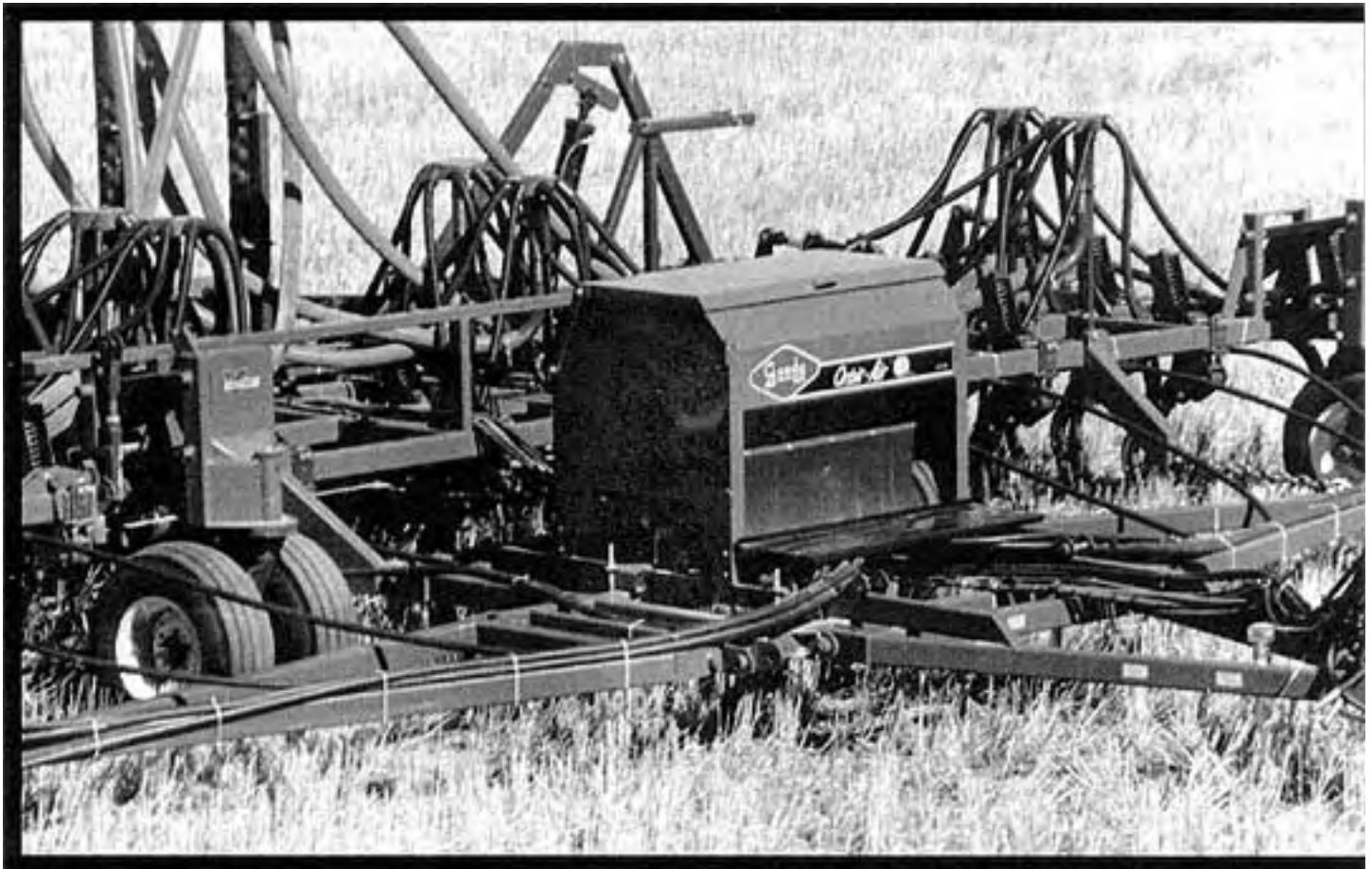


Evaluation Report

661



Gandy Orbit-Air Model 6216

A Co-operative Program Between



GANDY ORBIT-AIR MODEL 6216

MANUFACTURER:

Gandy Company
528 Gandrud Road
Owatonna, Minnesota 55060
U.S.A.
Telephone: (507) 451-5430

DISTRIBUTOR:

Dutch Agri Products
435 Maxwell Crescent
Regina, SK
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Telephone: (306) 721-4966

RETAIL PRICE:

\$5,288.00, (October 1991, f.o.b. Lethbridge, Alberta)

