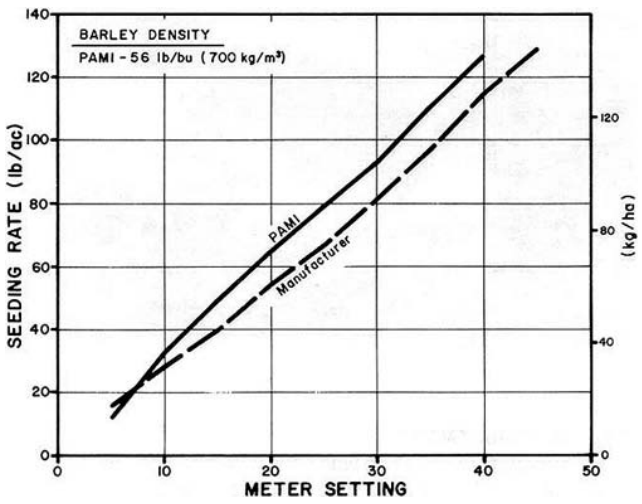


FIGURE 13. Metering Accuracy in Barley.

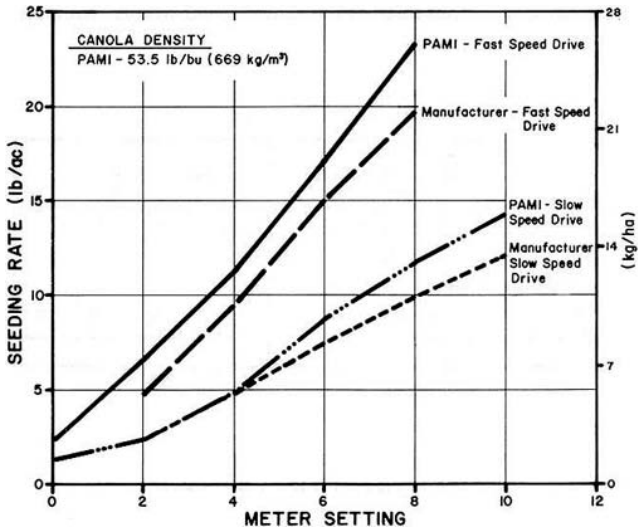


FIGURE 14. Metering Accuracy in Canola.

Fertilizer Metering System: FIGURE 16 shows the calibration curve for fertilizer obtained by PAMI and the manufacturer when using the slow speed drive while metering 11-51-00 fertilizer. The slight difference between the two curves is probably due to the variation in the size and density of the fertilizer used in the two calibrations. Application rates when using the high speed drive

range from about 107 to 400 lb/ac (120 to 448 kg/ha).

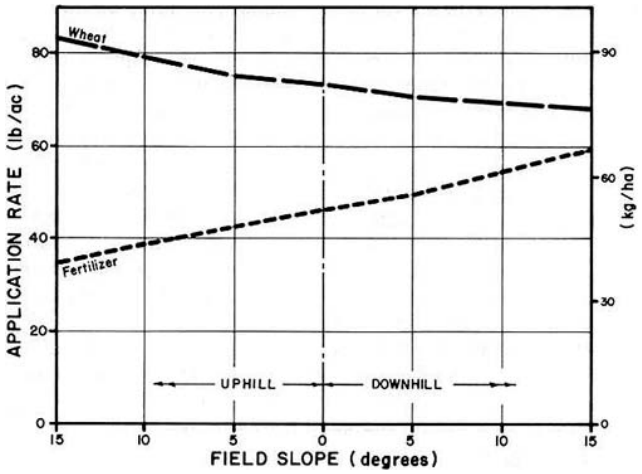


FIGURE 15. Variation in Seed and Fertilizer Application Rate with Change in Slope.

