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Group 9 (a)

Evaluation Report 525

Edwards H D 812 Hoe Drill

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

EDWARDS HD 812 HOE DRILL

MANUFACTURER AND DISTRIBUTOR:

Edwards Rod Weeder Ltd.
Box 995
Lethbridge, Alberta
T1J 4A2
Phone: (403) 328-9201
Telex: 038-49230

RETAIL PRICE:

$23,810.00 (May, 1987, f.o.b. Lethbridge, Alberta). Two units complete with fertilizer, transport, end tow, hitch lift, hitch jack, ladder, acreage counter, rock guards.

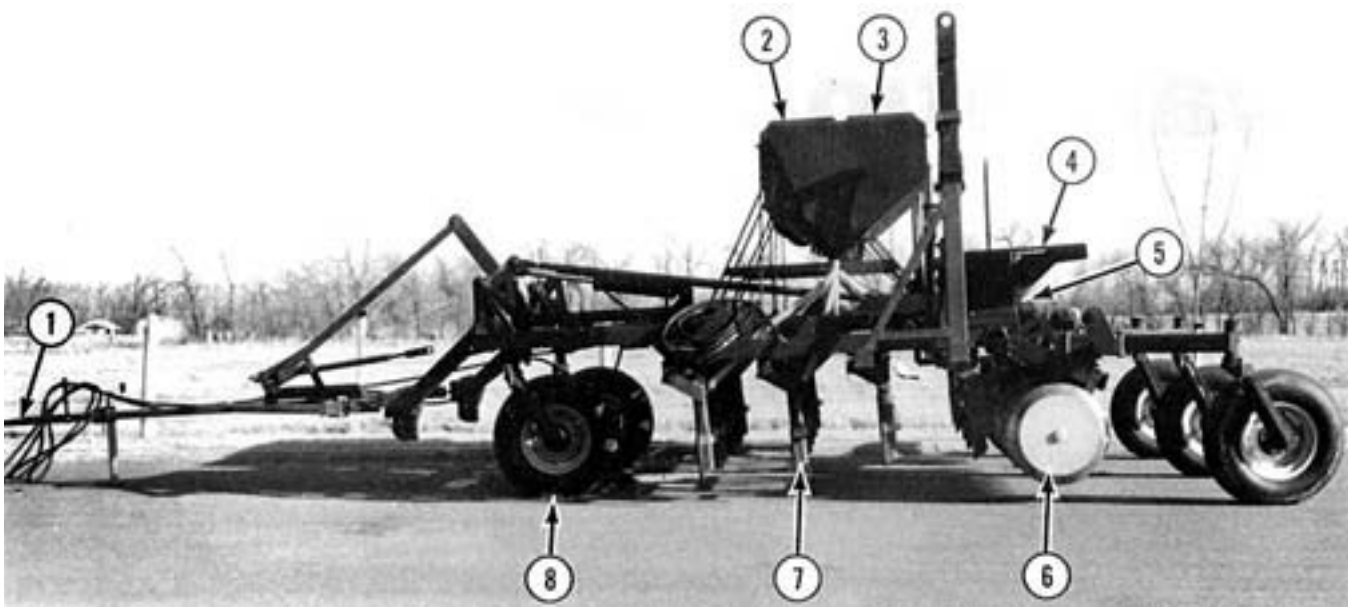

FIGURE 1. Edwards HD 812 Hoe Drill: (1) Hitch, (2) Fertilizer Box, (3) Grain Box, (4) Rear Walkway, (5) Hydraulic Lift Cylinder, (6) Press Wheels, (7) Hoe Openers, (8) Castor Wheels.

SUMMARY

Quality of Work: Penetration was very good in a wide variety of field conditions including stubble fields.

Seed and fertilizer were normally placed in a 1.6 in (41 mm) wide band with most seeds within 0.4 in (10 mm) of the average seed depth in uniform soil conditions. Uneven soil conditions, such as gulleys, did not significantly affect seed placement. Each press wheel exerted a packing force of at least 239 lbs (1064 N), which effectively packed the soil around the seed and fertilizer.

Trash clearance was very good in all test conditions. The four rows of openers allowed trash to be effectively cleared through the drill.

The spring trip shanks provided very good protection in stony conditions. Maximum lift height of the shank was 8.25 in (210 mm).

Metering calibrations in wheat, barley and canola were very good. Differences between the manufacturer's and PAMI's metering calibrations were attributed to the difference in seed size and density.

Variation in seeding rates among seed runs across the width of the machine was well within the acceptable range when seeding wheat, barley and 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 9% decrease while travelling down a 15° slope caused a 4% increase in seeding rate. Seeding on a 15° side slope caused a 4% decrease in seeding rate.

The fertilizer metering calibration was very good when density and particle size differences were considered. Variation in application rate among runs across the width of the machine was low when metering in the recommended setting between 3 and 6. The fertilizer rate could not be changed with the slow speed kit mounted.

The fertilizer application rate was unaffected by the level in the box, variations in ground speed or by field roughness. The fertilizer application rate was affected by field slope. Travelling up a 15° slope decreased the rate by 47% and travelling down a 10° slope increased the rate by 20%. Travelling on a 15° left side slope caused a 14% increase in rate and travelling on a 15° right side slope caused a 24% decrease in rate.

Ease of Operation and Adjustment: Lubrication was easy with good access to most grease fittings.

The large rear walkway and wide box openings made filling the grain and fertilizer boxes safe and convenient. The rear transport wheels did hinder filling with a truck. The feed gates could be fully opened for thorough cup cleanings. The grain box partition leaked during field operation.

The fertilizer cups were open and susceptible to rain and moisture.