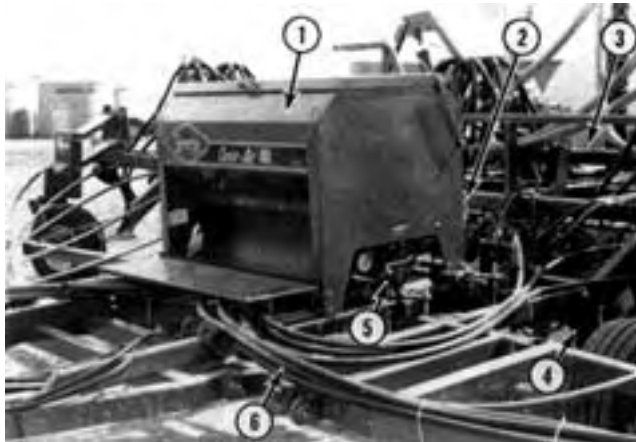


FIGURE 1. Gandy Orbit-Air Model 6216: (1) Tank, (2) Fan, (3) Deflector, (4) Drive Wheel, (5) Meter and (6) Delivery Hose.

SUMMARY AND CONCLUSIONS

QUALITY OF WORK

Laboratory tests were performed with Avadex BW and Treflan QR5. Metering accuracy was good. The manufacturer's rate was accurate for Avadex BW and 14 percent low for Treflan QR5 at an average application rate. The manufacturer's charts did not include high rates for Treflan QR5 and Avadex BW. Uphill slopes caused an increase and downhill slopes caused a decrease in the metering rate.

Uniformity of distribution of the application rate was very good. Variation from the individual outlets for Avadex BW resulted in a CV of 0.9 percent. Variation from the individual outlets for Treflan QR5 resulted in a CV of 1.4 percent.

Spreading uniformity was good. The CV was acceptable (less than 10 percent) for spreading Avadex BW at all combinations of deflector spacings and heights and fan pressures. Unacceptable CV's (greater than 10 percent) resulted at various combinations of deflector spacings and heights and fan pressures while spreading Treflan QRS.

EASE OF OPERATION AND ADJUSTMENT

Ease of performing routine maintenance was very good. The grease fittings were very easily accessible.

Ease of filling and cleaning the hopper was good. The hopper was filled during the test by hand with bagged chemical. The platform on the front of the unit provided adequate support for the person or persons filling the hopper. The mesh screen that prevented foreign material from entering the hopper was bent during the test from supporting bagged chemical while filling. The lid adequately prevented moisture from entering the hopper during the test.

Monitoring was good. The switch box in the tractor cab controlled the electric clutch to turn the metering wheels on and off. The switch box also contained two lights that indicated whether the metering wheels were turning and the system had air pressure.

Ease of setting the application rate was very good. The rate was adjusted by moving the lever on the adjustable speed control. Hydraulic flow to power the centrifugal fan was controlled by a bypass valve located in the hydraulic lines or the tractor hydraulic flow control.

POWER REQUIREMENTS

Maximum power take-off horsepower requirement for the centrifugal fan was 6.3 PTO hp (4.7 kW) at a fan pressure of 12 oz/in² (5.2 kPa).

EASE OF INSTALLATION

Ease of mounting the granular applicator was good. Two people required four hours to mount the complete unit on a Victory Seed-o-vator Air Drill.

OPERATOR SAFETY

The Gandy Orbit-Air was safe to operate if normal safety precautions were observed. Safety equipment was used when filling or cleaning the hopper to prevent exposure to granular chemical. Caution was required when carrying bagged chemical to the hopper to prevent slipping on the frame of the air drill.

OPERATOR'S MANUAL

The operator's manual was very good. It contained useful information on safety, operation, maintenance, trouble shooting, assembly and installation. Separate calibration charts and a parts list were also provided.

MECHANICAL HISTORY

The speed control driveshaft on the hopper was misaligned at the start of the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Extending the calibration charts for Treflan QR5 and Avadex BW to include higher rates at all deflector spacings.
2. Investigating the recommended fan pressure range for spreading Avadex BW.
3. Investigating the recommended fan pressures, deflector spacings and heights for spreading Treflan QR5.
4. Increasing the strength of the mesh screens to prevent bending while filling the hopper with bagged chemical.
5. Relocating the air pressure gauge to a more visible location to allow for all methods of mounting the hopper.
6. Providing calibration charts in SI units as well as in Imperial units.

