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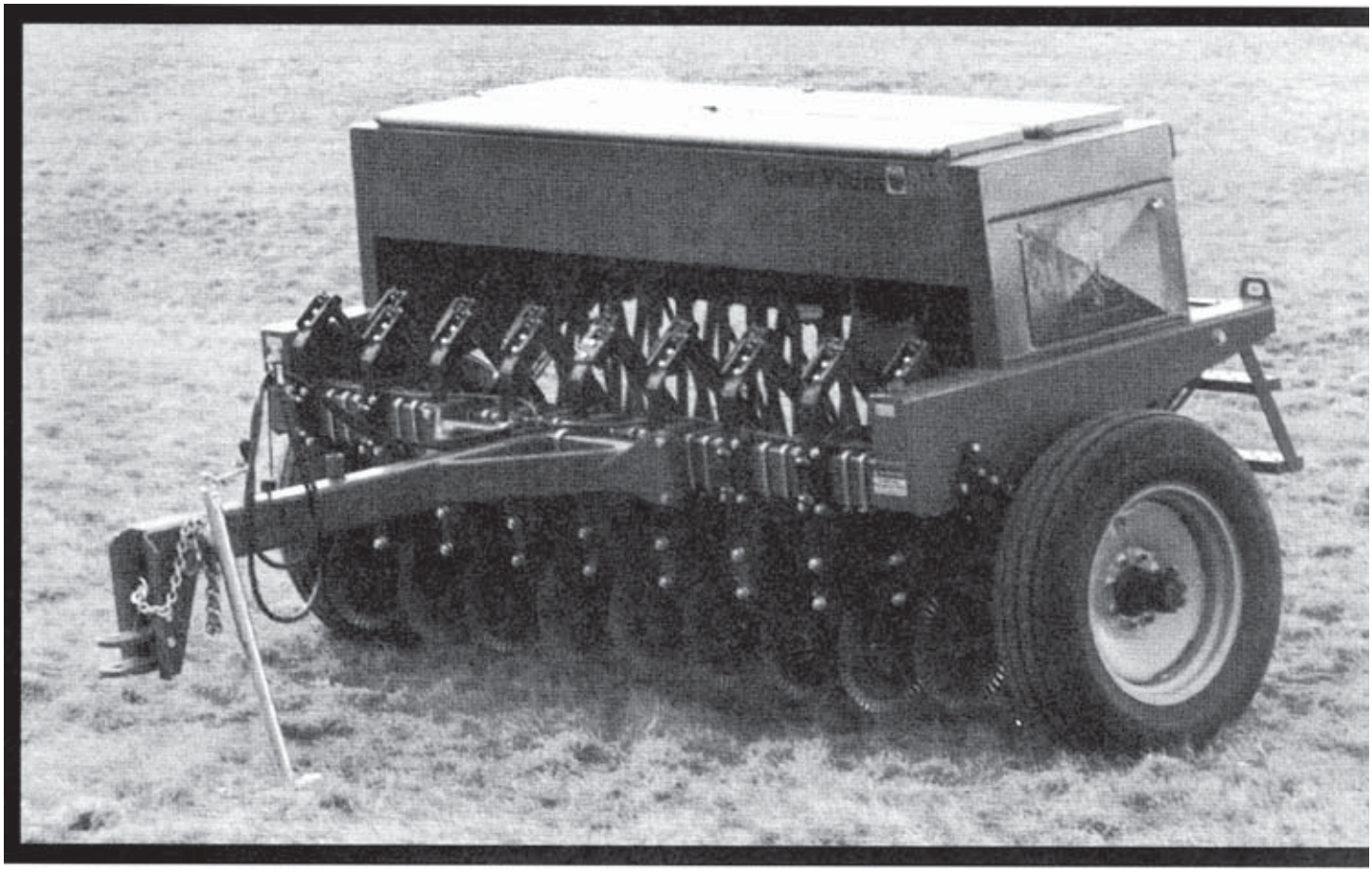

Great Plains Solid Stand No-Till Drill

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

GREAT PLAINS SOLID STAND NO-TILL DRILL

MANUFACTURER and DISTRIBUTOR

Great Plains Manufacturing, Inc.
P.O. Box 218
Assaria, Kansas
USA 67416
Phone: (913) 667-4755

RETAIL PRICE

U.S. $16,404.00 (June, 1994 f.o.b. Lethbridge, Alberta, Great Plains Solid Stand No-Till Drill.)

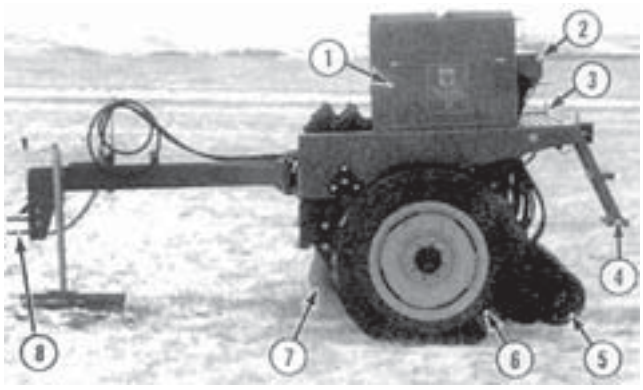

FIGURE 1. Great Plains Solid Stand No-Till Drill: (1) Grain and Fertilizer Box, (2) Small Seeds Attachment, (3) Walkway, (4) Ladder, (5) Double Disc Opener Packer, (6) End Wheel, (7) Coulter and (8) Hitch.

SUMMARY

QUALITY OF WORK

Penetration of the Great Plains Solid Stand No-Till drill was good. The coulters occasionally tripped when seeding into hard untilled soils. The trip-out force of each coulter was 210 lb (935 N).

Seed and fertilizer placement was very good. Variation in seed and fertilizer depth was uniform in all seeding conditions.

Soil finishing was good. The majority of the stubble was left on the surface with some standing after seeding into untilled stubble fields. Soil attached to the coulters and left the surface with soil lumps covering the stubble after operation in wet and heavy soil conditions.

Residue clearance was very good. The opener systems allowed residue to flow with no plugging. Operation in stony conditions was very good. The lift clearance of the double disk openers was adequate to clear large rocks.