The seed rate was easy to adjust. Adjusting the fertilizer rate and mounting the slow speed kit involved mounting and changing various gears which was time consuming. Seeding depth was adjusted with the hydraulic lift cylinders.

The area counter did not read acres directly and no calibration factors were given in the operator's manual.

Manueverability of the unit tested was good but was hindered by the long drawbar hitch and the poor visibility of the far right shank.

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 depth at 5 mph (8 km/h), a 120 hp (90 kW) tractor was needed to operate the 14 ft (4.3 m) test unit.

Operator Safety: The Edwards HD 812 hoe drill was safe to operate if normal safety precautions were observed. A slow moving vehicle sign was not provided.

Operator's Manual: The operator's manual contained a parts list and assembly instructions but lacked detailed information on the operation and adjustment.

Mechanical History: The packer lift assemblies on both drills were replaced during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying the slow speed kit to allow for changes in the fertilizer rate.
2. Modifying the fertilizer metering system to reduce the effect of

field slope on fertilizer rates.
3. Modifying the box partition to eliminate leakage.
4. Providing a way of preventing moisture from entering the fertilizer cups.
5. Providing calibration information for the area counter in the operator's manual.
6. Modifying the area counter trip mechanism to improve its durability.
7. Providing spacers for the depth control cylinders.
8. Modifying the drawbar hitch to improve field manueverability and to eliminate interference with the hitch lock-up assembly.
9. Rearranging the hoe shanks to improve visibility of the far right shank.
10. Supplying a slow moving vehicle sign.
11. Including more detailed information in the operator's manual on the operation and adjustment of the Model 812.
12. Supplying rate charts in SI units as well as Imperial units.

Station Manager: R. P. Atkins

Project Engineer. L. W. Papworth

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Modifications have been made to the slow speed kit designed primarily for use in seeding small seed crops (i.e. canola, mustard) and grass. This modification eliminates sprocket changeovers and provides a variety of fertilizer rates varying from 14 lbs to 42 lbs when seeding small seed.
2. Though side-slope affect on fertilizer rates is unavoidable to some degree, a careful review of the HD812 fertilizer metering system will be made to minimize this affect.
3. Additional fasteners are now used to secure the partition in place, preventing leakage.
4. An optional fabric shield is being developed to protect the fertilizer cups from windblown moisture.
5. Calibration formula for the area counter is now included in the Operator's Manual.
6. A spring-steel clip now replaces the lighter spring mechanism on the area counter.
7. It will be noted in the Operator's Manual that spacers may need to be used for shallow seeding.
8. It is the manufacturer's experience that the drawbar hitch is the correct length. However, consideration will be given to relocating the hitch lock-up assembly to maximize the turning radius.
9. The far right shank is clearly visible on 3, 5 and 7 unit combinations. On 2, 4 and 6 unit combinations an adjustable marker is available to align the outside drill accurately.
10. A slow moving vehicle sign for each set of drills will be provided.
11. Additional information on the operation and adjustment of the HD812 is being included in the Owner/Operator Manual.
12. SI units will be included in seed and fertilizer rate charts.

GENERAL DESCRIPTION

The Edwards HD 812 is a basic 6.7 ft (2.0 m) four-row hoe drill with either 8 or 12 inch (203 or 305 mm) spacing. Hitches are available for hitching up to ten basic drill units together. Seeding depth is controlled with a hydraulic cylinder equipped with an adjustable stop. The divider in the combination grain and fertilizer box may be opened to allow filling the entire box with grain. The box is capable of holding 12.6 bu (460 L) of grain with 530 lb (239 kg) of fertilizer or 19.6 bu (715 L) of grain only.

Grain is metered from the rear box by straight fluted feed rolls and is delivered to the openers by flexible plastic hoses. Fertilizer is metered from the front box by spiral fluted feed rolls and is delivered to the flexible plastic hoses by formed steel tubes. Motion indicators are attached to the end of the grain and fertilizer feed roll shafts. One gang of 22 in (560 mm) diameter steel press wheels pack the soil directly behind the openers.

The test machine consisted of two basic drill units with 8 in (203 mm) spacing, equipped with optional equipment including fertilizer attachment, transport, end tow, hitch lift assembly, hitch jack, ladder, acreage counter and rock guards.

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

SCOPE OF TEST

The Edwards HD 812 was operated in the conditions shown in TABLE 1 for 118 hours while seeding about 642 ac (257 ha). All spring crops were sown under very dry powdery conditions while all fall crops were sown under wet conditions. It 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.

TABLE 1. Operating Conditions

Material Sown	Soil Type and Condition	Stone Condition	Field Area		Hours
			ac	ha	
Spring Wheat	Loam to Silt Loam Secondary	Moderately Stony	160	64	32
Spring Wheat	Silt Loam to Clay Loam Secondary	Stone Free	160	64	25.5
Oats	Silt Loam Primary	Stone Free	10	4	5.5
Winter Wheat	Loam to Silt Loam Primary	Stone Free	60	24	9
Winter Wheat	Silt Loam Secondary	Occasional Stones	10	4	2.5
Winter Wheat	Fine Sandy Loam to Loam Primary	Occasional Stones	35	14	6.5
Winter Wheat	Clay Loam to Clay Primary	Occasional Stones	110	44	20
Winter Wheat	Silt Loam Primary	Moderately Stony	80	32	14
Winter Wheat	Clay Loam to Silty Clay Loam Primary	Stone Free	17	7	3
Total			642	257	118

RESULTS AND DISCUSSION

QUALITY OF WORK

Penetration: Penetration of the Edwards hoe opener was very good in a wide variety of field conditions including stubble fields. Proper soil moisture content did, however, improve penetration. Individual hoe openers could be set deeper for tire tracks by moving the openers down the shanks. The hoe assemblies (FIGURE 2) were equipped with a spring trip assembly and a 1.75 in (44.5 mm) wide opener. The trip force was set by adjusting the spring length using the nut on the bottom of the spring rod. No recommended spring length was given in the owner's manual. The pitch of the shank could also be adjusted with the two nuts on the end of the spring rod. The recommended shank pitch was the bottom of the shank 1 in (25 mm) back from vertical.

