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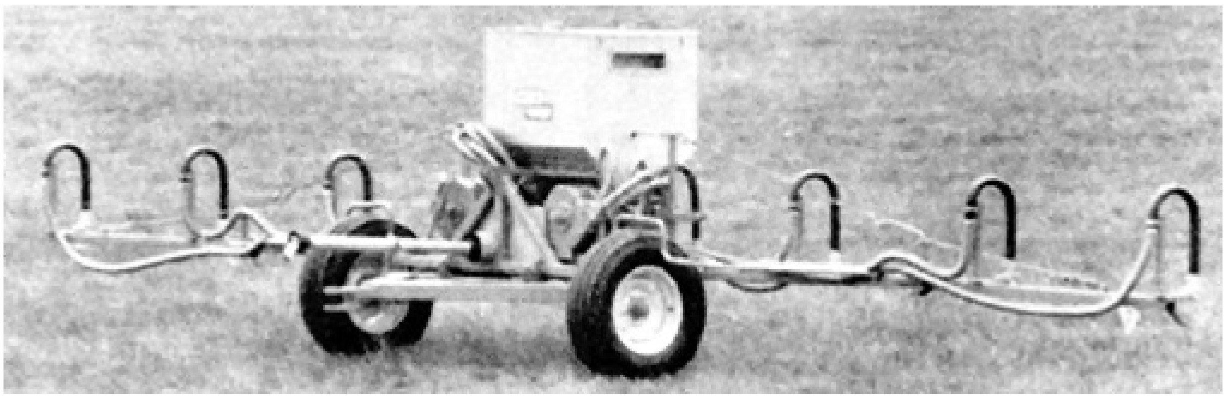

Horstine Model TMA 4, 10 m (32 ft) Airflow Granular Applicator

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

HORSTINE MODEL TMA 4, 10 m (32 ft) AIRFLOW GRANULAR APPLICATOR

MANUFACTURER:

Applicator
Horstine Farmery Limited
North Newbald
York Y04 3SP
England

Trailer and Hopper Assembly
Spierco Industries Limited
727 - 42 Avenue S.E.
Calgary, Alberta
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DISTRIBUTOR
Spierco Industries Ltd., Calgary

RETAIL PRICE:
$5,195.00 (June, 1978, f.o.b. Calgary)