Metering accuracy was good. The manufacturer's calibration curves were consistently lower for wheat and barley and consistently higher for alfalfa than the curves obtained by AFMRC. Changes in ground speed and up and downhill slopes significantly affected the metering rate of 11-51-0 fertilizer.

The distribution uniformity of the application rate was very good. The coefficient of variation (CV) ranged from 3 to 6.5% for canola, 3 to 8.5% for 11-51-0 fertilizer and 1.5 to 4% for wheat, barley, peas and alfalfa.

EASE OF OPERATION AND ADJUSTMENT

Ease of performing routine maintenance was good. One person required 15 minutes to service all 41 lubrication points.

Ease of filling and cleaning the drill was fair. The narrow walkway made filling and cleaning the seed and fertilizer boxes difficult. The small seeds attachment was difficult to fill because seeds usually fell between the box and lid. The seed and fertilizer boxes were adequately sealed from moisture. The fertilizer feed roll and slide were exposed to moisture during a rain.

Ease of transporting was very good. Two minutes were required to place the unit in transport position. The metering drive chains were disengaged by the lockout hub located on the drive wheel. The manufacturer did not supply a field marker.

Ease of changing the seed and fertilizer rates was good. The meter settings were difficult to set due to the small numbers on the numerical scales. Access to the knob for setting the fertilizer rate was poor due to the proximity of the small seeds attachment.

Ease of setting the seeding depth was very good. The operating depth of the coulters was set by a depth stop on the right hydraulic cylinder. The seeding depth of the double disk openers was controlled by the depth of the individual packers.

POWER REQUIREMENTS

Average tractor size needed varied from 45 to 55 PTO hp (34 to 41 PTO kW). Maximum tractor size needed was 70 PTO hp (53 PTO kW).

OPERATOR SAFETY

The Great Plains No-Till drill was safe to operate if normal safety precautions were observed. A safety chain and stow moving vehicle sign were provided with the test unit, The lever for setting the small seeds attachment protruded over the walkway making filling and cleaning very dangerous. The lever was removed when the small seeds attachment was not used.

OPERATOR'S MANUAL

The operator's manual was good. The manual was clearly written with many drawings for explanations but did not include detailed information on the operation of the opener system or application rate charts in SI units.

MECHANICAL HISTORY

Three of the fasteners used to hold the press wheel arm to the disk arm failed during the test because permanently mounted nuts failed, Average wear on each coulter was 0.5 in (13 mm) after seeding 47 ac (19 ha).

RECOMMENDATIONS

The AFMRC recommends that the manufacturer:

1. Provide accurate calibration curves for wheat, barley and alfalfa.
2. Modify the fertilizer metering system to eliminate the effect of slopes and changes in ground speed on application rates.
3. Increase the size of the walkway to make filling and cleaning the boxes easier.
4. Provide a spill shield for the small seeds attachment lid.
5. Provide sealing for the box partition to prevent leakage of material.
6. Provide a cover for the fertilizer meters to prevent fertilizer being exposed to moisture.
7. Offer a field marker as optional equipment.
8. Provide an easier method to calibrate the drill.
9. Reorganize the operator's manual in accordance with ASAE Standards.
10. Include application rate charts in SI units as well as Imperial units and including more detailed information in the owner's manual.
11. Use stronger hose clamps to secure the delivery hoses to the small seeds attachment.
12. Modify the fasteners that secure the press wheel arms to the disk arms to prevent failure.

Manager: R.P. Atkins, P. Eng.

Technical Aide: Anthony Pickard
Technical Aide: Blaine Metzger

MANUFACTURER'S REPLIES

The manufacturer states that with regards to recommendation number:

1. Calibration curves are derived from the seed rate charts and are quite accurate providing the seed cups have been centred on the drive shaft and all seed rate adjustments in section 5 of the owner's manual have been complied with.
2. A star wheel has replaced the older metering device and has eliminated rate changes due to slopes and ground speeds.
3. A walk board extension is available for this drill when the unit has the small seeds attachment mounted on the rear.

4. Provided on the 1993 and 1994 models.
5. A new seal and clamping mechanism is being used on the box partition and it is doing a good job.
6. In place on 1994 model.
7. A field marker option on models less than 15 ft has not been requested or purchased by our customers.
8. Stationary calibration using a tray or other self-contained device is not yet available.
9. Done.
10. Metric charts are attached inside the box lids on all export units. The metric charts are not in the owner's manuals.
11. When the hose clamp is placed above the lip on the small seeds feeder cup, Great Plains has not had complaints about the hose coming loose.
12. Done on 1994 model.

GENERAL DESCRIPTION

The Great Plains Solid Stand No-Till drill is a seeding unit consisting of a seed box mounted above two rows of opener assemblies. Optional fertilizer or native grass boxes and a small seed attachment are available. The front of the unit is supported by the tractor hitch. The back of the unit is supported by end wheels. Available widths of the drill are 7 and 10 ft (2.1 and 3.1 m).

Seeds and fertilizer are metered by externally straight fluted feed rolls. Separate convoluted rubber hoses deliver the seed and fertilizer to the opener assembly. A rubber hose delivers the small seed to the opener assembly. Seed rates are adjusted by sliding the feed roll to vary the exposed length in the seed cup and by a gearbox. Fertilizer rate is adjusted by moving a slide to vary the amount of exposed feed roll.

The opener system consists of a coulter followed by an offset double disk and a press wheel for soil finishing. Seed depth is controlled by the depth of the offset double disk. Force on the offset double disk and press wheel is controlled by the pressure spring. The opener systems are mounted on a single beam. Two hydraulic cylinders raise and lower the beam.

Available opener spacings are 7, 7.5, 8 or 10 in (178, 191, 203 and 254 mm). Other optional equipment includes a weight bracket, weights and various types of coulters and press wheels.

The test unit was 10 ft (3.1 m) wide and equipped with the fertilizer box and the small seeds attachment. The opener spacing was 7 in (178 mm) and the unit was equipped with 17 x 0.31 in (432 x 8 mm) fluted coulters and 2 x 13 in (51 x 330 mm) single press wheels. FIGURE 1 shows the location of major components. Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Great Plains Solid Stand No-Till drill was operated in the field conditions shown in TABLE 1 for 156 hours while seeding 751 ac (301 ha). The unit was evaluated for quality of work, ease of operation and 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.

The machine evaluated by AFMRC 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 and after AFMRC 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 AFMRC or the manufacturer to determine changes in performance.