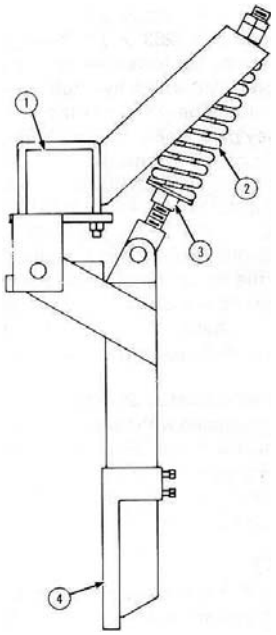

FIGURE 2. Hoe Assembly: (1) Frame Mounts, (2) Trip Spring, (3) Adjusting Nuts, (4) Hoe Opener.

Seed Placement: In normal prairie conditions, 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 the soil tightly packed around the seed for optimum moisture contact and minimum soil drying.

The Edwards HD 812 normally placed seed and fertilizer within a 1.6 in (41 mm) wide band. When seeding in pre-tilled uniform soil conditions, variation in seed depth was small. For example, at an average seeding depth of 1.8 in (46 mm), although seeding depth across the width of the machine varied from 1 to 2.8 in (25 to 71 mm), most of the seeds were placed within 0.4 in (10 mm) of the average seed depth.

Because of the longer frame length of the HD 812 due to four rows of openers, the variation in seed depth along the row was also checked. It was found that, even when seeding through gulleys or over hills, the seed depth was quite uniform. For example, when seeding through a gully at an average seeding depth of 1.6 in (41 mm), most of the seeds along the row were placed within 0.55 in (14 mm) of the average seed depth.

Soil Finishing: The V-shaped press wheels followed directly behind the openers, effectively pressing the soil about the seeds and fertilizer in all soils encountered. Average packing force exerted by each press wheel ranged from 239 lb (1064 N) with empty seed and fertilizer boxes to 314 lb (1397 N) with full boxes. Press wheel furrow depth ranged from 1.2 to 2.0 in (30 to 50 mm) depending on soil conditions. FIGURE 3 shows the soil surface after seeding into a tilled stubble field. The 1.75 in (44.5 mm) wide openers provided minimum soil disturbance, therefore giving the seed good soil coverage.

FIGURE 3. Soil Surface after Seeding into Stubble.

Trash Clearance: Trash clearance is dependant on field conditions and a number of drill design characteristics. Field conditions that effect 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 Edwards HD 812 was operated in three different types of trash conditions; pre-tilled wheat stubble, summerfallow with numerous weeds and wet wheat stubble. The HD 812 cleared trash adequately in all conditions. Plugging only occurred in adverse conditions such as a windrow left in a stubble field or weed piles. The four rows of openers increased the distance between shanks on each row to 32 in (813 mm). This allowed trash to be effectively cleared through the drill as shown by the wet wheat stubble field surface in FIGURE 4.

Stony Conditions: The spring trip shank assemblies provided adequate protection in stony conditions. No rock damage occurred to the openers during the test. Maximum lift height of the openers was 8.25 in (210 mm).

Grain Metering System: FIGURES 5 to 7 show the calibration curves obtained by PAMI and the manufacturer for the Edwards HD 812 in wheat, barley and canola. The curves were accurate.

Any differences between the 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.

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. Travelling up a 15° slope caused a 9% decrease in seeding rate and travelling down a 15° slope caused a 4% increase. Seeding on a 15° side slope caused a 4% decrease in seeding rate.

FIGURE 4. Soil Surface After Seeding into Wet Wheat Stubble Trash Conditions.

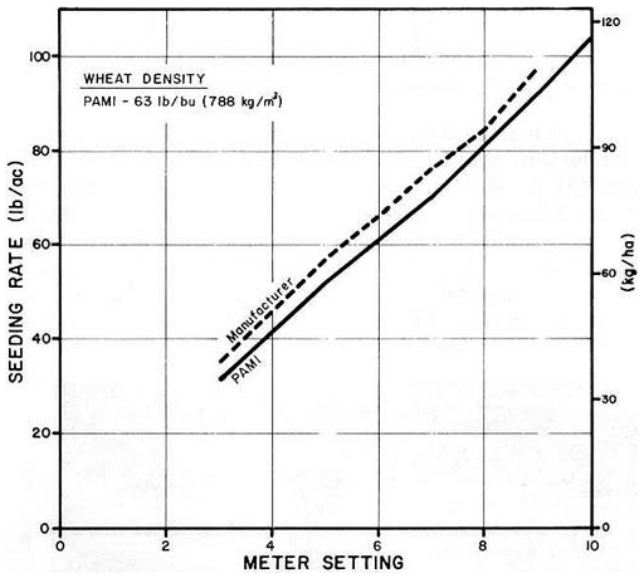

FIGURE 5. Metering Accuracy in Wheat.

