

# Evaluation Report

# 494



## Valmar Model 4400 Fertilizer Attachment

A Co-operative Program Between



## VALMAR MODEL 4400 FERTILIZER ATTACHMENT

### MANUFACTURER AND DISTRIBUTOR:

Valmar Airflo Inc.  
P.O. Box 34, Hwy #1 East  
Elie, Manitoba  
R0H 0H0  
(204) 353-2782

### RETAIL PRICE:

\$11,375.00 (March, 1986, f.o.b. Humboldt, with 44 outlets, fertilizer metering rollers, and power take-off fan drive).

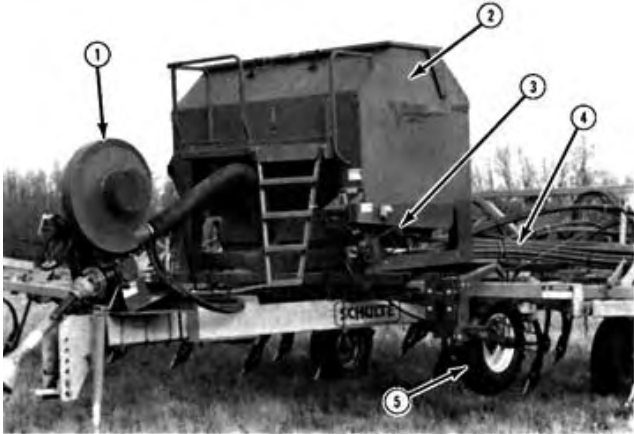


FIGURE 1. Valmar 4400: (1) Fan, (2) Tank, (3) Metering System, (4) Delivery Hoses, (5) Ground Drive.

### SUMMARY AND CONCLUSIONS

**Quality of Work:** The accuracy of the fertilizer metering system was excellent. Fertilizer was applied at rates from 35 to 436 lb/ac (39 to 488 kg/ha) depending on density. The manufacturer's calibration chart was accurate. A convenient scale was supplied for determining density, and checking application rates in the field. Distribution across the width of the Valmar 4400 was very uniform with CV's less than 5%.

Performance of the fertilizer delivery system was very good. The smooth plastic hoses did not plug and did not damage the fertilizer.

Fertilizer placement depended upon the cultivator and banding openers used, Fan speed did not affect fertilizer placement.

**Ease of Installation:** Ease of installing the Valmar 4400 was very good. It took two men about 16 hours. It was easily adapted to the test cultivator. A loader or crane was required. Installation instructions were adequate.

**Ease of Operation and Adjustment:** Ease of filling the tank was good. The 9.2 ft (2.8 m) filling height was too high for most drill fills, but worked well for auger filling. The tank lid was weather tight. The tank access ladder was too short.

Ease of cleaning was very good. The metering rollers were easily removed, once the tank was empty. The venturis and air manifold were easy to clean. Some fertilizer caked on the metering rollers and venturis in cool, damp weather.

Monitoring was good. A fan tachometer, a tow bin level alarm, and meter shutoffs were provided on the control console in the tractor. The meters and venturis could be viewed from the tractor, but the plexiglass shield became dirty and could not be kept clean. The high tank obstructed visibility of the cultivator frame.

Ease of transporting was very good. The Valmar 4400 did not interfere with normal transporting of the cultivator. The tank should be emptied before transporting to avoid excessive cultivator frame stress or tire overloading.

Application rate adjustment was very good. Fan adjustment was fair. With the PTO drive, the full range of fan speeds could not be obtained, Ease of maintenance was very good, Daily servicing took about 10 minutes.

**Power Requirements:** The PTO driven fan required about 10 hp (7.5 kW) at a fan speed of 5000 rpm and tractor PTO speed of 1100 rpm,

**Operator Safety:** Drive components were adequately shielded. Warning decals were supplied. The tank access ladder was too short, making it hazardous when filling the tank.