RESULTS AND DISCUSSION

QUALITY OF WORK

Penetration: Penetration of the Great Plains Solid Stand No-Till drill was good. The coulters occasionally tripped when seeding into hard untilled soils. Penetration was uniform across the entire width of the drill when seeding into soils with adequate moisture. Individual openers were set deeper in the tractor tire tracks.

The end wheels provided adequate support for the drill and the press wheels provided adequate support for the double disk openers. The end wheels also allowed the drill to follow rolling field contours. The openers remained in the soil through rolling terrain.

TABLE 1. Operating Conditions

Material	Soil Type and Operation	Stone Conditions	Field Area		Hours
			ac	ha	
Wheat	Clay Loam**	Occasioal Stones	292	117	59.0
Wheat	Sandy Loam**	Stone Free	15	6	3.5
Wheat	Sandy Loam**	Moderately Stony	20	8	4.5
Wheat	Sandy Loam*	Moderately Stony	20	8	4.5
Wheat	Clay Loam*	Moderately Stony	23	9	6.0
Wheat	Clay Loam*	Occasioal Stones	110	44	20.0
Alfalfa	Clay*	Stone Free	24	10	5.0
Wheat	Silt Loam*	Moderately Stony	88	35	21.5
Mustard	Clay Loam**	Moderately Stony	104	42	22.0
Canola	Sandy Loam**	Stone Free	7	3	2.0
Wheat	Clay*	Occasioal Stones	48	19	8.0
Total			751	301	156.0

*Primary
**Secondary

The opener system (FIGURE 2) consisted of a spring loaded coulter, compression spring, double disk opener, knob and trunnion depth adjustment and press wheel. Force on the double disk opener was varied by the operating depth of the coulters and two adjustments on the compression rod. The force on each double disk opener was varied from 125 to 200 lbs (555 to 890 N). FIGURE 3 shows the force deflection curve for the spring loaded coulters. The trip out force of each coulter was 210 lb (935 N).

The coulters were operated at the same depth as the double disk openers during the test.

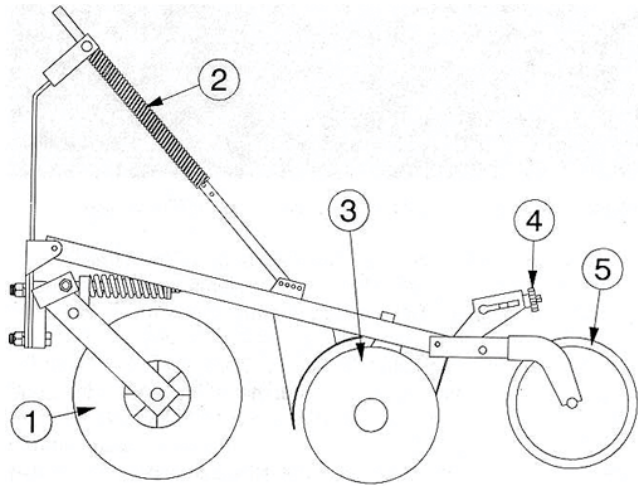

FIGURE 2. Great Plains Opener System: (1) Spring Loaded Coulter, (2) Compression Spring, (3) Double Disk Opener, (4) Knob and Trunnion Depth Adjustment and (5) Press Wheel.

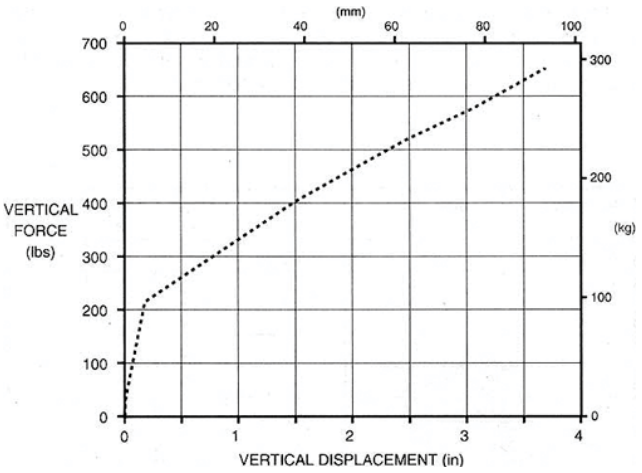

FIGURE 3. Force Deflection Curve for the Great Plains Spring Loaded Coulter.

Seed and Fertilizer Placement: The seed and fertilizer

placement of the Great Plains No-Till drill was very good. The seed and fertilizer were placed together in the furrows. The band widths of the rows averaged 1.1 in (28 mm).

Variation in seed and fertilizer depth was uniform in all seeding conditions. For example, at an average seed depth of 1.8 in (46 mm), most seeds were placed within 0.4 in (10 mm) of the average seed depth while seeding wheat.

Soil Finishing: Soil Finishing of the Great Plains No-Till drill was good. FIGURE 4 shows the soil surface before and after seeding into an untilled wheat stubble field. The majority of the stubble was left on the surface with some standing.

FIGURE 4. Soil surface before (left) and after (right) seeding into a wheat stubble field.

Ridge depths left by the soil openers varied depending on the soil, operating speed and seed depth. The packing force was adequate for the soils and conditions encountered during the test.

Operation of the drill in wet and heavy soil conditions was poor during the test. The coulters did not scour and left the surface with soil lumps covering the stubble. The manufacturer recommended that higher operating speeds and different coulters would allow operation in wet and heavy soil conditions.

Residue Clearance: Residue clearance of the Great Plains No-Till drill was very good. The opener systems allowed residue to flow with no plugging. Hair-pinning of straw in the furrow occurred during the test in moist previously tilled soil conditions.

Stony Conditions: Operation of the Great Plains No-Till drill in stony conditions was very good. No damage occurred to the coulters or the double disk openers during the test. Trip clearance of the coulters was 4 in (102 mm). Two large rocks were pinned between coulters during the test. The lift clearance of the double disk openers was adequate to clear large rocks.