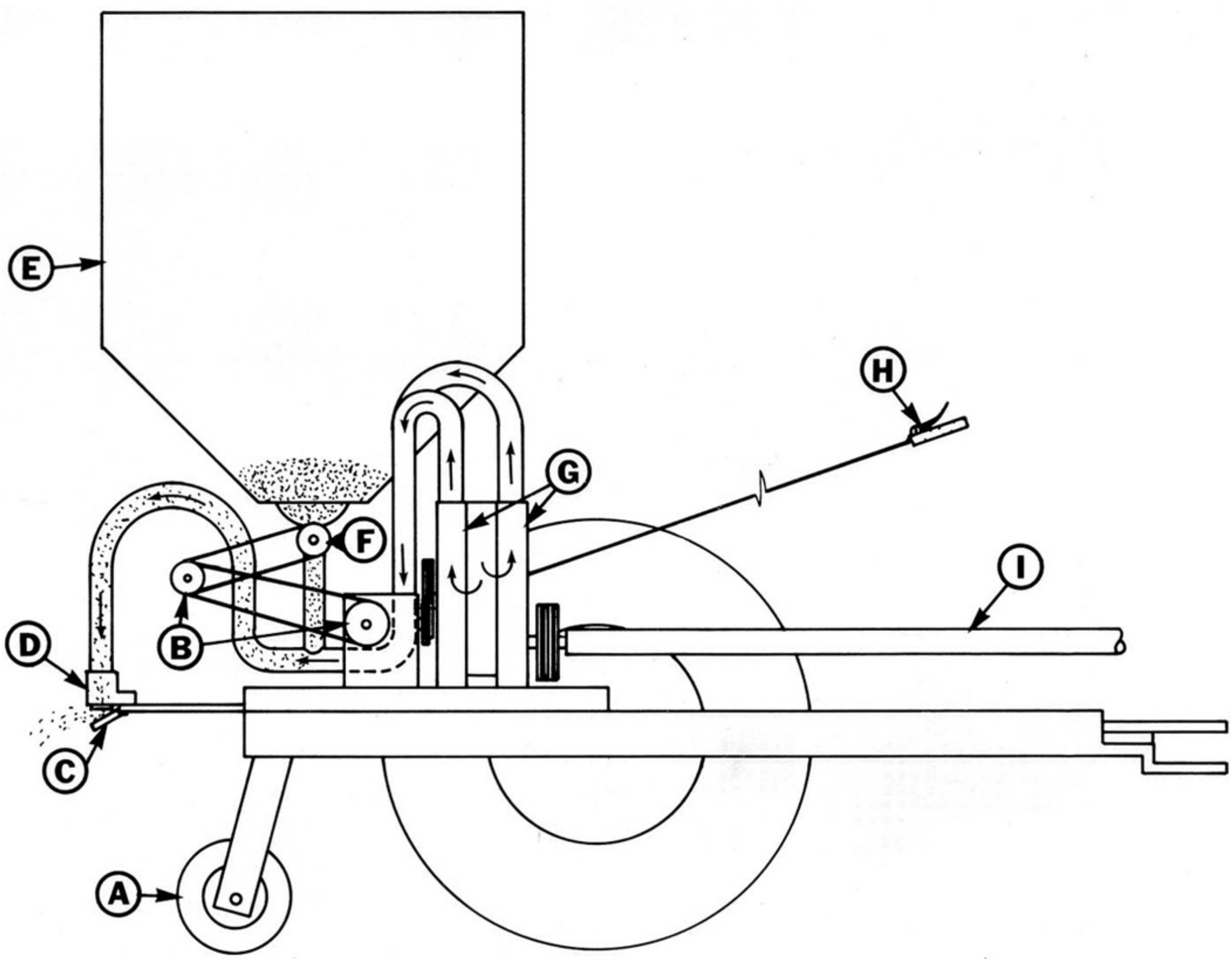

FIGURE 1. Schematic View of Horstine Granular Applicator: (A) Rear Wheel, (B) Interchangeable Meter Drive Sprockets, (C) Impact Plate, (D) Nozzle, (E) Hopper, (F) Meter, (G) Fans, (H) Meter Drive Clutch Control, (I) Power Shaft.

SUMMARY AND CONCLUSIONS

Overall functional performance of the Horstine TMA 4, 10 m (32 ft) airflow granular applicator was *fair.* Metering uniformity was *very good.* Distribution of granules on the soil surface was *good* when applying Avadex BW or low rates of Treflan on smooth fields in calm weather. Distribution was *fair* at high application rates of Treflan. Functional performance was reduced by inconvenient hitching, complicated calibration procedures, excessive boom bounce on rough fields, and poor trailer balancing. Durability of the Horstine during functional testing was *poor.*

The Horstine had a sufficient range of adjustment to suit recommended application rates for both granular Avadex BW and Treflan. Calibration procedure was complicated and inconvenient since the metering mechanism was driven by the tractor power take-off, rather than from a ground wheel. This meant that both the tractor ground speed in a specific gear and the metering drive sprockets had to be selected to suit specific application rates. The manufacturer's calibration chart was fairly accurate, since it read from 1.2 to 1.6 kg/ha (1.1 to 1.4 lb/ac) low for Avadex BW. The chart was incomplete since it suited only two application rates for granular Avadex BW. Application rates were not affected by field roughness, field slope, or level of granules in the hopper. Application rate was not affected by changing the engine speed in the tractor gear for which the applicator had, been calibrated. Changing tractor gears, however, necessitated recalibration.