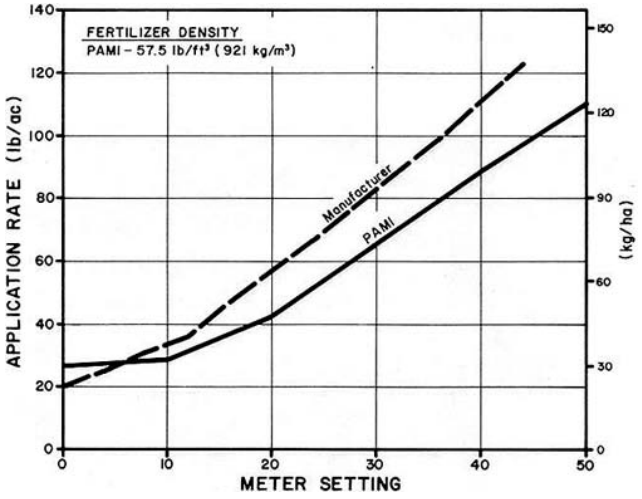


FIGURE 16. Metering Accuracy in Fertilizer.

Fertilizer distribution across the width of the drill was quite uniform. For example, when applying 11-51-00 fertilizer at a rate of 42 lb/ac (47 kg/ha), the coefficient of variation among individual seed cups was 6.5%.

The fertilizer application rate was not significantly affected by level of fertilizer in the box, ground speed or field roughness. It was, however, affected by field slope. FIGURE 15 shows the variation in fertilizer application rates as affected by field slope. For example, when applying 11-51-00 fertilizer at a setting of 22, travelling up a 15° slope caused a 25% decreased while travelling down a 15° slope caused a 28% increase in application rate. Seeding on a side slope caused a 7% change in application rate.

The Versatile 2200 also featured a split seed cup adaptor (FIGURE 11), which allowed a certain percentage of fertilizer to be placed with the seed when using the banding attachment. This was done using a small adjustable baffle that directed fertilizer into the fertilizer tube. PAMI's calibration results are compared to the manufacturer's in TABLE 2. Differences occurred at the number 2 and 3 settings. It is recommended that the manufacturer consider improving the calibration of the split seed cup adaptor. The split seed cup adaptor's distribution was not affected by field roughness or a change in fertilizer application rate.

EASE OF OPERATION

Hitching: Hitching in both transport and field positions were convenient since the transport hitch was supported by a jack and the drawbar hitch was supported by a mechanical hitch lifter.

Feed Gate: The grain seed cups were equipped with two-position feed gates. The gates were factory adjusted for small seeds but could be set for larger seeds. The gates could also be fully opened to allow for thorough cleaning of a seed cup.

Filling: The 29 in (737 mm) wide metal walkway and the wide opening lids made filling with grain and fertilizer safe and convenient. The partition between the grain and fertilizer boxes (FIGURE 11) could be set in two positions to suit application rates. This permitted carrying 13.5 bu (490 L) of grain and 681 lb (309 kg) of fertilizer or 20.4 bu (743 L) of grain only in each 7 ft (2.1 m) unit. Changing the partition in the seed box was very difficult. The holes for the six bolts did not line up when the partition was moved. It is recommended that the manufacturer consider modifying the grain box partition to make changing position of the partition easier.

TABLE 2. Metering Accuracy of Split Seed Cup Adaptor

Sector Position	Manufacturer's Approximate Percent of Fertilizer		PAMI'S Percent of Fertilizer	
	With Seed	Banded	With Seed	Banded
0	0	100	0	100
1	30	70	28	72
2	60	40	67	33
3	90	10	98	2
4	100	0	100	0

Moisture: The grain and fertilizer boxes were adequately sealed to prevent leakage into the boxes in light rains. The optional seed box tarp covers were very effective in preventing moisture from entering the seed boxes in heavy rain.

Cleaning: The 13 in (330 mm) wide openings made the grain and fertilizer boxes very accessible for cleaning. A vacuum cleaner or compressed air was needed for thorough cleaning of the grain box. The fertilizer box was easy to clean. The bottom of the fertilizer box containing the feed wheels could be swung down (FIGURE 17) to permit cleaning with a brush, water or compressed air.