Metering Accuracy: Metering accuracy of the Great Plains No-Till drill was good. The application rate for seed was varied by setting a gearbox and by changing the amount of exposed flute. The application rate for fertilizer was varied by changing the amount of exposed feed roll. The application rate for the small seeds attachment was varied by changing the amount of exposed flute. The calibration curves obtained by AFMRC and the manufacturer for the Great Plains drill with wheat, barley, canola, peas, alfalfa and 11-51-0 fertilizer are given in FIGURES 5 to 10. The alfalfa was metered through the small seeds attachment. The manufacturer stated the charts supplied are to be used as a guideline and the unit should be calibrated for the particular product used. The manufacturer's calibration curves for canola, peas and fertilizer were similar to the curves obtained by AFMRC. The manufacturer's calibration curves were consistently lower for wheat and barley and consistently higher for alfalfa than the curves obtained by AFMRC. The manufacturer's calibration rate for wheat was 21 percent lower at a seeding rate of 70 lb/ac (78 kg/ha). The manufacturer's calibration rate for barley was 37% lower at a seeding rate of 95 lb/ac (106 kg/ha). The manufacturer's calibration rate for alfalfa was 29% higher at a seeding rate of 7 lb/ac (8 kg/ha). The densities obtained by AFMRC and the manufacturer are indicated on the graphs. The manufacturer did not supply a density for barley. The AFMRC recommends the manufacturer provide accurate calibration curves for wheat, barley and alfalfa.

Level of material in the tank and field roughness did not affect metering rates. Variations in ground speed had no effect on the seeding rate of wheat but did affect the application rate of 11-51-0 fertilizer. An increase in ground speed from 5 to 7.5 mph (8 to 12 km/h) decreased the application rate of 11-51-0 fertilizer by 15%. A decrease in ground speed from 5 to 3 mph (8 to 4.8 km/h) increased the application rate of 11-51-0 fertilizer by 23%.

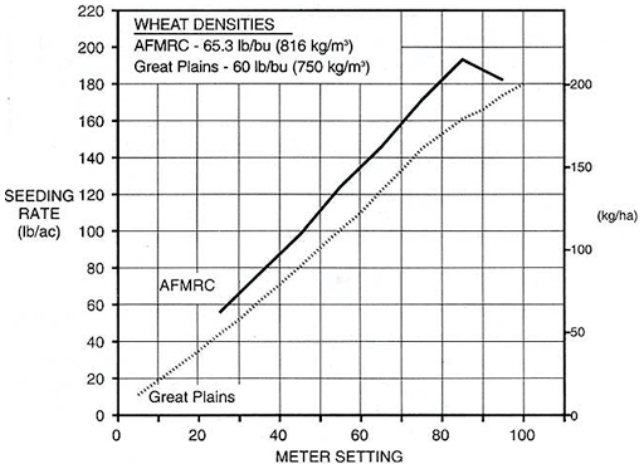

FIGURE 5. Metering accuracy with wheat.

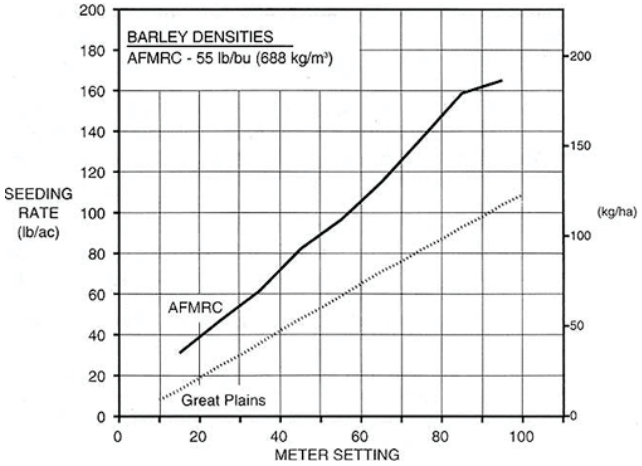

FIGURE 6. Metering accuracy with barley.

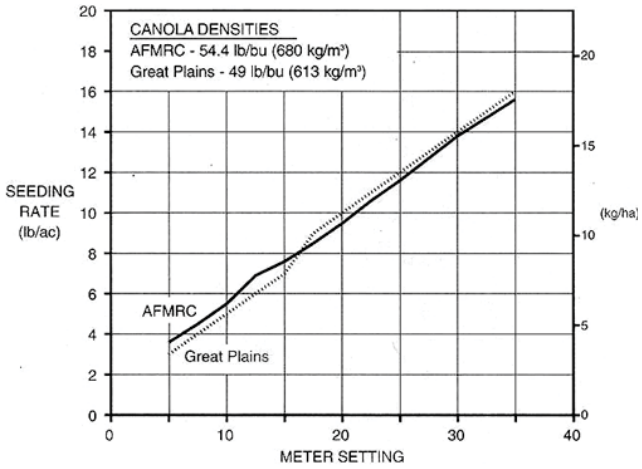

FIGURE 7. Metering accuracy with canola.

Operating the drill on side slopes did not affect the seeding rate of wheat or the application rate of 11-51-0 fertilizer. Operating on up and downhill slopes did affect the application rate of 11-51-0 fertilizer and the seeding rate of wheat. FIGURE 11 shows the effect of the metering rate of 11-51-0 fertilizer. Travelling on a 15° downhill slope decreased the application rate of 11-51-0 fertilizer by 36%. Travelling on a 15° uphill slope increased the application rate of 11-51-0 fertilizer by 39%. The AFMRC recommends the manufacturer modify the fertilizer metering system to eliminate the effect of slopes and changes in ground speed on application rates.

Travelling on a 15° downhill slope increased the seeding rate of wheat by 10%. Travelling on a 15° uphill slope decreased the seeding rate of wheat by 7%.

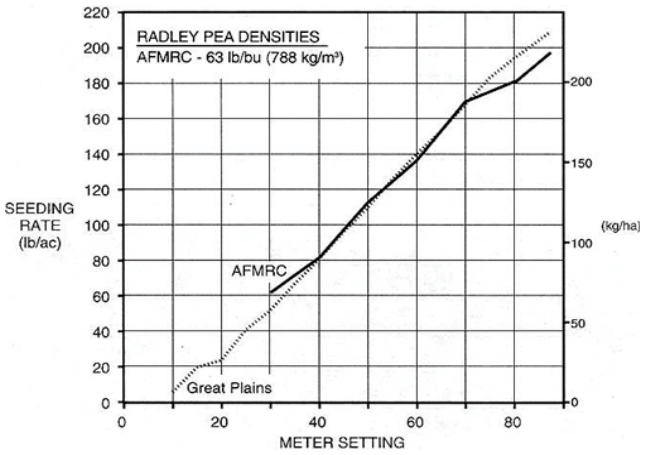

FIGURE 8. Metering accuracy with peas.