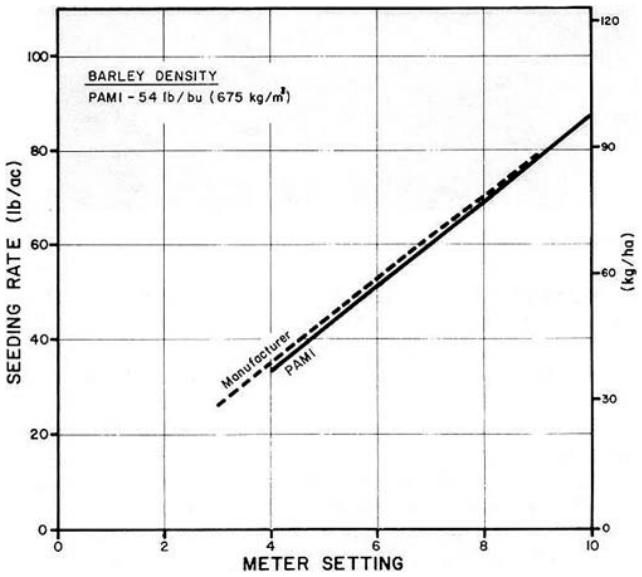

FIGURE 6. Metering Accuracy in Barley.

While doing the 15° uphill slope in the lab, the front seed delivery hoses plugged. This problem was not experienced in the field so it was assumed that field vibration prevented plugging. Occasional hose plugging did occur in the field caused by slackened hoses. When the hoses were shortened plugging did not occur.

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 that 15%. If the CV is less than 15%, seeding is acceptable, whereas if the CV is much greater that 15%, the variation among individual seed cups is excessive.

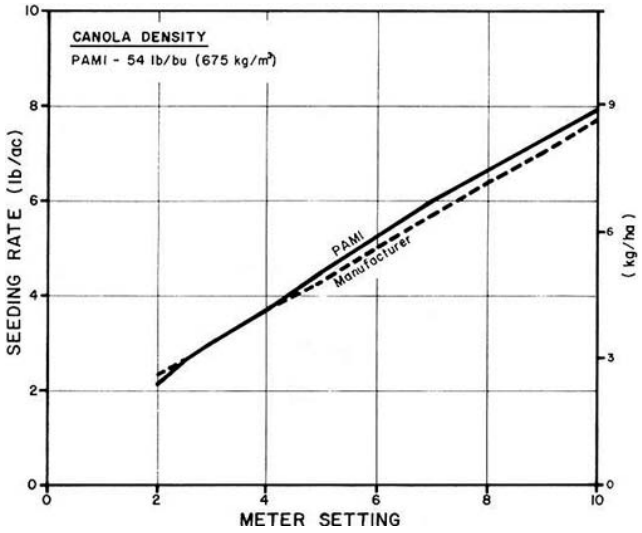

FIGURE 7. Metering Accuracy in Canola.

The seeding rate, across the width of the machine for wheat and barley, was very uniform with the CV varying from 1.5 to 7.5% as long as the meter setting was between 3 and 10. Below a meter setting of 3 the CV's were greater that 15%. The seeding rate, across the width of the machine for canola, was also uniform with the CV varying from 1.5% to 11.5% as long as the meter setting was between 2 and 10. Below a meter setting of 2 the CV's were greater that 15%.

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

Fertilizer Metering System: FIGURE 8 shows the calibration curve for fertilizer obtained by PAMI and by the manufacturer while metering 11-51-00 fertilizer. The difference between the curves is probably due to the variation in the size and density of the fertilizer used in the two calibrations. The curves obtained by PAMI for the 24-48 and 15-72 gears were flatter with a smaller rate change over the range than those obtained by the manufacturer.

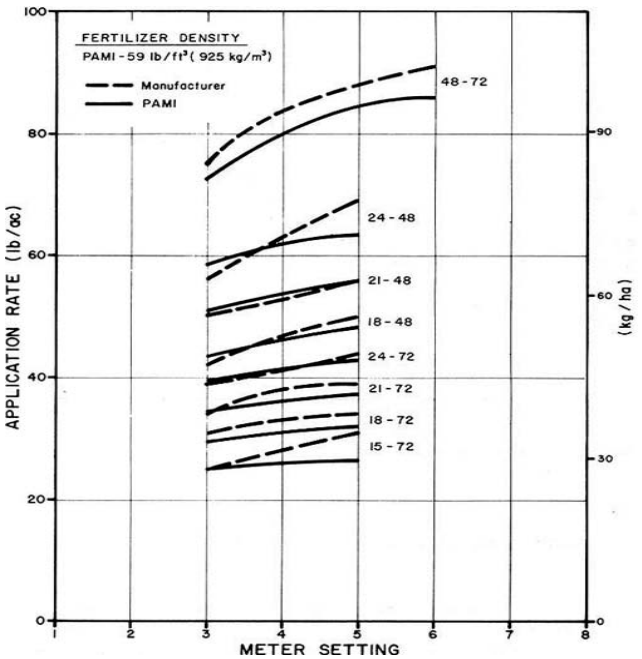

FIGURE 8. Metering Accuracy in Fertilizer (11-51-00).

[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 9 shows the calibration curve obtained by PAMI for the 24-48 gears over the entire metering range. The curve is very steep below a meter setting of 3 and levels out a meter setting above 6. Therefore, the only operable meter settings are between 3 and 6.