The delivery of granules from the individual metering mechanisms was very uniform with a coefficient of variation less than 2%. Distribution across the spreading width was uniform on smooth fields, with a coefficient of variation of only 10% over the normal range of application rate for Avadex BW. Distribution patterns at higher rates of granular Treflan were tess uniform. Distribution in the direction of travel was uniform with no detectible surging. Excessive boom bounce on rough fields and variation in boom height on rolling fields severely reduced distribution pattern uniformity, necessitating thorough soil incorporation to get uniform distribution in the soil. The tractor power take-off had to be operated at 540 rpm to obtain best distribution pattern uniformity. Operating at reduced power take-off speeds caused distribution pattern deterioration.

The Horstine applicator performed well on smooth soft fields with a maximum field capacity of about 13 ha/h (31 ac/h). Field capacity was significantly reduced on rough fields as slower speeds were required to prevent excessive boom bounce. The hopper held about 260 kg (570 lb) of Avadex BW which was sufficient to cover about 19 ha (48 ac) without filling, at common application rates. The hopper lid was weathertight. The hopper was of suitable height for easy filling from a truck box. The hopper emptied uniformly and was easy to clean.

The Horstine applicator was convenient to operate in the field and was very easy to fold into field or transport position, taking one man about one minute. The only marks left in the field were those of the tractor and trailer wheels, necessitating the need for a marker to avoid overlap and misses. Granules being discharged by the distribution nozzles could not be seen from the tractor seat, however, metering mechanism rotation could be observed. The metering drive could be conveniently started and stopped from the tractor seat.

Hitching was inconvenient due to the negative hitch weight. The rear of the applicator had to be jacked and the wheels blocked to prevent jack slippage. Since the hitch was not adjustable, the applicator could not be levelled with many tractors. The rear support wheel had to be removed to allow hitching and field operation with tractors having high drawbars. With the rear support wheel removed, the applicator had to be unhitched with caution and blocked to prevent it from tipping rearward. Towing the applicator with a filled hopper was hazardous, even at moderate transport speeds, due to swaying resulting from poor weight distribution.

Many mechanical problems occurred during the test. Interference occurred among the power take-off shaft, hitch and shaft transport bracket. The rear support wheel bearing had to be replaced twice, the right axle spindle broke during transport and the hopper bottom developed fatigue cracks.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Investigating the use of a ground drive for the metering mechanism to improve ease of calibration.
2. Supplying more comprehensive and accurate calibration charts, covering the full range of application rates for Avadex BW and Treflan.
3. Investigating the possibility of using boom support wheels and pivoting boom assemblies to reduce boom bounce and boom height variation on rough and rolling fields.
4. Investigating the possibility of modifying applicator weight distribution, to eliminate the need for a rear support wheel and to improve machine balance.
5. Incorporating an adjustable hitch to permit frame levelling over a complete range of tractor drawbar heights.
6. Modifications to eliminate interference among the power take-off shaft, the hitch and the shaft transport bracket.
7. Modifications to prevent premature fatigue failure of the hopper bottom.
8. Modifications for convenient meter drive chain adjustment for all meter drive sprocket combinations.
9. Improving quality control during assembly to eliminate problems such as loose set screws, interference between air hoses and wheels, improper alignment of chains and inability to fully lower the booms.
10. Providing operating instructions in both English and SI units, to facilitate applicator operation after conversion to the SI system.
11. Supplying a slow moving vehicle sign.

Chief Engineer - E. O. Nyborg
Senior Engineer - E. H. Wiens
Project Engineer - K. W. Drever

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. An optional landwheel drive is available at no additional charge.
2. Accurate, comprehensive and complete calibration charts will be provided.
3. This recommendation will be taken under consideration.
4. Modifications have been made to improve weight distribution and eliminate the rear support wheel.
5. An adjustable hitch will be incorporated on future models.
6. Modifications have been made to eliminate this interference.
7. The hopper supports have been modified to prevent hopper bottom failure.
8. Modifications to the chain adjusting mechanism will be made.
9. Quality control has been improved.
10. Operating instructions will be provided in both English and SI units.
11. A bracket for mounting a slow moving vehicle sign will be provided.