**Operator's Manual:** The operator's manual was very good. It was thorough, complete, and well illustrated.

**Mechanical History:** A few minor mechanical problems occurred during 70 hours of field work.

### RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to provide suitable fan speeds for the full range of application rates when using the PTO driven fan.
2. Supplying an optional extension step for the filler platform ladder.
3. Supplying a dipstick or sight glass for the ground drive hydraulic reservoir.

Senior Engineer: G.E. Frehlich

Project Engineer: M.E. Jorgenson

### THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Fan speed adjustments, if required, can be made by changing the V-belt sheaves. Alternate sheaves and V-belts are available from the manufacturer to provide suitable fan speeds for the full range of application rates.
2. An optional extension step will be offered by the manufacturer.
3. Modifications to the ground drive hydraulic reservoir are being considered.

### GENERAL DESCRIPTION

The Valmar 4400 (FIGURE 1) is an implement mounted pneumatic applicator that mounts on the hitch of a cultivator for deep banding fertilizer.

Fertilizer is metered from the 75 ft<sup>3</sup> (2.1 m<sup>3</sup>) tank by two multiple speed grooved rollers into venturi cups. A ground wheel drives the metering system using sprockets, hydraulic motors, and a 9 speed gearbox. The power take-off driven fan delivers air through a manifold to the venturis. Plastic hoses deliver fertilizer from each venturi to each banding boot.

Metering rate is adjusted by changing sprockets or by shifting the gearbox. A fan tachometer and control box mounted in the tractor cab monitors the fan speed and controls electromagnetic clutches on the metering rollers. Fan output is adjusted by varying the fan speed.

The Valmar 4400 is available in sizes ranging from 24 to 44 outlets, suitable for cultivator widths up to 44 ft (13.4 m). The fan may be driven by tractor PTP, hydraulics, or an 18 hp (13 kW) or 23 hp (17 kW) gas engine. The test machine was equipped with a PTO driven fan and 44 outlets, with 6 outlets returned to the tank. Detailed specifications are given in APPENDIX I.

### SCOPE OF TEST

The Valmar 4400 was installed on a 38 ft (11.6 m) Schulte 300 series cultivator with 38 shanks arranged in 4 rows. Fertilizer was placed on a 12 in (305 mm) spacing using Dutch #70 fertilizer banding knives.

The machine was operated in the field and laboratory for about 70 hours while banding about 1800 ac (730 ha). It was evaluated for quality of work, ease of installation, operation and adjustment, power requirements, safety, and suitability of the operator's manual.

### RESULTS AND DISCUSSION

#### QUALITY OF WORK

**Fertilizer Metering:** The accuracy of the Valmar 4400 metering system (FIGURE 2) was excellent when applying fertilizer.

Fertilizer could be applied at 27 different rates ranging from 35 to 436 lb/ac (39 to 488 kg/ha) depending on the fertilizer density. The manufacturer's calibration chart, which listed rates for several fertilizer densities, agreed closely with the rates obtained by PAMI.

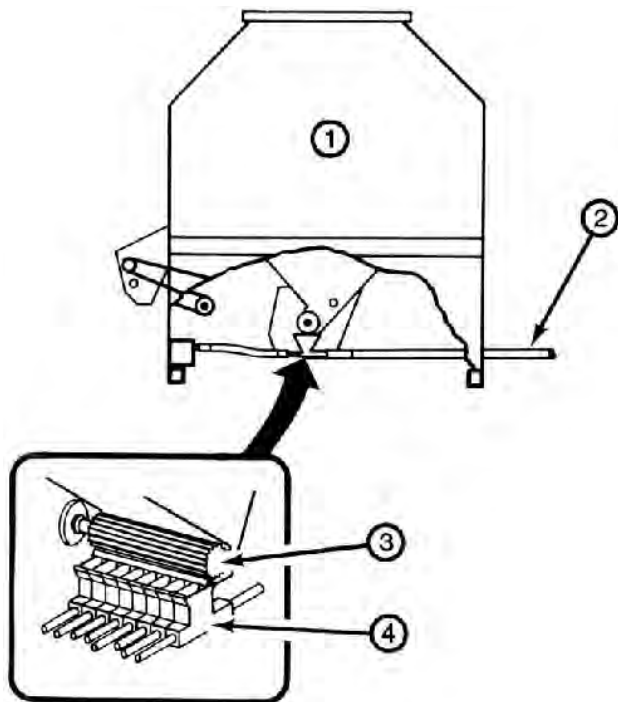


FIGURE 2. Fertilizer Metering System: (1) Tank, (2) Delivery Hose, (3) Metering Roller, (4) Venturi Cups.