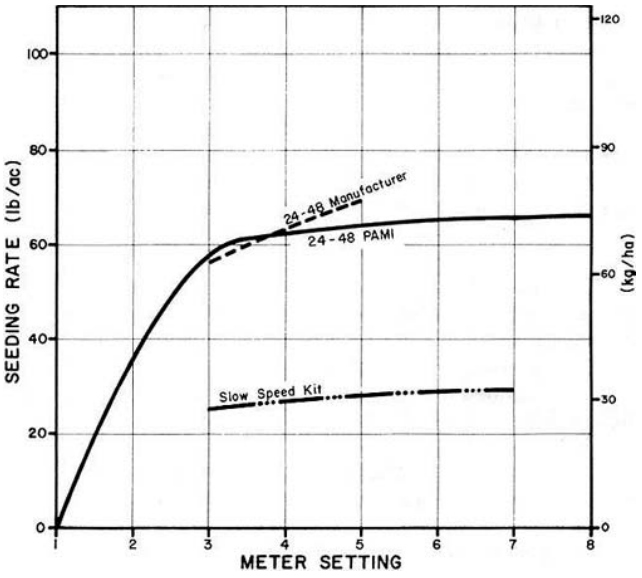

FIGURE 9. Fertilizer (11-51-00) Calibration Curves for 24-48 Gearing and with Slow Speed Kit Mounted.

FIGURE 9 also shows the fertilizer calibration curve obtained by PAMI with the slow speed kit mounted. The gear combinations could not be changed when the slow speed kit was mounted. It is recommended that the manufacturer consider modifying the slow speed kit to allow for changes in the fertilizer rate.

The maximum fertilizer rate attainable with the gears supplied was 272 lb/ac (305 kg/ha) to 397 lb/ac (445 kg/ha) using the 48-15 gears.

Fertilizer distribution across the width of the drill was uniform. CV's ranged from 1.5 to 4.5% at and above a meter setting of 3. Below a meter setting of 3 the CV's were usually greater than 15%.

Level of fertilizer in the box, variation in ground speed and field roughness did not significantly affect the application rate of fertilizer. The rate was however, affected by field slope. FIGURE 10 shows the variation in fertilizer application rates obtained when fertilizing uphill, downhill, left side-slope, right side-slope and on level ground with 24-48 gears at a meter setting of 3 while applying 11-51-00 fertilizer. Travelling up a 15° slope decreased the rate by 47% and travelling down a 10° slope caused a 20% increase in the rate. Travelling on a 15° left side-slope caused a 14% increase in rate and travelling on a 15° right side-slope caused a 24% decrease in the fertilizer rate. It is recommended that the manufacturer consider modifying the fertilizer metering system to reduce the effect of field slope on fertilizer rates.

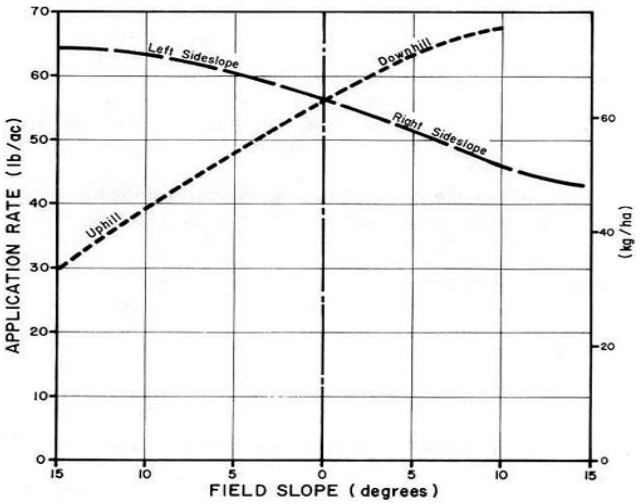

FIGURE 10. Variation in Fertilizer (11-51-00) Application Rate with Change in Slope.

The front seed delivery tubes plugged at the 15° uphill slope in the lab with fertilizer. As mentioned before, this problem was not experienced in the field so it was assumed that field vibration prevented plugging. The 15° downhill fertilizer slope could not be obtained because the steel delivery tubes plugged. This problem was also not experienced in the field so it was assumed that field vibration also prevented this plugging.

EASE OF OPERATION AND ADJUSTMENT

Maintenance: Lubrication was easy with good access to most grease fittings. Thirty seven grease fittings required regular greasing and it took one man approximately 15 minutes to do both units. Tightening or aligning the seed metering drive chain a large amount required moving the seed and fertilizer box.

Filling and Cleaning: The 30 in (762 mm) wide metal walkway on the rear of the drill made filling and cleaning the grain and fertilizer boxes safe and convenient. Filling with a truck was hindered by the protrusion of the rear transport wheels.

The 12 in (305 mm) wide openings made the grain and fertilizer boxes accessible for cleaning with a pail and brush. The seed and fertilizer cup feed gates could be fully opened as shown in FIGURE 11 to allow material to fall through. A vacuum cleaner or compressed air was usually used to clean the unit.

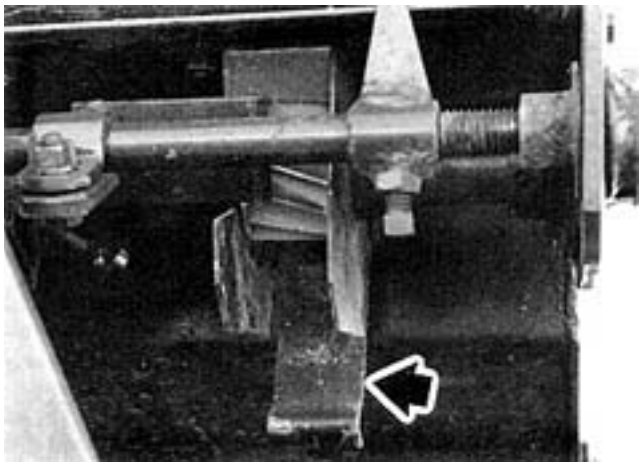

FIGURE 11. Fertilizer Feed Gate in Open Position.

The fertilizer boxes contained a cover plate and screen over the seed cups, which had to be removed during clean out.