Manager: Rick Atkins

Project Engineer: Lawrence Papworth

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. The rate charts will be extended to include higher settings as called for.
2. & 3. Gandy Company will follow the recommendations to investigate fan pressures, deflector spacing and deflector height. Additional recommendations will then be printed in the Owner's Manual.
4. Heavier metal bracing will be used to eliminate this situation.
5. The air pressure gauge will be mounted so as to be easily seen from the operator's position. This will be included on future production runs.
6. Gandy Company will supply SI rate charts to their distributor and charts will be included in the Owner's Manual Packet of Materials in all future shipments.

GENERAL DESCRIPTION

The Gandy Orbit-Air model 6216 is an implement mounted pneumatic applicator for distributing granular chemical, fertilizer or seed. The unit can have a maximum broadcast width of 40 ft (12.2 m). The hopper has a capacity of 21.9 cubic feet (0.62 cubic meters).

Material is metered by three different types of interchangeable cogged metering wheels. The standard metering wheel meters granular chemical and small seeds at low rates. Optional metering wheels meter fertilizer and small seeds at high rates or large seeds such as soybeans and field peas. Each of the cogged wheels meter material into a venturi. Any of the sixteen metering wheels can be blocked off by a slide gate to accommodate smaller widths of implements.

A hydraulically driven centrifugal fan conveys the material through PVC delivery hoses from the venturis to the deflectors. The deflectors can be spaced at 24, 27 or 30 in (610, 686 or 762 mm). The speed of the fan is varied by a hydraulic bypass flow valve or the tractor hydraulics. A pressure gauge on the outlet of the fan indicates the operating air pressure.

Application rate is controlled by varying the speed of the metering wheels. The speed is adjusted through a variable speed gearbox. The gearbox is driven by a ground engaging drive wheel. The metering wheels are shut on and off by raising the ground engaging drive wheel or with an optional electric clutch. The clutch is remotely controlled by a switch box in the tractor. The switch box also has warning lights for metering wheel motion and system air pressure.

The Gandy Orbit-Air model 6216 was mounted on a 37.5 ft (11.4 m) Victory Seed-o-vator Air Drill (Evaluation Report No. 599). The 30 in (762 mm) deflector spacing was used. One of the sixteen metering wheels was blocked off for the field test. The optional electric clutch and switch box was evaluated as part of the system. The test unit required the use of one set of remote hydraulics. FIGURE 1 shows the location of major components while detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The machine evaluated by the Alberta Farm Machinery Research Centre (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 or 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 the manufacturer or AFMRC to determine changes in performance.

The Gandy Orbit-Air Granular Applicator was operated for 30 hours while spreading Avadex BW on 350 ac (140 ha) and Fortress on 160 ac (64 ha).

The applicator was evaluated for quality of work, ease of operation and adjustment, ease of installation, power requirements, operator safety and suitability of the operator's manual. The quality of work was measured in the laboratory.

RESULTS AND DISCUSSION

QUALITY OF WORK

Metering Accuracy: Metering accuracy of the Gandy Orbit-Air was good. The metering system was calibrated in the laboratory with Avadex BW and Treflan QR5. The calibration curves for the granular applicator at a 30 in (762 mm) deflector spacing with Avadex BW and Treflan QR5 are given in FIGURES 2 and 3. The manufacturer's rate was the same as the rate obtained by AFMRC for Avadex BW at a normal operating meter setting of 20. The manufacturer's rate was 14 percent lower than the rate obtained by AFMRC for Treflan QR5 at a normal operating meter setting of 16. The maximum rate on the manufacturer's chart for Treflan QR5 at a 30 in (762 mm) deflector spacing was 16 lb/ac (18 kg/ha). The manufacturer of Treflan QR5 recommended rates of 15 to 30 lb/ac (17 to 34 kg/ha).

The maximum rate on the manufacturer's chart for Avadex BW at a 30 in (762 mm) deflector spacing was 15.2 lb/ac (17 kg/ha). The manufacturer of Avadex BW recommended rates of 10 to 20 lb/ac (11 to 22 kg/ha). It is recommended that the manufacturer consider extending the calibration charts for Treflan QR5 and Avadex BW to include higher rates at all deflector spacings.

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

Operating the granular applicator on side slopes did not affect metering rates. Operating on uphill and downhill slopes did affect metering rates. A 10 degree uphill slope caused a 7 percent increase

and a 10 degree downhill slope caused a 9 percent decrease in the metering rate with Avadex BW. A 10 degree uphill slope caused an 11 percent increase and a 10 degree downhill slope caused a 5 percent decrease in the metering rate with Treflan QR5.