The actual application rate at a given setting will vary with factors such as size, density, and moisture content of the fertilizer, making it difficult for the manufacturer to provide charts which include all types and blends of fertilizers. Small variations in amount of fertilizer applied may not significantly affect yield, but can reduce economic returns. For best results, the application rate should be adjusted according to the supplied chart and then checked in the field. The manufacturer provided a convenient scale (FIGURE 3) for determining fertilizer densities and for checking the application rate in the field.



FIGURE 3. Valmar Density and Application Rate Scale.

Fertilizer application rates were not affected by changes in ground speed, level of fertilizer in the tank, nor field roughness. Rates were only slightly affected on slopes. For example, when applying 34-0-0 at 48 lb/ac (54 kg/ha), the rate increased by 10% on a 15 degree downhill slope. The rate decreased by 6% on a 15 degree uphill slope.

The operator's manual listed fan speeds for various application rates and number of outlets. Metering was not affected by higher than recommended fan speeds. However, if the fan was run below the recommended speed, some material was blown out of the venturis or the venturis plugged. Suitable fan speeds were obtained with the Allis Chalmers FW-305 tractor used in the test, for application rates up to 200 lb/ac (224 kg/ha). However, suggested fan speeds for applying at rates above 200 lb/ac (224 kg/ha) could not be obtained with the tractor PTO. It is recommended that the manufacturer consider modifications to provide suitable fan speeds for the full range of application rates.

The metering rollers and venturis had to be cleaned twice daily in cool damp weather. Fertilizer dust adhered to the metering rollers and to the venturis and slightly affected metering accuracy. A coating

of laundry antistatic spray or fabric sheets helped to reduce fertilizer caking in these conditions.

The fertilizer application rate across the width of the Valmar 4400 was very uniform at recommended fan speeds. For example, FIGURE 4 shows the distribution of 46-0-0 fertilizer at a rate of 106 lb/ac (119 kg/ha) and a fan speed of 4500 rpm. Coefficients of Variation<sup>1</sup> (CV's) at all application rates for all materials tested were less than 5%.

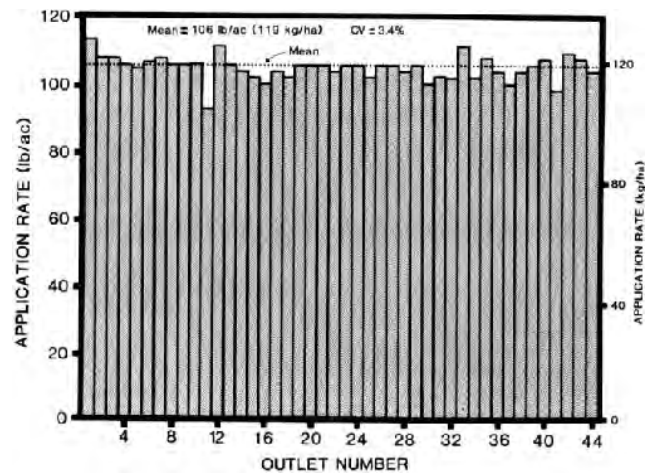


FIGURE 4. Distribution Uniformity Pattern in 46-0-0 at 106 lb/ac (118 kg/ha) and a Fan Speed of 4500 rpm.

**Fertilizer Delivery to Openers:** Performance of the fertilizer delivery system was very good. The smooth plastic hoses did not restrict material flow or cause noticeable damage to the fertilizer granules. Delivery was not affected by the length of individual hoses. No hoses plugged during the test. Some banding knives which use a restricted fertilizer outlet may effect air delivery at the venturis and could lead to some hose plugging. The Dutch #70 knives did not significantly restrict air flow.