A partition between the grain and fertilizer boxes could be set in two positions to suit application rates. This permitted carrying 12.6 bu (460 L) of grain and 530 lb (234 kg) of fertilizer or 19.6 bu (715 L) of grain only in each 6.7 ft (2.0 m) unit. The partition was secured in place by two bolts when in the combination position. The bolts were easily removed. During field operation the partition let a small amount of material cross over. It is recommended that the manufacturer consider modifying the box partition to eliminate leakage.

Moisture: The grain and fertilizer boxes were adequately sealed to prevent leakage into the boxes in light rains. The fertilizer cups were, however, susceptible to moisture. To prevent moisture from getting into the fertilizer cups, the drills had to be completely tarped. It is recommended that the manufacturer consider providing a way of preventing moisture from entering the fertilizer cups.

Seeding and Fertilizer Rates: The seeding rate was easily adjusted by turning the crank handle to the desired setting (FIGURE 12). The seeding rate could be zeroed by moving the setting indicator to zero and then zeroing each individual sliding barrel assembly. Changing to the optional slow speed kit required removal of three gears, changing a mounting bracket and mounting four gears and three chains. This procedure took one man at least 15 minutes.

The fertilizer rate was adjusted by changing the gear drive combination (FIGURE 13) and by turning the crank handle to the desired setting (FIGURE 12). Changing to the various gear drive combinations required removal of the seed shaft drive gear and sometimes changing the length of the fertilizer drive chain. This procedure took approximately 5 to 10 minutes per drill.

Monitoring: The optional area counter (FIGURE 14) did not read acres directly and no multiplication factors were given in the operator's manual. It is recommended that the manufacturer consider providing calibration information for the area counter in the operator's manual.

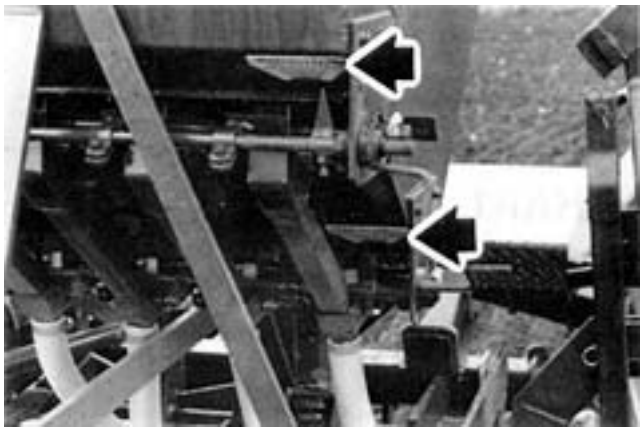

FIGURE 12. Seed and Fertilizer Meter Settings.

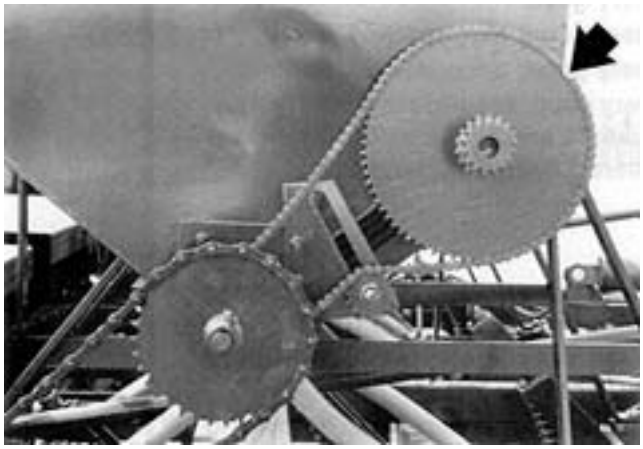

FIGURE 13. Fertilizer Gear Drive.

FIGURE 14. Area Counter.

The counter was tested in the lab with the slow speed kit mounted. It was measured to have 28.7 counts per acre per 14 ft drill or 70.9 counts per hectare per 4.3 m drill. It should be noted that the calibration changes with the slow speed kit mounted.

The area counter was tripped by a spring, mounted on the seed shaft drive chain (FIGURE 14). This spring broke two times during the test. It is recommended that the manufacturer consider modifying the area counter trip mechanism to improve its durability. Reflective motion indicators were attached to the end of each seed shaft but the motion of the gears was easier to view during daylight operating.

Depth Adjustment: Seeding depth was adjusted by positioning the stop collar on the hydraulic cylinders. Access to the hydraulic cylinders was hindered by the rear walkway. During the test, spacers had to be mounted on the hydraulic cylinders to provide

shallow enough depths for field operation. It is recommended that the manufacturer consider providing spacers for the hydraulic depth control cylinder. Small adjustments in the depth of each individual hoe opener could be made by moving the openers down the shanks. Front to back levelling could be made by turning the adjustment swivel on the front axle lift pull arm.

Transporting: The manufacturer provided an optional end tow transport hitch for the test. This hitch was convenient to use but due to the smaller width of the unit in field position, the drill was easier to transport using the drawbar hitch.

It took 5 to 10 minutes to place the drills in the end tow transport position (FIGURE 15). The drawbar hitch was conveniently moved in and out of transport position with a hydraulic cylinder. The unit could be safely transported at speeds up to 15 mph (24 km/h).

FIGURE 15. End Tow Transport Position.

At the start of the test the Edwards HD 812 had only 2 in (51 mm) of ground clearance in transport position making transportation difficult. The packer lift assemblies were changed during the test and the transport ground clearance was increased to 6 in (152 mm). The unit transported without difficulty for the rest of the test.

Manueverability: It was found during field testing that the manueverability of the unit tested was fair. The drawbar hitch was too long for the width of machine tested, which made corners difficult. On sharp corners the hitch lock-up assembly (Figure 16) would damage the tractor tires. It is recommended that the manufacturer consider modifying the drawbar hitch to improve field maneuverability and to eliminate interference with the hitch lock-up assembly.