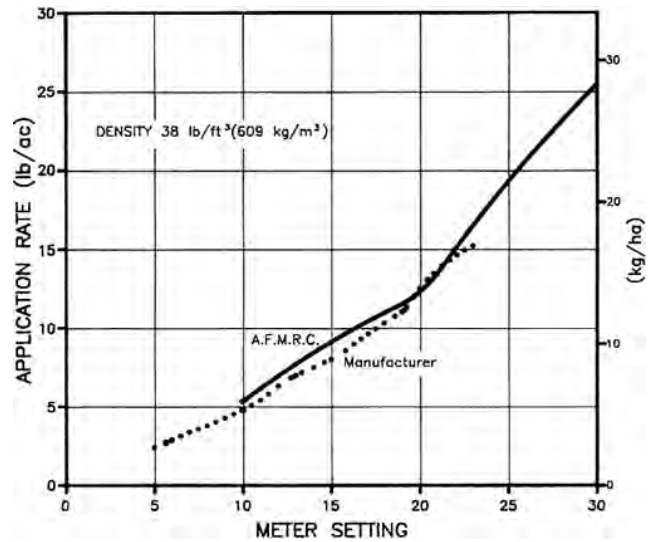


FIGURE 2. Metering Accuracy with Avadex BW.

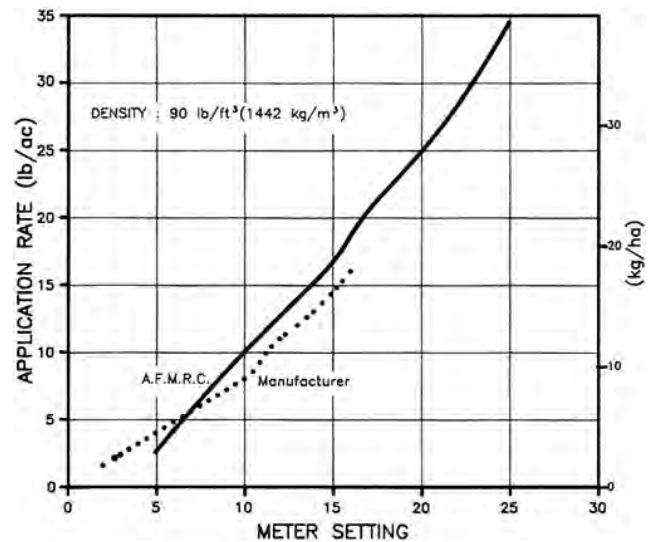


FIGURE 3. Metering Accuracy with Treflan QR5.

The manufacturer recommended that a field calibration of the metering rate be performed before field operation. The procedure for the calibration was to place and tie securely bags over each deflector. The unit was then operated over a calibrated distance. The total weight of material from the bags was then weighed and put into a formula in the owner's manual. Field calibration method was found to be accurate.

Distribution Uniformity: Uniformity of distribution of the application rate for the Gandy Orbit-Air granular applicator was very good. FIGURE 4 shows the delivery rate for each of the 16 outlets while applying Avadex BW at a rate of 12.6 lb/ac (14.1 kg/ha). Application rates from the individual outlets varied from 12.4 to 12.8 lb/ac (13.9 to 14.3 kg/ha) resulting in a coefficient of variation¹ (CV) of 0.9 percent.

FIGURE 5 shows the delivery rate for each of the 16 outlets while applying Treflan QR5 at a rate of 20.6 lb/ac (23 kg/ha). Application rates from the individual outlets varied from 20 to 21.1 lb/ac (22.4 to 23.6 kg/ha) resulting in a coefficient of variation of 1.4 percent.

Variations in fan pressure, metering rate, delivery hose length and field slopes had no significant effect on the delivery rates of individual outlets while applying Avadex BW and Treflan QR5.

¹The coefficient of variation (CV) is the standard deviation of the application rate. A low CV represents uniform application whereas a high CV indicates non-uniform application.

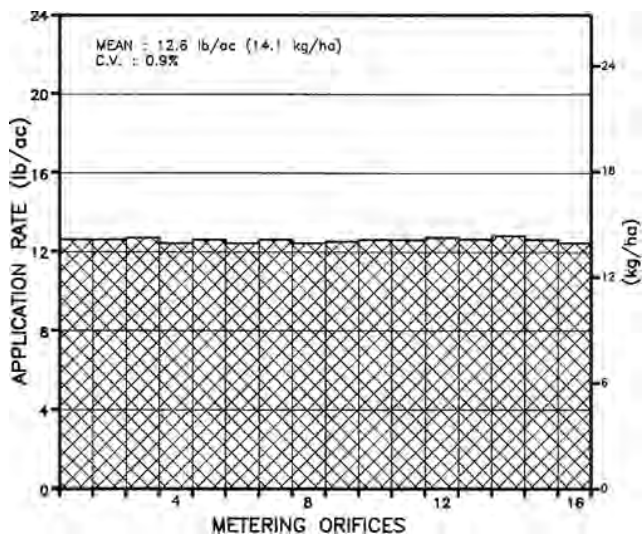


FIGURE 4. Variation in Delivery Rates from individual outlets when applying Avadex BW at 12.6 lb/ac (14.1 kg/ha).