GENERAL DESCRIPTION

The Horstine TMA 4 is a trailer mounted pneumatic granular applicator. Granules are metered from a 0.38m^3 (13.5 ft^3) hopper by eight fluted feed metering mechanisms and are pneumatically conveyed across the machine width by four fans feeding eight distribution nozzles. The nozzles, which are spaced at 1.2 m (4 ft), discharge onto impact plates, resulting in a spreading width of 9.8 m (32 ft). The fans and metering mechanisms are driven from the tractor power take-off. Application rate is controlled by changing meter drive sprockets and selecting an appropriate tractor gear.

Distribution booms fold upward for transporting.

FIGURE 1 shows a schematic view of the Horstine applicator while detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Horstine applicator was operated for 22 hours while spreading granular Avadex BW on about 240 ha (590 ac). Field speeds ranged from 6 km/h (4 mph) on rough fields to 13 km/h (8 mph) on smooth, soft fields.

The applicator was evaluated for quality of work, ease of operation, power requirements, operator safety and suitability of the operator's manual. Metering and distribution accuracy was evaluated in the laboratory with Avadex BW and Treflan. Standard procedures[1] were used to determine the effect of field and machine variables on metering and distribution.

[1] *PAMI T772-R78, Detailed Test Procedures for Granular Applicators.*

RESULTS AND DISCUSSION

QUALITY OF WORK

Calibration Chart Accuracy: FIGURE 2 compares the manufacturer's calibration for Avadex BW with PAMI calibrations for both granular Avadex BW and granular Treflan. The manufacturer did not supply a calibration chart for Treflan, but FIGURE 2 shows there was sufficient adjustment to achieve the 28 kg/ha (25 lb/ac) application rate recommended for Treflan. The manufacturer's calibration chart for Avadex BW was in error, reading from 1.2 to 1.6 kg/ha (1.1 to 1.4 lb/ac) low over the normal range of application rates. Application rates were not affected by field roughness, level of material in the hopper, field slope or tractor engine speed. Since the metering mechanism was driven from the power take-off, reducing the engine speed reduced ground speed and metering speed proportionally, resulting in a constant application rate. Operating the power take-off at speeds below 540 rpm, however, resulted in poor distribution patterns. Changing tractor gears changed the application rate since the metering mechanism speed and ground speed were now at a different ratio.

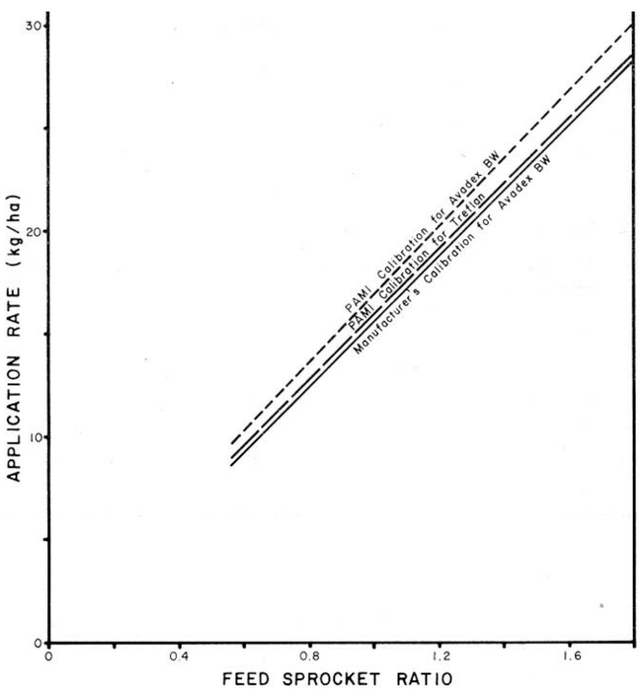

FIGURE 2. Calibration Curves for Avadex BW and Treflan at 540 rpm Power Take-off Speed and 9 km/h (5.6 mph).