Due to the arrangement of the shanks the far right shank was impossible to see as shown in FIGURE 17. This shank was located on the fourth or back row of shanks. It is recommended that the manufacturer consider rearranging the hoe shanks to improve visibility of the far right shank. Visibility of plugged seed runs was very good since both the seed and fertilizer cups were located at the front of the boxes.

FIGURE 16. Hitch Lock-up Assembly.

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), in silt loam soil for the 14 ft (4.3 m) drill unit tested, ranged from 4900 lb (21,805 N) to 5200 lb (23,140 N).

FIGURE 17. Poor Visibility of Far Right Shank from Tractor.

Tractor Size: The power take-off horsepower requirements per foot of drill width for varying seed depths are given in FIGURE 18. Requirements varied from 5.2 hp/ft (12.8 kW/m) at a 0.75 in (19 mm) seed depth to 12.5 hp/ft (30.8 kW/m) at a 3.25 in (83 mm) seed depth. Therefore, overall tractor size needed to pull the Edwards HD 812 14 ft (4.3 m) test unit at a normal seeding depth varied form 118 hp (89 kW) to 125 hp (94 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.

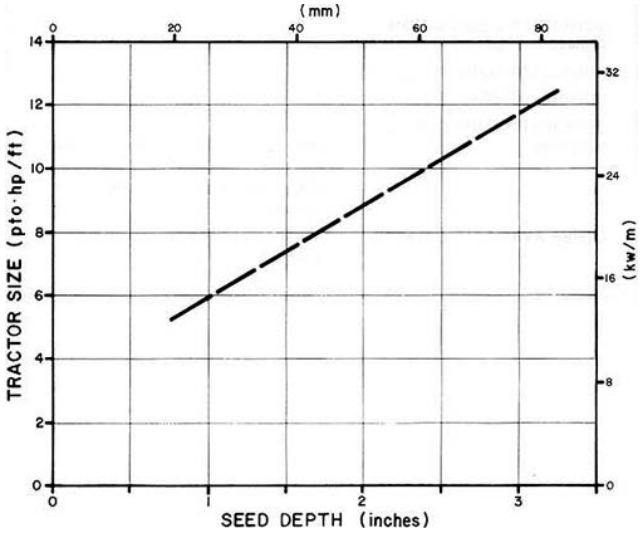

FIGURE 18. Average Horsepower Requirements at 5 mph (8 km/h).

OPERATOR SAFETY

The Edwards HD 812 was safe to operate if normal safety precautions were observed. Lock-up pins were provided for the hoe bed, the drawbar hitch and the transport hitch. The platform at the rear of the drill was large enough for safe filling of the grain and fertilizer boxes. Caution had to be taken not to step on the free wheeling transport wheels while filling the unit. Caution also had to be taken to avoid the protruding shaft shown in FIGURE 19. No slow moving vehicle sign or holder was supplied. It is recommended that the manufacturer consider supplying a slow moving vehicle sign.

Tire loads did not exceed the Tire and Rim Association maximum load ratings except when the unit was in transport position and full of grain and fertilizer. It is recommended that the unit be transported empty of grain and fertilizer at all times.

OPERATOR'S MANUAL

The operator's manual contained a complete parts list, assembly instructions and some information on maintenance, adjustment and operation. The operator's manual could, though, have contained more detailed information on topics such as hoe position on the shank, operation of the transport hitch, chain tightening, grease nipple location and area counter calibration information. It is recommended that the manufacturer consider including more detailed information in the operator's manual on the operation and adjustment of the Model 812. Calibration charts for wheat, barley, oats and flax were provided in the operator's manual and on the drill box. The calibration chart for canola was given with the slow speed kit. Rates were expressed in Imperial units (lb/ac) only. It is recommended that the manufacturer consider supplying rate charts in SI units as well as Imperial units.

MECHANICAL HISTORY

The Edwards HD 812 was operated for 118 hours while seeding about 642 ac (257 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)
-drive chain from packer came off right drill at	beginning of test		
-hit an embedded rock in road damaging one packer and bending the gang bolt on left drill at	32	160	(64)
-shortened several flexible plastic delivery hoses and tightened with a tie strap due to plugging with grain	throughout the test		
-adjusted and tightened jam nuts on one shank	59	323	(129)
-slackened metering drive chain on right drill	60	325	(130)
-drive chain from packer came off right drill	61	327	(131)
-broke hoe opener while seeding into very hard ground	63	330	(132)
-replaced bent packer lift assemblies on drill with new ones	63	330	(132)
-replaced broken spring on area counter trip mechanism	63	330	(132)
-replaced leaky hydraulic cylinder for hitch lift with new one	63	330	(132)
-tightened left packer gang bolt	115	625	(250)
-replaced broken spring on area counter trip mechanism	118	642	(257)

DISCUSSION OF MECHANICAL PROBLEMS

Replacement of Packer Lift Assemblies: The packer lift assemblies were bent causing a lack of ground clearance during transport. The lack of ground clearance caused the packer and gang bolt to be damaged at 32 hours. The packer lift assemblies were bent because the holding brackets were not in line. After the assemblies were replaced and their holding brackets lined up, the drills had adequate ground clearance for transport.

Broken Hoe Opener: The opener in FIGURE 20 failed while seeding into very hard ground.