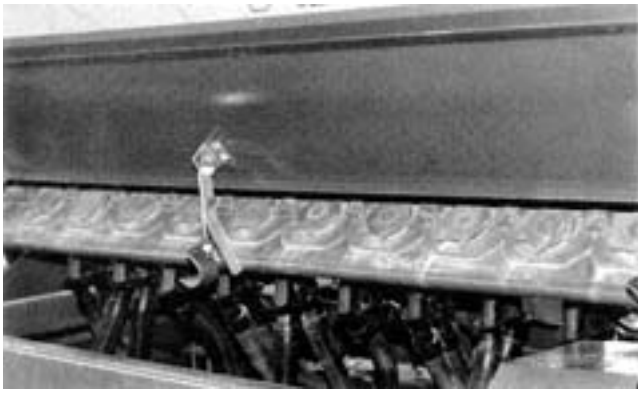


FIGURE 17. Fertilizer Hopper Drop Bottom.

Area Counter: The acre counter (FIGURE 18) read about 12% low. The counter recorded the nearest tenth acre up to one thousand acres and had a reset button.

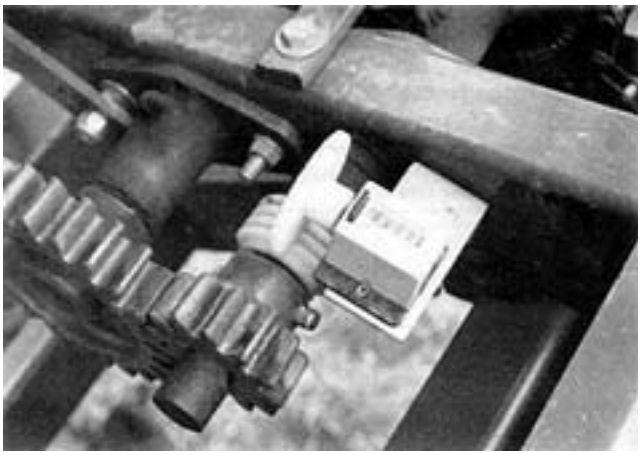


FIGURE 18. Area Counter.

Transporting: The optional drill transport package (FIGURE 19) was convenient for transporting the drill over long distances. It took 5 to 10 minutes to place the drill in transport position. The manufacturer recommended that the drills be transported empty

and not above 10 mph (16 km/h). When transported above 10 mph (16 km/h) the castor wheels tended to oscillate.

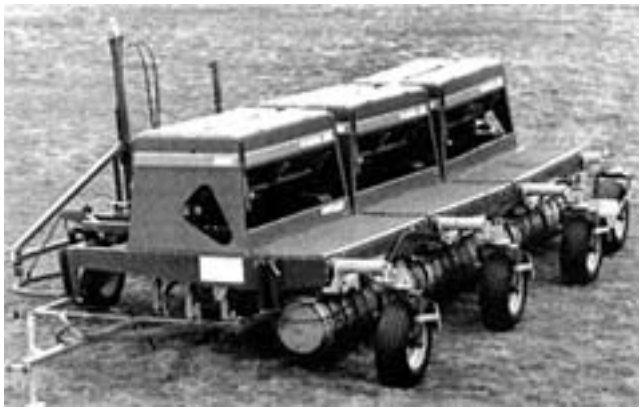


FIGURE 19. Transport Position.

EASE OF ADJUSTMENT

Lubrication: Lubrication was easy with good access to most grease fittings. The rear walkway covers were easily removed allowing good access to the clutch shift, shift plates and sprocket. The farthest left hand double disc opener could not be greased due to interference from the drill frame. During the test a 90° grease fitting was installed to grease the opener.

Twenty-four grease fittings required greasing every 5 hours, while forty-two grease fittings required greasing every 50 hours.

Seeding and Fertilizing Rates: The seeding rate was adjusted by changing the rate selection lever (FIGURE 20) to the desired setting. The rate selection lever became more difficult to adjust when the grain box was full. The seeding rate could be zeroed by turning the zeroing nut and by adjusting the individual seed cups. Changing to the optional slow speed drive required changing of the sprockets and deleting some roller chain links. This procedure was time consuming, especially on the inside drills where access to the sprockets was difficult.