**Fertilizer Placement:** The Valmar 4400 did not come with its own banding boots or knives. Fertilizer placement depends on the knife or chisel and boot used. Fertilizer placement was very good with the Dutch #70 banding knives and the Schulte 300 immediate cultivator on 12 in (305 mm) spacing. Fields were fall-banded to a depth of 4 to 4-1/2 in (102 to 114 mm). Fertilizer was placed in a band about 1 in (25 mm) wide and varying in depth about 1/2 in (12 mm). Higher fan speeds did not affect the fertilizer placement.

#### EASE OF INSTALLATION

Ease of installation was very good. The Valmar 4400 was assembled and installed by two men in about 16 hours. No special mounting brackets were required. The tank and the fan with the PTO drive were mounted on the hitch, the ground drive was assembled and installed, and the hoses were routed across the frame to the openers. The electronic fan tachometer and control console were easily mounted in the tractor cab.

A front-end loader, hoist or crane was required to lift the box onto the cultivator. Lifting hooks were provided on the tank. A welder and common hand tools were also required. Installation instructions in the operator's manual were clearly written. Numerous sketches were helpful.

On the test machine, the Valmar 4400 had to be blocked up 6 in (150 mm) above the hitch to clear hydraulic lines. No other modifications were required to the Valmar 4400 or to the cultivator.

#### EASE OF OPERATION AND ADJUSTMENT

**Filling:** Ease of filling was good. The filler opening was about 9.2 ft (2.8 m) above ground. This was too high for convenient filling with a truck mounted drill fill; however, a standard grain auger worked well (FIGURE 5). The tank could be maneuvered under the auger for filling. The 69 x 21 in (1750 x 535 mm) filler opening was large enough for most augers. The screens in the filler opening helped to

<sup>1</sup>The coefficient of variation is the standard deviation of application rates from individual openers expressed as a percent of the mean. Application is not uniform if the CV is greater than 15%. A CV of less than 15% is considered acceptable. A CV less than 10% is considered very uniform.

trap large clumps of foreign material, however, some of the fertilizer bounced off the screen and out onto the ground.



FIGURE 5. Filling with a Conveyor Auger.

The tank held 75 ft<sup>3</sup> (2123 L) of fertilizer. This amounted to about 3600 to 4500 lb (1640 to 2050 kg) depending on the fertilizer being applied. The amount of area covered between fills depended on application rate and type of fertilizer used.

The tank lid was weather tight. No rain entered the tank or metering rollers during the test. The ladder was too short for climbing up to the platform. It is recommended that the manufacturer consider supplying an optional extension step for the filler platform ladder.

**Cleaning:** Ease of cleaning was very good. The metering rollers were easily removed without tools, but could only be removed if the tank was empty. With the metering rollers removed, the tank could be completely cleaned or flushed out. Cleanout ports were provided on the manifolds, however a screen on the fan inlet kept the manifold clean. The screens in the tank filler opening were easily removed without tools.

**Monitoring:** Monitoring of the Valmar 4400 was good. The fan tachometer and control console in the tractor cab provided a digital display of fan speed, a low fan speed warning, a low hopper level warning, and shutoffs for the left and main meter drives. The fan speed indication was accurate up to 5000 rpm, but gave a false reading at higher speeds. The hopper low level sensor worked well. A sight glass on the tank was also useful. The metering shutoff switches helped prevent unnecessary overlap on corners or when finishing a field.

A material flow monitoring system was not available for the Valmar 4400. However, a plexiglass shield covered the metering rollers and the venturis to allow the operator to monitor feeding, while keeping out moisture and foreign material. However, dust and fertilizer powder adhered to the shield making it very hard to see the metering rollers and venturis. For most of the test season, the shield was simply latched up out of the way. Also, the corner posts of the hopper support blocked visibility to the outer ends of the rollers and venturies.