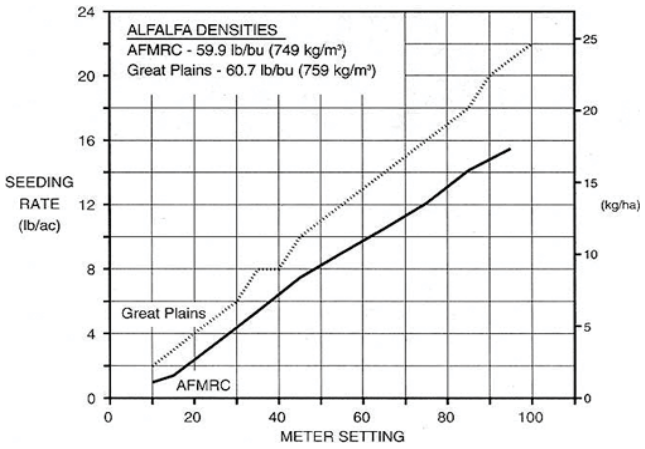

FIGURE 9. Metering accuracy with alfalfa.

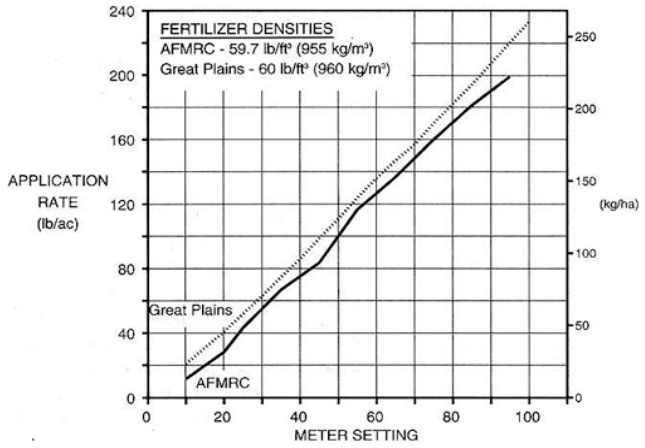

FIGURE 10. Metering accuracy with 11-51-0 fertilizer.

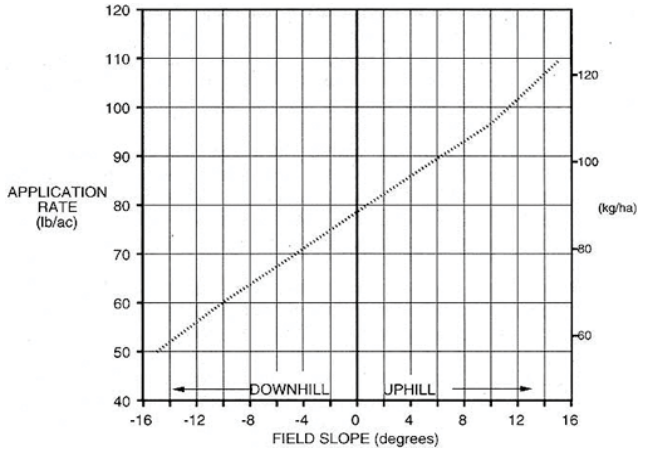

FIGURE 11. Variation in 11-51-0 fertilizer application rate with change in slope.

Distribution Uniformity: Uniformity of distribution of the application rates for the Great Plains No-Till drill was very good. The application rate, across the width of the machine, was uniform with canola, 11-51-0 fertilizer, wheat, barley, peas and alfalfa. The coefficient of variation (CV[1]) ranged from 3 to 6.5 percent for canola, 3 to 8.5 percent for 11-51-0 fertilizer and 1.5 to 4 percent for wheat, barley, peas and alfalfa. The higher CV's for canola and 11-51-0 fertilizer were obtained at low application rates.

Level of material in the tank and field slopes had no effect on the uniformity of distribution of the application rates.

Seed Handling: Seed handling was very good. Damage by the metering systems was negligible for both small and large seeds.

EASE OF OPERATION AND ADJUSTMENT

Maintenance: Ease of performing routine maintenance on the Great Plains No-Till drill was good. Thirty-nine grease fittings required lubrication every 12 to 15 hours and two grease fittings every 20 to 25 hours. Access to all grease fittings was adequate. One person required 15 minutes to service the lubrication points. The speed change box required no regular servicing.

Filling/Cleaning: Ease of filling and cleaning the Great Plains No-Till drill was fair. The narrow walkway made filling and cleaning the seeds and fertilizer boxes difficult. The AFMRC recommends the manufacturer increase the size of the walkway to make filling and cleaning the boxes easier. The attached ladder provided easy access to the walkway.

The seed box capacity was 16.0 bu (580 L) and the small seeds attachment capacity was 1.1 bu (41 L). The fertilizer box capacity was 13.9 ft³ (0.39 m³). With the box partition removed the drill held 26 bu (946 L) of seed. The fertilizer drive chain was removed to prevent the rollers from turning when operating with the partition removed.

The boxes were filled by pail or with a drill fill during the test. The small seeds attachment was difficult to fill because seeds usually fell between the box and lid. The AFMRC recommends the manufacturer provide a spill shield for the small seeds attachment lid.

The partition between the seed and fertilizer boxes was easy to remove and install but the partition leaked material from one side to the other. Weather stripping was installed on the partition to prevent the leakage of material. The AFMRC recommends the manufacturer provide sealing for the box partition to prevent leakage of material. The right side of the fertilizer box emptied faster than the left side during field operation. The box could not be adjusted to correct the difference in rates.

The 10 in (254 mm) wide seed box opening and the 11 in (79 mm) wide fertilizer box opening permitted cleaning large amounts of material out of the boxes with a small pail only. Seed in the bottom of the box was brushed through the feed cups after fully opening the feed gates. A vacuum cleaner or compressed air was faster and usually used during the test to clean small amounts of seed out of the box. Small amounts of fertilizer were easily removed by dropping the bottom of the box and using a brush.

The seed and fertilizer boxes were adequately sealed from moisture. The fertilizer feed roll and slide were exposed to moisture during a rain. Caked fertilizer was cleaned off the slide and roll after a rain. The AFMRC recommends the manufacturer provide a cover for the fertilizer meters to prevent fertilizer being exposed to moisture.