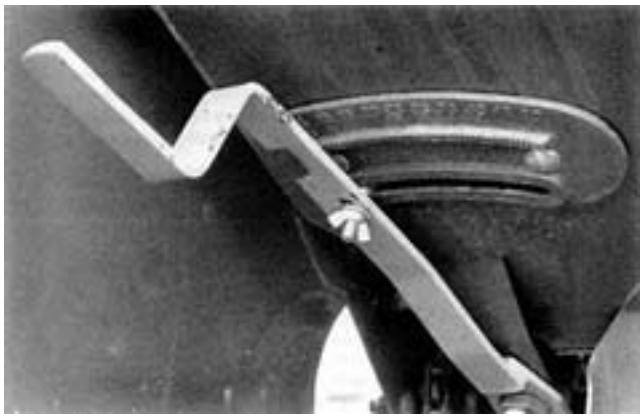


FIGURE 20. Seeding Rate Selection Lever.

The fertilizer rate was adjusted by moving the selection lever (FIGURE 21) to the desired setting. The rate was difficult to increase when the boxes were full. The fertilizer drive was easily changed from low to high-speed drive. Each fertilizer gate was easily set by a setscrew. The seed cup adaptor setting was changed by moving the selection lever on the side of each adaptor.

The Versatile 2200 grain and fertilizer boxes contained gauges, which indicated the amount left in each box. These were very useful for field calibration.

Depth of Tillage: Seeding depth was adjusted by positioning the stop collar on the hydraulic cylinders. The frame could be levelled by placing shims between each packer gang bearing standard and the drill frame.

POWER REQUIREMENTS

Draft: Draft (drawbar pull) requirements depended on field preparation, soil type and moisture content, ground speed and amount of fertilizer and grain in the boxes.

Average draft at a normal seeding depth and at 5 mph (8 km/h), with fully loaded seed boxes, in silt loam soil for one 7 ft (2.1 m) drill unit ranged from 1975 lb (8789 N) to 2200 lb (9790 N) for the hoe openers and from 1230 lb (5474 N) to 1350 lb (6008 N) for the double disc openers.

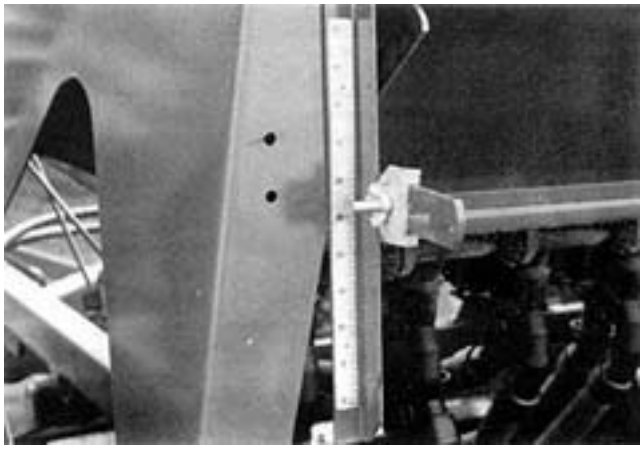


FIGURE 21. Fertilizer Rate Selection Lever.

Tractor Size: The power take-off horsepower requirements per foot of drill width for varying depths are given in FIGURE 22. Requirements varied from 3.1 hp/ft (7.6 kW/m) at 0.5 in (13 mm) seed depth to 8.4 hp/ft (20.6 kW/m) at 2.5 in (64 mm) seed depth for the hoe openers. Requirements varied from 2.5 hp/ft (6 kW/m) at 0.75 in (19 mm) seed depth to 5.0 hp/ft (12.2 kW/m) at 2.25 in (57 mm) seed depth for the double disc openers. Therefore, overall tractor size needed to pull 7 ft (2.1 m) of Versatile 2200 drill varied from 47 hp (35 kW) to 53 hp (40 kW) for the hoe opener unit and from 29 hp (22 kW) to 32 hp (24 kW) for the double disc opener in silt loam soil. 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.