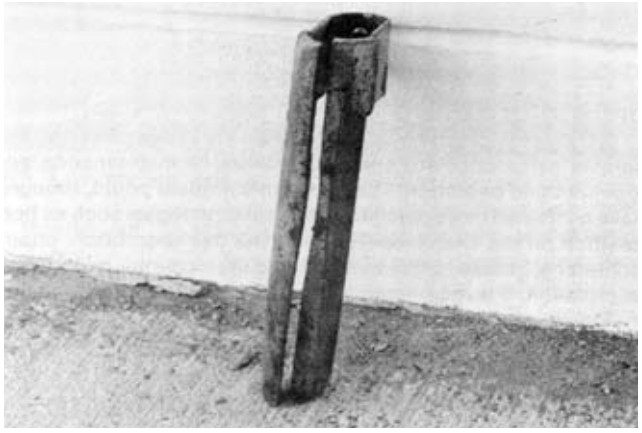

FIGURE 20. Broken Hoe Opener.

Hoe Point Wear: The average wear on each opener was 0.35 in (8.9 mm) after seeding 320 acres (128 ha) with both units or 16 ac (6 ha) per opener. The openers could be slid down the shank a total of 8 in (203 mm) and as a result would have a very long life. The normal opener placement of 0.75 in (19 mm) below the shank was not given in the operator's manual.

APPENDIX I
SPECIFICATIONS

MAKE:	Edwards	
MODEL:	HD-812-8F	
SERIAL NUMBER:	85-2-1283, 85-2-1284	
MANUFACTURER:	Edwards Rod Weeder Ltd. Box 995 Lethbridge, Alberta T1J 4A2	
DIMENSIONS OF TWO UNITS:	**Field Position**	**Transport Position**
-- height	8.4 ft (2.6 m)	9.7 ft (3.0 m)
-- length	26.9 ft (8.2 m)	20.5 ft (6.3 m)
-- width	14.6 ft (4.5 m)	17.7 ft (5.4 m)
-- effective seeding width	13.5 ft (4.1 m)	
-- transport ground clearance		6.0 in (152 mm)
SEED METERING SYSTEM:		
-- type	straight fluted feed rollers mounted in sliding barrel assemblies	
-- drive	chain and gear from press wheels	
-- adjustment	shaft controlling sliding barrel protrusion, seed shaft speed reducer	
-- transfer to openers	flexible plastic hose	
FERTILIZER METERING SYSTEM:		
-- type	spiral fluted feed rollers with sliding gate assemblies	
-- drive	gear off seed shaft	
-- adjustment	various gear combinations and sliding gate assemblies	
-- transfer to openers	formed steel tubes to flexible plastic hose	
OPENERS:		
-- type	hoe	
-- point	standard	
-- number	10 per unit	
-- spacing	8 in (203 mm)	
-- number of rows	4	
-- distance between rows	20 in (508 mm)	
-- options	12 in (305 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	
CAST OR WHEELS:		
-- number	2 per drill unit	
-- tire size	9.5 L x 15, 6-ply	
GRAIN AND FERTILIZER BOX CAPACITIES:		
-- with box partition in position 1		
-grain	25.3 bu (919 L)	
-fertilizer	1029 lb (463 kg)	
-- with box partition in position 2		
-grain	39.2 bu (1425 L)	
WEIGHTS: (FIELD POSITION)	**Boxes Empty**	**Boxes Full**
-- weight on press wheels	4770 lb (2170 kg)	6290 lb (2850 kg)
-- weight on castor wheels	2930 lb (1350 kg)	4040 lb (1830 kg)
Total	7750 lb (3520 kg)	10320 lb (4680 kg)
WEIGHTS: (TRANSPORT POSITION)	**Boxes Empty**	**Boxes Full**
-- weight on front castor wheels	3870 lb (1760 kg)	5220 lb (2370 kg)
-- weight on transport wheels	3880 lb (1760 kg)	5100 lb (2310 kg)
Total	7750 lb (3520 kg)	10320 lb (4680 kg)
NUMBER OF CHAIN DRIVES:	6	
NUMBER OF LUBRICATION POINTS:	37	
NUMBER OF HYDRAULIC LIFTS:	3	
NUMBER OF SEALED BEARINGS:	14	
OPTIONS INCLUDED ON TEST MACHINE:	fertilizer attachment, transport, end tow, hitch lift assembly, hitch jack, ladder, acreage counter, rock guards	
OTHER AVAILABLE OPTIONS:	marker, seed box covers, small seed kit	

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/hours (km/h)
inches (in) x 25.4	= millimeters (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/acres (lb/ac) x 1.12	= kilograms/hectare (kg/ha)
pounds/bushel (lb/bu) x 12.5	= kilograms/cubic meter (kg/m^3)

SUMMARY CHART

EDWARDS HD 812 HOE DRILL

RETAIL PRICE:	$23,810.00 (May, 1987, f.o.b. Lethbridge)
QUALITY OF WORK:	
Penetration	**very good**
Trash Clearance	**very good;** plugged very rarely
Stony Conditions	**very good;** adequate protection
Metering	**very good;** accurate in wheat, barley, canola and fertilizer; fertilizer rates were affected by field slope
EASE OF OPERATION AND ADJUSTMENT:	
Filling/Cleaning	convenient; rear transport wheels hindered filling with a truck
Seeding and Fertilizer Rates	seed easy to set; fertilizer involved changing gears
Depth Adjustment	simple; hoe openers could be lowered for tire tracks
Transportability	**good**
Maneuverability	**fair;** long drawbar hitch; visibility of far right shank obstructed
POWER REQUIREMENTS:	120 PTO hp (90 kW) tractor for the 14 ft (4.3 m) unit tested was sufficient for all conditions
OPERATOR SAFETY:	safe, if normal precautions observed no slow moving vehicle sign supplied
OPERATOR'S MANUAL:	**good;** lacked detailed information on operation and adjustment; contained parts list and assembly instructions
MECHANICAL HISTORY:	replaced both packer lift assemblies

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