Transporting: Ease of transporting the Great Plains No-Till drill was very good. Two minutes were required to place the unit in transport position. A hydraulic valve (FIGURE 12) locked the openers in transport position. Spacers also came with the drill to secure the hydraulic cylinders in transport position but were not used during the test. The metering drive chains were disengaged by the lockout hub (FIGURE 13) located on the drive wheel. Transport width was 12.5 ft (3.8 m) and transport height was 6.4 ft (2.0 m). The unit required the use of a tractor with one set of remote hydraulics to raise and lower the drill.

The manufacturer recommended the transport speed not exceed 20 mph (32 km/h). The ground clearance of 5 in (127 mm) was adequate for transporting during the test if caution was used.

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[1]*The coefficient of variation (CV) is the standard deviation of application rates from individual outlets expressed as a percent of the average application rate. A low CV represents uniform application whereas a high CV indicates non-uniform application. An acceptable variation for seeding or applying fertilizer is a CV value of not greater than 15%.*

The packers occasionally rubbed the ground when the drill bounced. The wheel tread of 11.6 ft (3.5 m) provided good stability for both field operation and transporting.

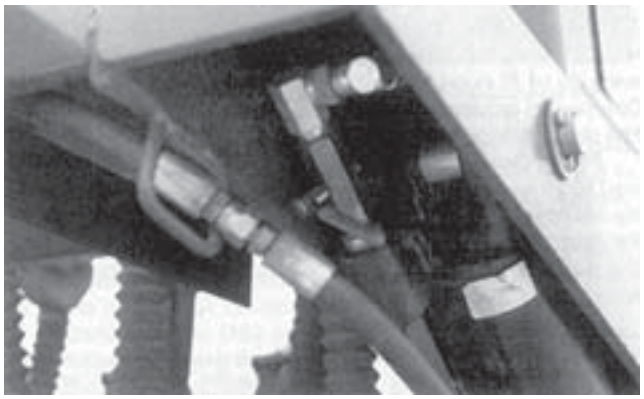

FIGURE 12. Hydraulic Transport Lock.

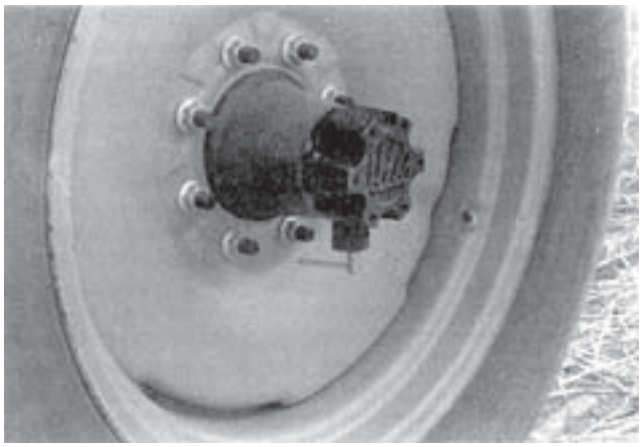

FIGURE 13. Drive Lockout Hub.

Visibility of the seeded edge was poor in fields with high straw because of minimum soil disturbance of the drill. The manufacturer did not supply a field marker. The AFMRC recommends the manufacturer offer a field marker as optional equipment.

The hitch tongue adjustment of 10 in (254 mm) was adequate during the test. A convenient transport position for the hitch jack was provided on top of the drill hitch to prevent damage to the hitch jack during field operation.

Monitoring: Monitoring on the Great Plains No-Till drill was good. Monitoring equipment included an acre meter. The acre meter (FIGURE 14) was a seven digit mechanical continuous read unit that recorded to the nearest tenth of an acre. The acre meter read an average of 5.5% high.

The seed cups were viewed from the tractor during field operation to monitor the flow of seed to the openers. No motion indicator was provided for the metering shafts.

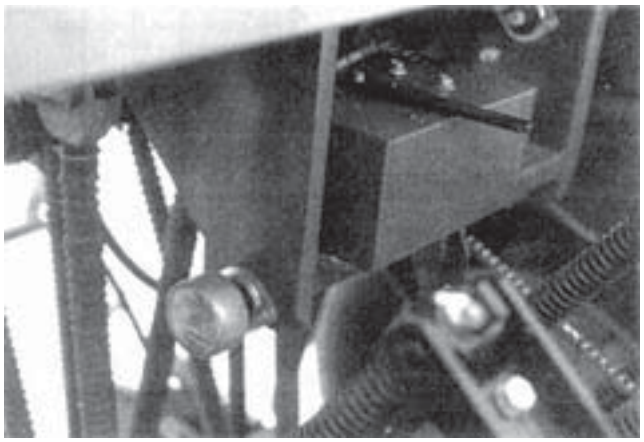

FIGURE 14. Acre Meter and Speed Change Box.

Application Rates: Ease of changing the seed and fertilizer rates was good. The numerical scales for the rate settings ranged from 0 to 100. The rate for the seed box was set by sliding the fluted feed rolls using a lever (FIGURE 15) and with a gearbox (FIGURE 14). The gearbox had four different speeds. Access to the lever was good but setting was difficult due to the small numbers on the numerical scale. The seed cup feed gates (FIGURE 15) were set at one of three positions. Each feed gate was set separately. The top setting was for wheat and other small seeds. The middle setting was for soybeans and other large seeds. The bottom setting was used if excessive crackage occurred at the middle setting.

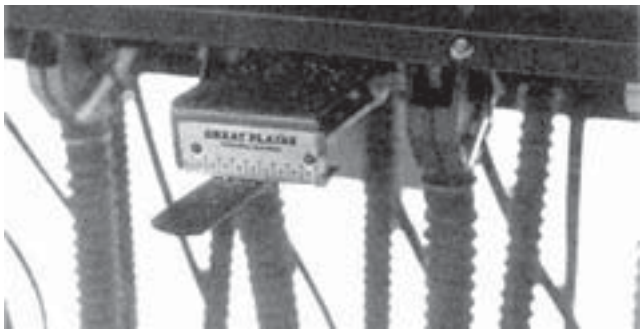

FIGURE 15. Seed box metering lever adjustment and seed cup feed gate adjustment.