The hitch-mounted tank obstructed visibility to the cultivator main frame. This made it hard to spot problems such as trash plugging.

**Transporting:** Ease of transporting was very good. The Valmar 4400 did not interfere with normal transporting of the cultivator. The drive wheel lifted off the ground when the cultivator was raised. Hoses had to be properly routed to avoid kinks or pinches when the wings were folded. The Valmar should not be transported with material in the tank to minimize stress on the tires, axles, and the frame.

**Application Rate Adjustment:** Ease of setting and adjusting application rates was very good. Sprockets were changed, and the gearbox was shifted to one of nine positions. A calibration chart decal was conveniently located on the box. The supplied density and application rate scale was very convenient to use.

**Fan Adjustment:** Ease of adjusting the PTO driven fan was fair. Fan output was adjusted by changing the fan speed. The operator's manual listed appropriate fan speeds for different numbers of outlets and application rates. On the PTO driven model, fan speed could be slightly adjusted by varying the tractor engine speed, but the full range of fan speeds listed could not be obtained. Recommendations

to provide the full range of fan speeds when using the PTO driven fan have been made. Fan speed adjustment would not be a problem on hydraulic or gas engine powered fans.

**Maintenance:** Ease of maintenance and servicing was very good. Daily maintenance took about 10 minutes. The metering rollers were removed for cleaning and inspection. The venturis were checked and cleaned out if necessary. The banding boots were inspected for plugging. Oil levels were checked in the fan gearbox and the hydraulic ground drive. It was difficult to judge the oil level in the ground drive hydraulic reservoir. It is recommended that the manufacturer consider supplying a dipstick or sight glass for the hydraulic reservoir.

#### POWER REQUIREMENTS

The power required to operate the Valmar 4400 fan at a power take-off speed of 1100 rpm and fan speed of 5000 rpm was about 10 hp (7.5 kW). The electrical power required for the control console was less than 10 amps at 12 volts.

No increase in cultivator draft due to the added weight of the full fertilizer tank could be measured in the field. Power requirements for cultivators listed in PAMI reports include sufficient margin to allow for the effects of such attachments in most conditions.

#### OPERATOR SAFETY

No serious safety hazards were apparent. The PTO shaft and fan drive belts were well shielded. Some ground drive chains were not shielded, but were not hazardous since they rotated only when the machine was moving.

Climbing on and off the filler platform was hazardous because the ladder was too short. Modifications have been recommended.

#### OPERATOR'S MANUAL

The operator's manual was very good. It contained useful information on operation, adjustment, safety, and calibrations. It also contained assembly instructions and a parts list. A separate manual on the fan tachometer and control console clearly explained its functions. Both manuals were easy to follow and well illustrated.

#### MECHANICAL HISTORY

The intent of the test was evaluation of functional performance. An extended durability test was not conducted. TABLE 1 outlines the mechanical problems, which occurred during 70 hours of field tests.

TABLE 1. Mechanical History

Item	Field Area		
	Hours	ac	(ha)
-The pressurized hydraulic hose on the ground drive motor leaked and was retightened. The reservoir was refilled at	35	800	(324)
-The bearing on the fan shaft slipped out of the bearing housing. It was repositioned and a proper lock screw installed at	40	950	(385)
-The spring pin on the drive wheel sprockets fell off and was replaced at	43	1000	(405)
-The sprocket on the gearbox shaft began to slip and the set screw was retightened at	43	1000	(405)
-The electrical clutch relay box prevented the metering roller shield from being flipped up. The shield was wired open	Throughout the test		
-Ten delivery hoses were kinked or torn near the knife boot due to shanks tripping out	Throughout the test		

**Cultivator Frame Loading:** The Val mar 4400 weighed about 6700 lb (3045 kg) when full of fertilizer. On the test machine, about half of the weight was carried by the hitch tongue and half by the cultivator main frame wheels. The main frame tires on the Schulte 300 cultivator were within recommended load ratings in field position even when the tank was full. The Valmar 4400 should not be transported with a full tank. No mechanical problems occurred with the cultivator as a result of the added weight. The Valmar 4400 operator's manual warned of potential cultivator overload and suggested additional bracing if required.