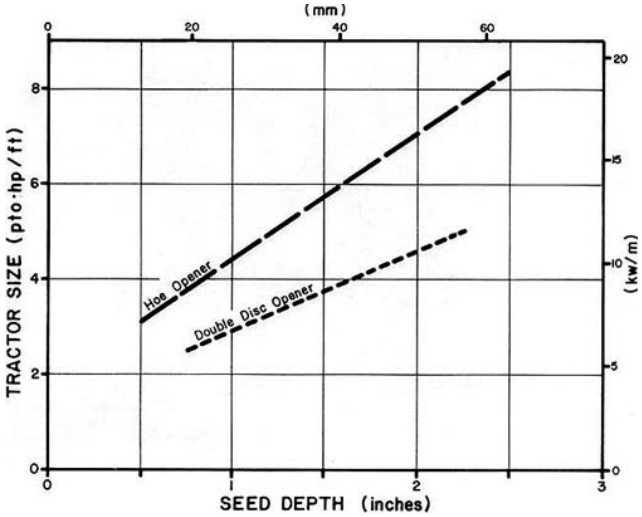


FIGURE 22. Average Horsepower Requirements at 5 mph (8 km/h).

OPERATOR SAFETY

The Versatile 2200 was safe to operate if normal safety precautions were observed. Lock-up pins were provided for the hoe bed, the transport system and the drawbar hitch. The platform at the rear of the drill was large enough for safe filling of the grain and fertilizer boxes. The rear platform consisted of sharp protruding holes which gave the operator good traction but also provided operator discomfort on the hands and knees while adjusting the drill. The wheel guards on the rear transport wheels were safe to step on while filling the drill. A slow moving vehicle sign was provided.

Tire loads did not exceed the Tire and Rim Association maximum load ratings.

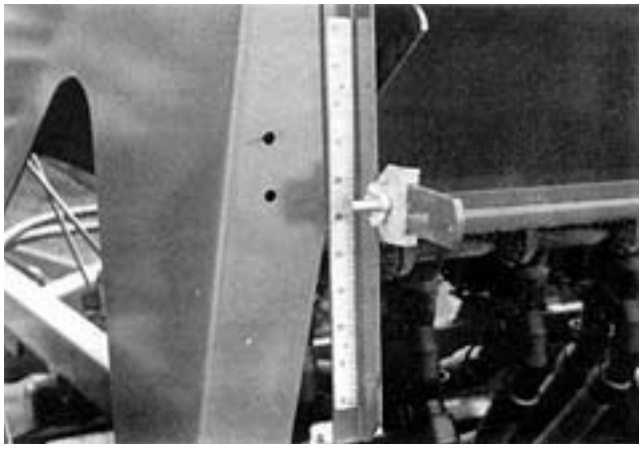


FIGURE 21. Fertilizer Rate Selection Lever.

OPERATOR'S MANUAL

The operator's manual contained useful information on adjustments, maintenance, operation and assembly, as well as a complete parts list. Calibration charts were provided in the operator's manual and on the drill box. Rates were expressed in Imperial units (lb/ac) and in metric (SI) units (kg/ha).

MECHANICAL PROBLEMS

The Versatile 2200 was operated for 108 hours while seeding about 958 ac (383 ha). The intent of the test was evaluation of functional performance and an extended durability evaluation was not conducted. TABLE 3 outlines the mechanical problems that did occur during the functional testing.

TABLE 3. Mechanical History

Item	Operating Hours	Equivalent Field Area ac	(ha)
-hydraulic hose rubbed on packer and failed at	7	75	(30)
-three hydraulic hoses failed	throughout the test		
-nuts on disc springs needed tightening	throughout the test		
-the hoe openers were worn and replaced at	70	635	(254)

DISCUSSION OF MECHANICAL PROBLEMS

Hoe Point Wear: FIGURE 23 shows the wear on a typical hoe point after seeding 21 ac (8 ha) in the conditions listed in TABLE 1. The point was removed and replaced because penetration was inadequate.