The rate for the small seeds attachment was set by sliding the fluted feed rolls using a lever (FIGURE 16) and with various sprocket combinations. The sprocket combination depended on the speed change box setting for the main seed box. Access to the lever was good but setting was difficult due to the small numbers on the numerical scales. The feed gates were not adjustable on the small seeds attachment.

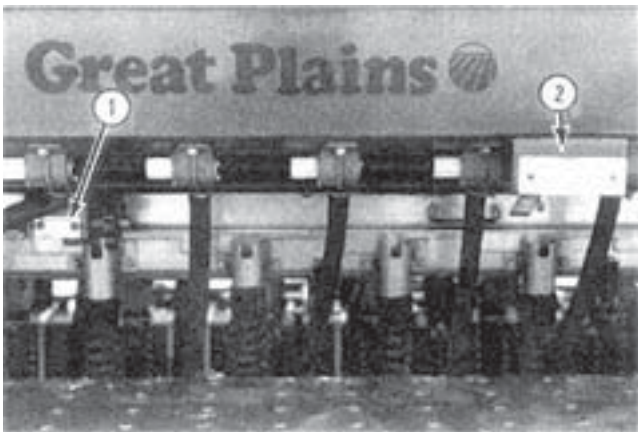

FIGURE 16. Rate Adjustments: (1) Fertilizer Rate Adjustment and (2) Small Seeds Attachment Metering Lever Adjustment.

The fertilizer rate was set by turning a knob (FIGURE 16) to move a slide to expose the metering flutes. Access to the knob was poor due to the proximity of the small seeds attachment and the numerical scale was difficult to read due to the small numbers.

The drill was calibrated by removing three delivery hoses on the end of the drill and placing containers under the outlets. A small amount of material was placed over the three seed cups. The drive wheel was then raised and turned a measured number of turns. The number of turns specified in the owner's manual was 422. This was a long procedure during the test. The AFMRC recommends the manufacturer provide an easier method to calibrate the drill.

The seed cups were zeroed at the start of the test. The lever adjustments were also zeroed on the numerical scale settings.

Depth Adjustment: Ease of setting the seeding depth was very good. The operating depth of the coulters was set by a depth stop on the right hydraulic cylinder. Individual coulters were set by loosening the clamp and sliding the mounting bracket. The seeding depth of the double disk openers was set by turning a knob (FIGURE 17) located on each opener. The knob controlled the depth of the packer with respect to the double disk openers. Access to the knobs was good. A few of the knobs were difficult to turn during the test. A scale was provided for each knob (FIGURE 17) for easy reference.

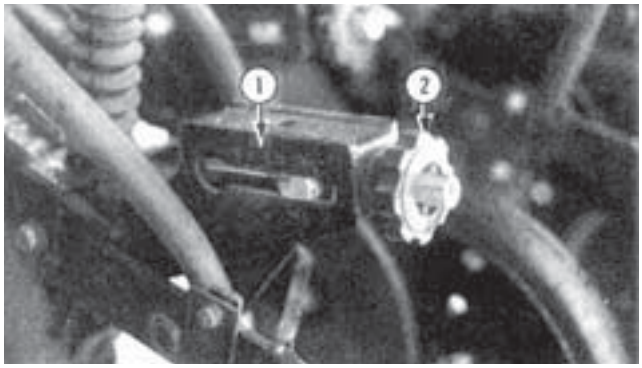

FIGURE 17. Opener Depth Adjustment: (1) Scale and (2) Adjustment Knob for Double Disk Opener Depth.

Pressure on the double disk openers was varied by the spring pressure. A "W" clip held the spring in four different positions. Access to the clips was hindered by the drill frame. The double disk openers were set deeper or shallower by positioning the spring rod in one of four positions on the double disk arm. This adjustment also changed the force on the double disk opener.

POWER REQUIREMENTS

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

Average draft in primary conditions, at a 2 in (51 mm) seed depth and at 6 mi/h (9.6 km/h), in clay loam soil for the 10 ft (3.1 m) unit tested, ranged from 1550 to 1910 lb (6.9 to 8.5 kN). Maximum draft was measured at 2425 lb (10.8 kN).

Tractor Size: The average tractor size needed to operate the Great Plains No-Till 10 ff (3.1 m) test unit varied from 45 to 55 PTO hp (34 to 41 PTO kW). Maximum tractor size needed to operate the test unit was 70 PTO hp (53 PTO kW). 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 Great Plains No-Till drill was safe to operate if normal safety precautions were observed. As mentioned in the 'Filling and Cleaning' section, the walkway was narrow and caution was taken when filling and cleaning the drill. Caution was also taken when using the small seeds attachment. The lever for setting the small seeds attachment protruded over the walkway. This was very dangerous when filling or cleaning the boxes. The lever was removed when the small seeds attachment was not used.

A safety chain and slow moving vehicle sign were provided with the test unit.

Tire loads did not exceed the Tire and Rim Association maximum load rating for the recommended tire inflation pressure and recommended transport speed for the drill.

OPERATOR'S MANUAL

The operator's manual for the Great Plains No-Till drill was good. The operator's manual contained sections with information on safety, preparation, hitching, transporting, operation, adjustments, maintenance, lubrication, storage, optional equipment and trouble-shooting. The AFMRC recommends the manufacturer reorganize the operator's manual in accordance with ASAE Standards. A parts book and a separate owner's manual for the small seeds attachment were also included. The parts book included information on servicing the hydraulic cylinders. The manual was clearly written, with many drawings for explanations but did not include detailed information on the operation of the opener system. For instance, the manual did not state that lowering individual coulters would increase pressure on the corresponding disk opener. The manual also did not state the operating depth of the coulters with respect to the disk openers for various seeding depths. The manual also did not include application rate charts in SI units. The AFMRC recommends the manufacturer include application rate charts in SI units as well as Imperial units and include more detailed information in the owner's manual.

MECHANICAL HISTORY

The Great Plains No-Till drill was operated for 156 hours while seeding 751 ac (301 ha). The intent of the test was evaluation of functional performance. An extended durability evaluation was not conducted. TABLE 2 outlines the mechanical problems that occurred during the functional testing.