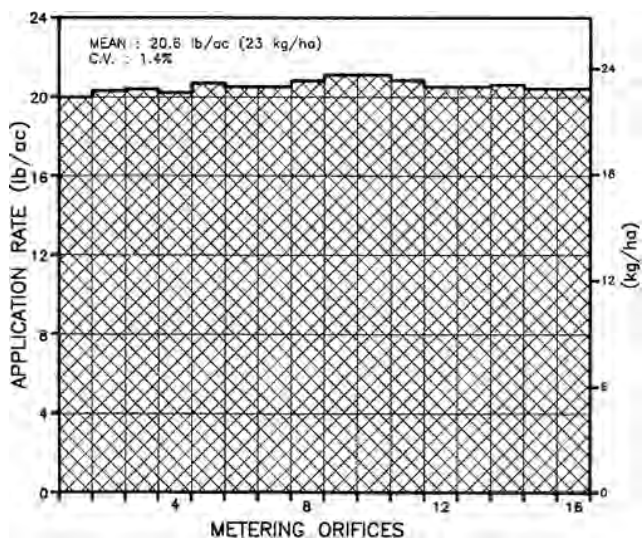


FIGURE 5. Variation in Delivery Rates from individual outlets when applying Treflan QR5 at 20.6 lb/ac (23 kg/ha).

One granular herbicide manufacturer has suggested that the CV should be no greater than 10 percent. A CV of 10 percent is used through this report as a dividing point between acceptable and unacceptable uniformity.

Spreading Uniformity: Spreading uniformity of the Gandy Orbit-Air Granular Applicator was good. Pneumatically conveyed granules were spread over the soil by a deflector (FIGURE 6). Each deflector consisted of a single plate with a downward bend and a tube holder. Deflectors could be spaced at 24, 27 or 30 in (610, 686 or 762 mm). The spacing depended on the width of the tillage implement. The manufacturer recommended a deflector height of 14 to 18 in (356 to 457 mm) when using a spacing of 24 in (610 mm) and a height of at least 18 in (457 mm) when using a spacing of 27 or 30 in (686 or 762 mm). The system was tested in the laboratory at the 24 and 30 in (610 and 762 mm) deflector spacings.

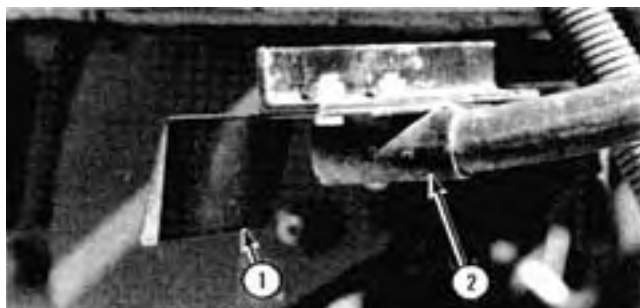


FIGURE 6. Deflectors: (1) Deflector Plate, (2) Tube Holder.

FIGURE 7 shows a typical distribution of Avadex BW when applying 14.6 lb/ac (16.4 kg/ha) using a 30 in (762 mm) deflector spacing, a 22 in (559 mm) deflector height and a fan pressure of 8 oz/sq in (3.5 kPa). Application rates varied from 13.0 to 16.5 lb/ac (14.6 to 18.5 kg/ha) across the width, resulting in a pattern with a CV of 5.6 percent. The spreading uniformity of Avadex BW was affected by variations in fan pressure, deflector spacing and deflector height. In all cases the CV was still 8 percent or less. Lowering the deflector height from 22 in (559 mm) to 18 in (457 mm) lowered the CV of the spread pattern from 5.6 to 5.1 percent. Metering rate had no effect on the spreading uniformity. Changing the deflector spacing to 24 in (610 mm) and deflector height to 14 in (356 mm) resulted in a CV of 6.5 percent. Lowering the fan pressure to 5 oz/sq in (2.2 kPa) increased the CV to 7.9 percent. This fan pressure was lower than the range of 8 to 12 oz/sq in (3.5 to 5.2 kPa) recommended by the manufacturer for granular chemical. Less power was required to operate the fan at the lower pressures. It is recommended that the manufacturer consider investigating the recommended fan pressure range for spreading Avadex BW.