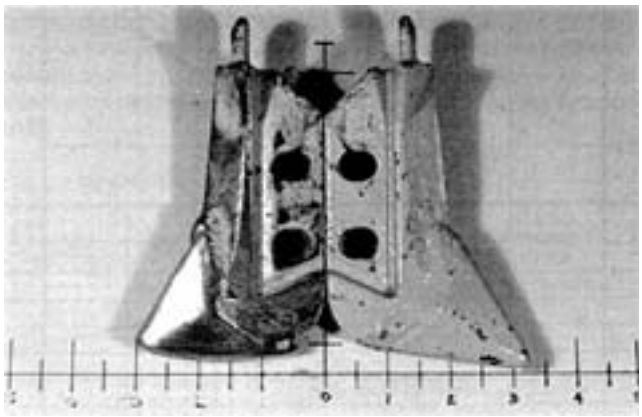


FIGURE 23. Hoe Point Wear.

Some of the hoe points were very hard to replace. The bottom fasteners were very hard to remove when worn. It is recommended that the manufacturer consider modifying the hoe boot and opener assembly to make replacement easier.

Double Disc Wear: The double disc openers wore approximately 0.2 in (5 mm) while each seeding approximately 32 ac (13 ha) in the conditions listed in TABLE 1.

APPENDIX I
SPECIFICATIONS

MAKE:	Versatile	
MODEL:	2200 Seed Drill	
SERIAL NUMBER:	268064 (R), 268063 (C), 268061 (L)	
MANUFACTURER:	Versatile Farm Equipment Company 1260 Clarence Avenue Winnipeg, Manitoba R3T 1T3	
DIMENSIONS OF THREE UNITS:	**Field Position**	**Transport Position**
-- height	8.6 ft (2.6 m)	7.7 ft (2.3 m)
-- length	21.0 ft (6.4 m)	28.0 ft (8.5 m)
-- width	21.8 ft (6.6 m)	15.0 ft (4.6 m)
-- effective seeding width	20.3 ft (6.2 m)	
-- transport ground clearance		4.8 in (122 m)
SEED METERING SYSTEM:		
-- type	externally fluted feed rolls	
-- drive	chain and gear from press wheels	
-- adjustment	lever controlling feed roll protrusion, seed shaft speed reducer	
-- transfer to openers	flexible plastic hose	
FERTILIZER METERING SYSTEM:		
-- type	star-shaped feed wheels rotating on a vertical shaft	
-- drive	chain and gear from press wheels	
-- adjustment	lever controlling feed inlet size, fast and slow shaft speed	
-- transfer to openers	flexible plastic hose	
OPENERS:		
-- type	0.75 in (19 mm) narrow hoe points or 15 in (380 mm) diameter double disc	
-- number	10 per drill unit	
-- spacing	8 in (203 mm)	
-- number of rows	3 for the hoe opener and 2 for the double disc opener	
--- istance between rows	18 in (457 mm)	
-- options	regular hoe points and boots, 1.5 in (38 mm) wide, 9, 10, 12 and 13.5 in (229, 254, 305 and 343 mm) spacing	
PRESS WHEELS:		
-- type	V-shaped formed steel	
-- diameter	22 in (559 mm)	
-- width	4 in (102 mm)	
-- number	10 per drill unit	
-- spacing	8 in (203 mm)	
-- number of gangs	1 per drill unit	
CASTOR WHEELS:		
-- number	1 per drill unit	
-- tire size	9.5 L x 15, 6-ply	
GRAIN AND FERTILIZER BOX CAPACITIES:		
-- with box partition in position 1		
-grain	40.5 bu (1474 L)	
-fertilizer	1870 lb (842 kg)	
-- with box partition in position 2		
-grain	60.7 bu (2209 L)	
WEIGHTS: (FIELD POSITION)	**Boxes Empty**	**Boxes Full**
-- weight on press wheels	7590 lb (3440 kg)	10,160 lb (4610 kg)
-- weight on castor wheels	3670 lb (1670 kg)	5440 lb (2470 kg)
Total (As Tested)	11,260 lb (5110 kg)	15,600 lb (7080 kg)
WEIGHTS: (TRANSPORT POSITION)	**Boxes Empty**	**Boxes Full**
-- weight on front castor wheels	5690 lb (2580 kg)	7830 lb (3550 kg)
-- weight on transport wheels	5570 lb (2530 kg)	7770 lb (3530 kg)
Total (As Tested)	11,260 lb (5110 kg)	15,600 lb (7080 kg)
NUMBER OF CHAIN DRIVES:	12	
NUMBER OF LUBRICATION POINTS:	77	
NUMBER OF HYDRAULIC LIFTS:	7	
NUMBER OF SEALED BEARINGS:	21	