**APPENDIX I  
SPECIFICATIONS**

<b>MAKE:</b>	Valmar
<b>MODEL:</b>	4400
<b>SERIAL NO.:</b>	8544192
<b>OVERALL DIMENSIONS:</b>	
-- tank	
-height	5.5 ft (1.6 m)
-width	6.0 ft (1.8 m)
-length	4.5 ft (1.4 m)
-- filling height (mounted on cultivator)	9.2 ft (2.8 m)
<b>METERING AND DELIVERY SYSTEM</b>	
-- type	full length grooved rollers
-- drive	chain and hydraulics from ground drive wheel
-- tire size	7.60 x 15, 4-ply
-- adjustment	change sprockets or gearbox setting
-- air stream loading	venturi for each opener
-- number of outlets	44, 6 were returned to tank
-- transfer to openers	1-1/4 in (32 mm) inside diameter, smooth plastic hose
<b>FAN:</b>	
-- type	straight blade centrifugal
-- drive	power take-off and V-belts
-- operating speed	3750 to 5640 rpm

<b>TANK CAPACITY:</b>	75 ft <sup>3</sup> (2123 L)
<b>WEIGHT:</b>	
-- tank, ground drive, and fan	2200 lb (1000 kg)
-- fertilizer (11-51-0)	4500 lb (2045 kg)
-- gross weight	6700 lb (3045 kg)
<b>NUMBER OF LUBRICATION POINTS:</b>	4
<b>NUMBER OF V-BELTS:</b>	2
<b>NUMBER OF CHAINS:</b>	4
<b>OPTIONAL EQUIPMENT:</b>	
-- hydraulic or gas engine fan drive	
-- distribution systems with 24, 28, 32, 38 or 44 outlets	
-- herbicide metering rollers and deflectors	
-- tank divider panels	

**APPENDIX II  
MACHINE RATINGS**

The following rating scale is used in Machinery Institute Evaluation Reports:

excellent	fair
very good	poor
good	unsatisfactory

**SUMMARY CHART  
VALMAR 4400 FERTILIZER ATTACHMENT**

<b>RETAIL PRICE</b>	\$11,375.00 (March, 1986, f.o.b. Humboldt, Sask.)
<b>QUALITY OF WORK</b>	
-Fertilizer Metering	<b>Excellent;</b> rates from 35 to 436 lb/ac (39 to 488 kg/ha), accurate charts, very uniform distribution with CV's less than 5%
-Fertilizer Delivery to the Openers	<b>Very Good;</b> no plugging, no fertilizer damage
-Fertilizer Placement Banding boots	not supplied; placement depends on cultivator and openers used
<b>EASE OF INSTALLATION</b>	<b>Very Good;</b> took two men about 16 hours, loader or crane required, instructions adequate
<b>EASE OF OPERATION AND ADJUSTMENT</b>	
-Filling	<b>Good;</b> filling height was 9.2 ft (2.8 m), weather tight lid, ladder too short
-Cleaning	<b>Very Good;</b> meters easily removed, venturis easy to clean, some fertilizer caked in cool, damp weather
-Monitoring	<b>Good;</b> console in cab, metering viewed from cab, tank obstructed visibility to cultivator
-Transporting	<b>Very Good;</b> did not interfere with cultivator, should be transported with empty tank
-Application Rate Adjustment	<b>Very Good</b>
-Fan Adjustment	<b>Fair;</b> full range of fan speeds not possible with PTO drive
-Maintenance	<b>Very Good;</b> daily servicing took 10 minutes
<b>POWER REQUIREMENTS</b>	About 10 hp (7.5 kW) at fan speed of 5000 rpm, no measurable effect on cultivator draft
<b>OPERATOR SAFETY</b>	Drives well shielded, decals supplied, ladder was too short
<b>OPERATOR'S MANUAL</b>	<b>Very Good</b>
<b>MECHANICAL HISTORY</b>	A few minor problems occurred



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