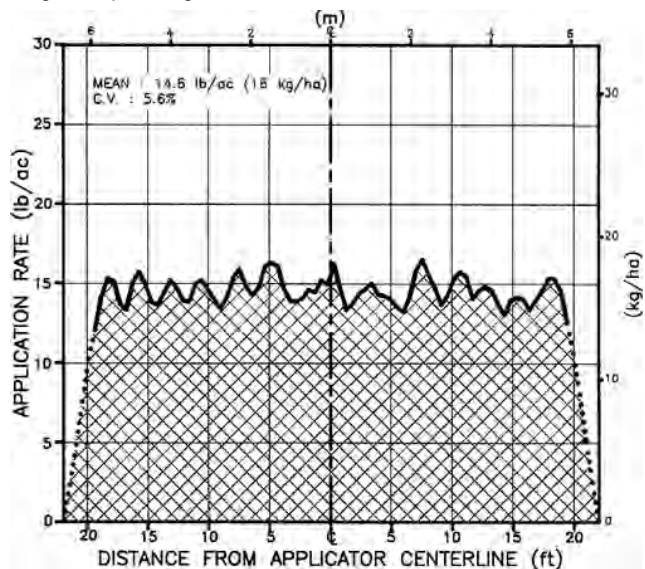


FIGURE 7. Distribution Pattern when Applying 14.6 lb/ac (16.4 kg/ha) of Avadex BW using a 30 in (762 mm) deflector spacing, a 22 in (559 mm) deflector height and a fan pressure of 8 oz/sq in (3.5 kPa).

The typical distribution of Treflan QR5 when applying 21.9 lb/ac (24.5 kg/ha) using a 30 in (762 mm) deflector spacing, a 22 in (559mm) deflector height and a fan pressure of 12 oz/sq in (5.2 kPa) is shown in FIGURE 8. Application rates varied from 19.1 to 26.1 lb/ac (21.4 to 29.2 kg/ha) across the width, resulting in a pattern with a CV of 7.0 percent. The spreading uniformity of Treflan QR5 was not affected by variations in metering rate but was affected by variation in fan pressure, deflector spacing and deflector height. Lowering the deflector height to 18 in (457 mm) from 22 in (559 mm) with a 30 in (762 mm) deflector spacing raised the CV to 10.4 percent. Lowering the fan pressure from 12 oz/sq in (5.2 kPa) to 8 oz/sq in (3.5 kPa) with a 30 in (762 mm) deflector spacing and a deflector height of 18 in (457 mm) increased the CV to 12.6 percent. Using a 24 in (610 mm) deflector spacing with a deflector height of 18 in (457mm) resulted in a CV of 8.1 percent. Lowering the deflector height to 14 in (356 mm) for the above setup further increased the CV to 12.7 percent. Unacceptable CV's occurred at the lower deflector heights. It is recommended that the manufacturer consider investigating the recommended fan pressures, deflector spacings and heights for spreading Treflan QR5.

EASE OF OPERATION AND ADJUSTMENT

Maintenance: Ease of performing routine maintenance on the Gandy Orbit-Air was very good. Grease fittings were easily accessible. A service schedule was not provided. One person required five minutes to service the five grease fittings and check the oil level in the adjustable speed control. Filling/Cleaning: Ease of filling and cleaning the hopper on the Gandy Orbit-Air was good. The hopper was filled during the test by hand with bagged chemical. Bulk chemical could be put into the hopper using a small auger or

bulk bags with a front end loader tractor. The 14 by 51 in (360 by 1300 mm) platform on the front of the unit provided adequate support for the person or persons filling the hopper. A mesh screen under the lid prevented foreign material from entering the hopper. The mesh screen was divided into four sections for easy removal. The screen was bent during the test from supporting the bagged chemical while filling. It is recommended that the manufacturer consider increasing the strength of the mesh screens to prevent bending while filling the hopper with bagged chemical. The hopper held 820 lb (370 kg) of Avadex BW. This would cover 66 ac (26 ha) when applied at 12.5 lb/ac (14 kg/ha). The lid adequately prevented moisture from entering the hopper during the test. Large amounts of material were cleaned out of the hopper with a pail or by removing an outlet and draining the material into a container.