Metering Accuracy: FIGURE 3 shows typical delivery rates from eight fluted metering mechansims which feed the distribution nozzles. Output of the adjacent metering mechanisms was very uniform over the common range of application rates with a coefficient of variation[2] less than 2%. For example, at 9 km/h (5.6 mph), using 22 and 28 tooth sprockets, application rates of adjacent metering mechanisms varied from 14.2 to 14.6 kg/ha (12.6 to 13.0 lb/ac), resulting in a CV of only 1%.

Spreading Accuracy: Granules delivered by the eight metering mechan, isms are pneumatically conveyed to the boom and are discharged through eight nozzles spaced at 1.2 m (4 ft). The nozzles discharge onto impact plates (FIGURE 4), spreading the granules across the operating width. FIGURE 5 shows a typical distribution of Avadex BW on the ground when applying 12 kg/ha (11 lb/ac) at 9 km/h (5.6 mph). Application rates varied from 10 to 16 kg/ha (9 to 14 lb/ac) across the spreading width, resulting in a CV of 10%.

[2]The coefficient of variation (CV) is the standard deviation of the application rates, expressed as a percent of the mean application rate. A low CV represents uniform application whereas a high CV indicates non-uniform application. One granular herbicide manufacturer has suggested that the CV should be no greater than 10%.

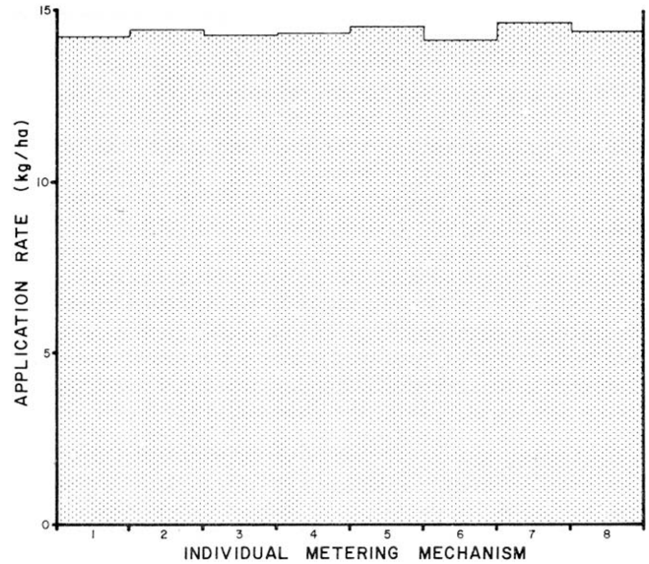

FIGURE 3. Typical Application Rates of Avadex BW for Individual Metering Mechanisms at 540 rpm Power Take-off Speed and 9 km/h (5.6 mph) with 0.79 Sprocket Ratio (22 and 28 Tooth Sprockets).

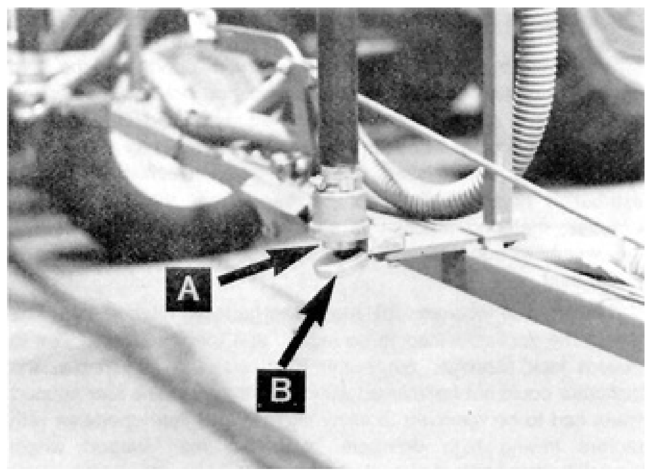

FIGURE 4. Distribution System: (A) Nozzle, (B) Impact Plate.