OPTIONS INCLUDED ON TEST MACHINE:
- -- seed box tarp covers, rock, guards, acreage tally
- -- seed shaft speed reducer sprockets
- -- fertilizer banding attachment, transport system, along with mechanical hitch lifter

OTHER AVAILABLE OPTIONS:
- -- 16-tooth seed shaft sprockets
- -- semi-pneumatic packer wheels
- -- field marker, front spreader bar attachments

APPENDIX II
MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

Excellent	Very Good
Good	Fair
Poor	Unsatisfactory

APPENDIX III
CONVERSION TABLE

acres (ac) x 0.40	= hectares (ha)
miles/hour (mph) x 1.61	= kilometres/hour (km/h)
inches (in) x 25.4	= millimetres (mm)
feet (ft) x 0.305	= metres (m)
horsepower (hp) x 0.75	= kilowatts (kW)
pounds (lb) x 0.45	= kilograms (kg)
pounds force (lb) x 4.45	= newtons (N)
bushels (bu) x 36.4	= litres (L)
pounds/acre (lb/ac) x 1.12	= kilograms/hectare (kg/ha)
pounds/bushel (lb/bu) x 12.5	= kilograms/cubic meter (kg/m^3)

SUMMARY CHART

VERSATILE (1985 MODEL) 2200 SEED DRILL

RETAIL PRICE:	$9,623.00 7 ft (2.1 m) basic unit equipped with hoe openers and fertilizer banding attachments $10,871.00 7 ft (2.1 m) basic unit equipped with double disc openers (August, 1 986, f.o.b. Lethbridge)
QUALITY OF WORK:	
Penetration	- hoe openers, very good - disc openers, good, but tended to rip and throw moist, packed soil
Trash Clearance	- hoe openers plugged occasionally in summerfallow with long wheat straw and often in wet wheat stubble - disc openers tended to hairpin tough straw
Stony Conditions	- hoe openers, adequate protection, but some damage did occur in excessively stony conditions - disc openers, adequate protection
Metering	- accurate in wheat, barley, and fertilizer; canola accurate with slow speed drive
EASE OF OPERATION:	
Filling	- convenient
Cleaning	- dropout bottom for fertilizer box
Transportability	- convenient
EASE OF ADJUSTMENT:	
Seeding and Fertilizer Rates	- easy to set; slow speed kit time consuming to install
Depth	- simple; openers in tire tracks could not be set deeper
POWER REQUIREMENTS:	- 50 PTO hp (38 kW) tractor per 7 ft (2.1 m) hoe opener drill and 30 PTO hp (23 kW) tractor per 7 ft (2.1 m) double disc opener drill was sufficient for all conditions
OPERATOR SAFETY:	- safe, slow moving vehicle sign supplied
OPERATOR'S MANUAL:	- contained useful information; parts list provided
MECHANICAL HISTORY:	- hoe points replaced after seeding 21 ac (8 ha); points difficult to replace - disc wear negligible

ALBERTA FARM MACHINERY RESEARCH CENTRE

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html

Prairie Agricultural Machinery Institute
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:
P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080