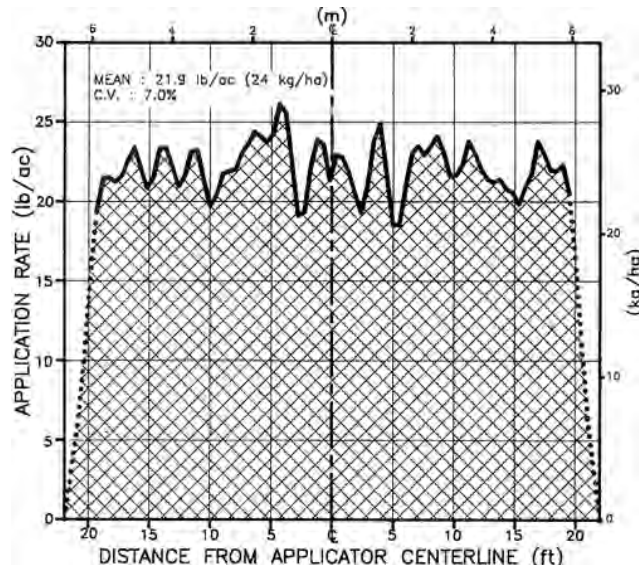


FIGURE 8. Distribution Pattern when Applying 21.9 lb/ac (24.5 kg/ha) of Treflan QR5 using a 30 in (762 mm) deflector spacing, a 22 in (559 mm) deflector height and a fan pressure of 12 oz/in² (5.2 kPa).

The complete metering system could also be removed allowing the material to fall on a canvas or plastic. Small amounts of material were cleaned out with a vacuum. The air chamber was cleaned by removing the plug on either end of chamber and inserting a vacuum hose. The 24 by 51 in (610 by 1300 mm) hopper opening and the platform at the front of the tank made the hopper accessible for cleaning with a pail or vacuum.

Monitoring: Monitoring for the Gandy Orbit-Air was good. The metering wheels were turned on and off from the tractor cab by a switch box controlling an electric clutch. The switch box also contained two lights that indicated whether the metering wheels were turning and the system had air pressure. A gauge (FIGURE 9) located on the fan outlet monitored air pressure. The gauge was not visible while adjusting the hydraulic bypass valve. It is recommended that the manufacturer consider relocating the air pressure gauge to a more visible location to allow for all methods of mounting the hopper.



FIGURE 9. Air Pressure Gauge.

Application Rate: Ease of setting the application rate was very good. The rate was adjusted by moving the lever on the adjustable speed control (FIGURE 10). The meter setting numbers were determined from the calibration charts. The speed control scale ranged from 0 to 4.3 in one tenth unit markings.

Removing and installing the meter wheel shaft took one person approximately fifteen minutes. The shaft could be removed and installed with material in the hopper.

Air flow from the fan was varied by changing the fan speed. The fan speed was controlled by the flow of hydraulic oil from the tractor and this was regulated by an inline hydraulic bypass valve.



FIGURE 10. Adjustable Speed Control.

POWER REQUIREMENTS

Hydraulic: Maximum hydraulic flow requirement for the centrifugal fan was 8.7 gal/min (39.6 L/min) at 820 psi (5650 kPa). This was measured at a fan pressure of 12 oz/in² (5.2 kPa). Flow requirements for the centrifugal fan decreased as the air pressure decreased.

Tractor Size: Maximum horsepower requirement for the centrifugal fan was 6.3 PTO hp (4.7 kW) at a fan pressure of 12 oz/in² (5.2 kPa).

EASE OF INSTALLATION

Ease of mounting the Gandy Orbit-Air granular applicator was good. Two people required four hours to mount the complete unit on a Victory Seed-o-vator Air Drill (FIGURE 11). The hopper was held to the floating hitch of the air drill with bar clamps. The deflector mounting bars were mounted behind the first row of shanks. The ground drive wheel (FIGURE 12) was also attached to the floating hitch of the air drill. Spring pressure was used to hold the drive wheel on the ground while operating at an average seed depth. The cable and pulley system was not used to raise and lower the ground drive wheel because the variation in operating depths was small.

The electrical harness and the hydraulic hoses had to be lengthened to reach the tractor.



FIGURE 11. Gandy Orbit-Air Model 6216 mounted on Victory Seed-o-vator Air Drill.



FIGURE 12. Ground Drive Wheel.

OPERATOR SAFETY

The Gandy Orbit-Air was safe to operate if normal safety precautions were observed. Safety equipment was used when filling or cleaning the hopper to prevent exposure to granular chemical. All moving parts were adequately shielded. Caution was required when carrying bagged chemical to the hopper to prevent slipping on the frame of the air drill.