TABLE 2. Mechanical History

Item	Operating Hours	Equivalent Field Area ac	ha
Damaged several delivery hoses for the small seeds attachment: replaced	Throughout the Test		
Three fasteners that hold press wheel arm to the disk arm failed: replaced the fasteners	Throughout the Test		
Lost packer wheel replaced and tightened all other wheels at	31	127	51
Lost rubber cover off press wheel replaced at	154	740	296
Lubricated the square feed cup shaft at	End of Test		
Hydraulic hose failed repaired at	End of Test		
Tightened loose seed meter pivot bolts at	End of Test		

DISCUSSION OF MECHANICAL HISTORY

Damaged Delivery Hoses: Several of the delivery hoses for the small seeds attachment were damaged during operation of the drill.

APPENDIX I
SPECIFICATIONS

MAKE:	Great Plains	
MODEL:	Solid Stand No-Till Drill EWNF10-160790	
SERIAL NUMBER:	GP 1458U 0131	
MANUFACTURER AND DISTRIBUTOR:	Great Plains Manufacturing, Inc. P.O. Box 218 Assaria, Kansas USA 67416 Phone: (913) 667-4755	
DIMENSIONS:	**Field Position**	**Transport Position**
-- height	5.6 ft (1.7 m)	6.4 ft (2.0 m)
-- length	11.2 ft (3.4 m)	11.2 ft (3.4 m)
-- width	12.5 ft (3.8 m)	12.5 ft (3.8 m)
-- effective seeding width	9.3 ft (2.8 m)	
-- ground clearance		5.0 in (127 mm)
-- wheel tread		11.6 ft (3.5 m)
METERING SYSTEM:		
-- seed		
-type	externally straight fluted feed rolls	
-drive	chain and gear from drive wheel	
-adjustment	gearbox and lever controlling feed inlet size with adjustable gate	
-transfer to openers	1.25 in (32 mm) I.D. convoluted rubber hose	
-- fertilizer		
-type	externally straight fluted feed rolls	
-drive	chain and gear from drive wheel	
-adjustment	slide to adjust exposed flute	
-transfer to openers	1.25 in (32 mm) I.D, convoluted rubber hose	
-- small seeds		
-type	externally straight fluted feed rolls	
-drive	chain and gear from drive wheel	
-adjustment	gearbox and lever controlling feed inlet size	
-transfer to openers	1.6 in (15.2 mm) I.D. rubber hose	
TANK CAPACITIES:		
-- seed	16.0 bu (580 L)	
-- fertilizer	13.9 ft³ (0.39 m³)	
-- small seeds	1.1 bu (41 L)	
OPENERS:		
-- type	coulter followed by offset double disk and press wheel for soil finishing	
-- number	16	
-- spacing	7 in (178 mm)	
-- number of rows	2	
-- distance between rows	6.5 in (165 mm)	
-- coulter		
-type	0.31 in (8 mm) fluted with spring trip	
-diameter	17 in (432 mm)	
-- double disk		
-type	off-set	
-diameter	13.5 in (343 mm)	
PRESS WHEELS:		
-- type	rubber with steel rim	
-- diameter	13 in (330 mm)	
-- width	2 in (51 mm)	

END WHEELS:		
-- number	2	
-- tire size	9 - 24, 8-ply	
HITCH:		
-- type	clevis	
-- vertical adjustment	10 in (254 mm)	
-- pin hole size maximum	1.2 in (30.5 mm)	
TRANSPORT LOCKS:	valve in hydraulic circuit and safety depth stop bracket	
WEIGHTS:	**Tanks Empty**	**Tanks Full of Wheat**
-- left end wheel	2220 lb (1007 kg)	3240 lb (1470 kg)
-- right end wheel	2210 lb (1002 kg)	3230 lb (1465 kg)
-- hitch	450 lb (204 kg)	360 lb (163 kg)
Total	4880 lb (2213 kg)	6830 lb (3098 kg)
NUMBER OF CHAIN DRIVES:	7	
NUMBER OF SEALED BEARINGS:	**59**	
NUMBER OF LUBRICATION POINTS:	41 grease nipples; one gearbox	
NUMBER OF HYDRAULIC LIFTS:	2	

OPTIONS INCLUDED ON TEST MACHINE:	seed and fertilizer box combination; small seeds attachment; 7 in (178 mm) opener spacing; 17 x 0.31 in (432 x 8 mm) fluted coulters; 2 x 13 in (51 x 330 mm) single press wheels
OTHER AVAILABLE OPTIONS:	weight bracket and weights; seed box only; seed and native grass box combination; 18 x 1 in (457 x 25 mm) wavy and 17 x 1 in (432 x 25 mm) bubble coulters; 4 x 12 in (102 x 305 mm), 1 x 12 in (25 x 305 mm) single and 2 x 13 in (51 x 330 mm) double press wheels; 7.5, 8 and 10 in (191, 203 and 254 mm) opener spacings

APPENDIX II
MACHINERY RATINGS

The following rating scale is used in Alberta Farm Machinery Research Centre Evaluation Reports:

- Excellent	- Very Good
- Good	- Fair
- Poor	- Unsatisfactory

SUMMARY CHART

GREAT PLAINS SOLID STAND NO-TILL DRILL

RETAIL PRICE:	$16,404.00 U.S. (June, 1994 f.o.b. Lethbridge, Alberta, Great Plains Solid Stand No-Till Drill)
QUALITY OF WORK:	
-penetration	**good;** coulters occasionally tripped in hard untilled soil
-seed and fertilizer placement	**very good;** uniform in all conditions
-soil finishing	**good;** left soil lumps in wet and heavy soil conditions
-residue clearance	**very good;** no plugging
-metering accuracy	**good;** fertilizer rates affected by slopes and changes in ground speed
-distribution uniformity	**very good;** CV's ranged from 1.5 to 8.5 percent
EASE OF OPERATION AND ADJUSTMENT:	
-maintenance	**good;** 41 lubrication points
-filling/cleaning	**fair;** narrow walkway
-transporting	**very good;** lockout hub disengaged metering drives
-application rates	**good;** numerical scales difficult to read
-depth adjustment	**very good;** coulter depth set by depth stop on hydraulic cylinder
POWER REQUIREMENTS:	maximum tractor size: 70 PTO hp (53 PTO kW)
OPERATOR SAFETY:	safe; safety chain and SMV sign provided
OPERATOR'S MANUAL:	**good;** short of detailed information
MECHANICAL HISTORY:	average coulter wear: 0.5 in (13 mm) after seeding 47 ac (19 ha)

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