OPERATOR'S MANUAL

The operator's manual was very good. It contained useful information on safety, operation, maintenance, trouble shooting, assembly and installation. Separate calibration charts, and a parts list were also provided. Calibration charts were provided for alfalfa, flax, oats, sorghum, wheat, and many granular fertilizers and chemicals. The application rates were only given in Imperial units. It is recommended that the manufacturer consider providing calibration charts in SI units as well as in Imperial units.

MECHANICAL HISTORY

The Gandy Orbit-Air was operated for 30 hours while applying granular chemical on 510 ac (204 ha). The intent of the test was the evaluation of functional performance and an extended durability test was not conducted.

The speed control drive shaft on the hopper was misaligned at the start of the test. The housing for the shaft was aligned with washers and secured in place with four fasteners instead of two fasteners. Some of the delivery hoses had to be rerouted during the first part of the field test due to rubbing on the frame of the air drill. The metering wheels were protected from the sunlight by a canvas, which hung from the hopper.

APPENDIX I SPECIFICATIONS

MAKE:	Gandy Orbit-Air Granular Applicator
MODEL:	6216
SERIAL NUMBER:	8166
MANUFACTURER:	Gandy Company 11-528 Gandrud Road Oatonna, Minnesota 55060 U.S.A.
TELEPHONE:	(507) 451-5430
DIMENSIONS:	
-- height	3.6 ft (1.1 m)
-- width	5.2 ft (1.6 m)
-- length	5.9 ft (1.8 m)
METERING SYSTEM:	
-- type	externally clogged metering wheels
-- number of meters	16
-- drive	chain driven from ground engaging wheel
-- adjustment	zero max speed control
-- airstream loading	venturi
-- transfer system	pneumatic conveyance through 1.0 in (25 mm) PVC hoses
SPREADING SYSTEM:	
-- spreader type	single plate deflectors
-- deflector spacing	24, 27 or 30 in (610, 686 or 762 mm)
-- deflector height	14 to 18 in (356 to 457 mm) at 24 in (610 mm) spacing 18 in (457 mm) or greater at 27 and 30 in (686 and 762 mm) spacing
FAN:	
-- type	radial blade centrifugal
-- drive	hydraulic from tractor remote
HOPPER CAPACITY:	21.9 ft ³ (0.62 m ³)
WEIGHTS:	
-- hopper	705 lb (320 kg)
-- accessories	<u>190 lb (86 kg)</u>
Total	895 lb (406 kg)
NUMBER OF CHAIN DRIVES:	4
NUMBER OF LUBRICATION POINTS:	5 grease nipples; 1 gearbox
NUMBER OF SEALED BEARINGS:	11
GROUND DRIVE:	
-- tire	6 x 12, 2-ply super lug
-- pivot to center of wheel	28 in (710 mm)
OPTIONS INCLUDED ON TEST MACHINE:	-- electric clutch for metering system
OTHER AVAILABLE OPTIONS:	-- metering wheels for fertilizer and small seeds and for large seeds.

APPENDIX II MACHINE RATINGS

The following rating scale is used:

Excellent	Very Good
Good	Fair
Poor	Unsatisfactory

SUMMARY CHART

GANDY ORBIT-AIR MODEL 6216 GRANULAR APPLICATOR

RETAIL PRICE:	\$5,288.00 (October 1991, f.o.b. Lethbridge, Alberta)
QUALITY OF WORK:	
Metering Accuracy:	good ; 14% low with Treflan QR5 at average application rate
Distribution Uniformity:	very good ; CV of 0.9% for Avadex BW and 1.4% for Treflan QR5
Spreading Uniformity:	good ; unacceptable CV's could be obtained with Treflan QR5
EASE OF OPERATION AND ADJUSTMENT:	
Maintenance:	very good ; grease fittings easily accessible
Filling/Cleaning:	good ; platform on front provided adequate support while filling
Monitoring:	good ; warning lights for metering and fan pressure
Application Rate:	very good ; adjusted by lever on speed control
POWER REQUIREMENTS:	maximum of 6.3 PTO hp (4.7 kW) required for centrifugal fan with granular chemical
EASE OF INSTALLATION:	good ; two people required four hours to mount on air drill
OPERATOR SAFETY:	safe; caution taken when carrying bagged chemical to hopper
OPERATOR'S MANUAL:	very good ; useful information
MECHANICAL HISTORY:	speed control drive shaft on hopper misaligned at start of test



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