Spreading uniformity for Avadex BW was not influenced by the application rate over the normal range of application rates. Distribution patterns similar to those shown in FIGURE 5, with a CV of about 10%, occurred over a range of application rates from 12 to 24 kg/ha (11 to 21 lb/ac).

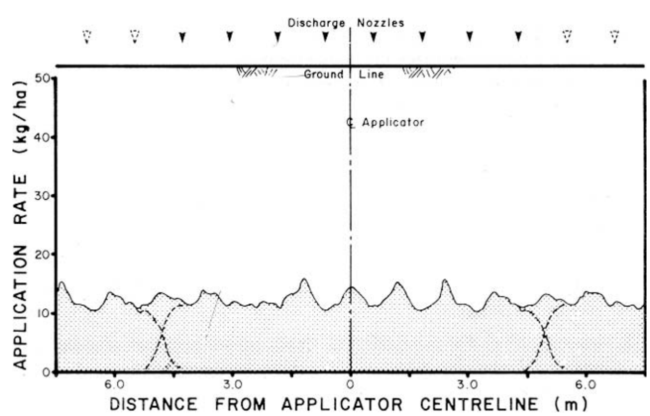

FIGURE 5. Typical Distribution Pattern when Applying 12 kg/ha (11 lb/ac) of Avadex BW at 540 rpm Power Take-off Speed and 9 km/h (5.6 mph).

Distribution pattern uniformity for granular Treflan was quite dependent on the application rate and poorer distribution patterns usually occurred with Treflan than with Avadex BW. FIGURE 6 shows a typical distribution of Treftan on the ground when applying 26 kg/ha (23 lb/ac) at 9 km/h (5.6 mph). Application rates varied from 18 to 41 kg/ha (16 to 37 l b/ac) across the spreading width, resulting in a CV of 23%. At reduced application rates, spreading uniformity improved. For example, when applying 17 kg/ha (15 lb/ac) the CV was only 9%. Recommended application rates for granular Treflan range from 17 to 28 kg/ha (15 to 25 lb/ac).

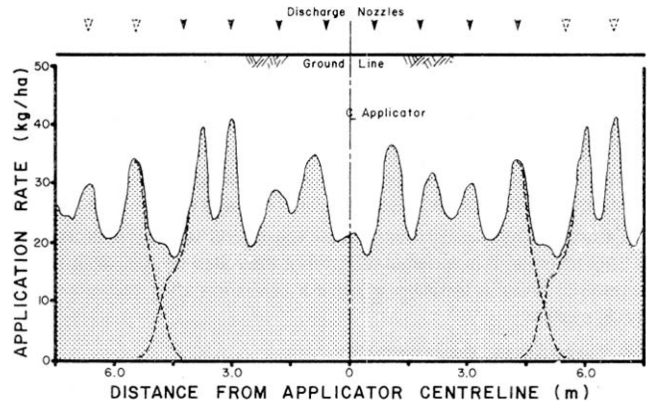

FIGURE 6. Typical Distribution Pattern when Applying 26 kgha (23 lb/ac) of Treflan at 540 rpm Power Take-off Speed and 9 km/h (5.6 mph).

Distribution patterns, especially at higher application rates, deteriorated if the power take-off was operated at reduced speed. It was important to run the power take-off at 540 rpm to obtain the best distribution. The distribution patterns shown in FIGURES 5 and 6 represent operation on smooth level fields on calm days. High wind and boom bounce on rough fields would change these patterns considerably. Since there were no supporting wheels under the outer boom ends, large boom height variation occurred on rolling land, significantly influencing the distribution patterns. Thorough soil incorporation was necessary to get uniform distribution in the soil.

Distribution in the direction of travel was uniform with no detectable surging.

EASE OF OPERATION

Hitching: The Horstine applicator was inconvenient to hitch to a tractor. A jack was needed at the rear of the applicator to hold the hitch at the proper level. The wheels also had to be blocked to prevent the jack from slipping. The quick disconnect power take-off coupler was easy to connect.

Hitch height was not adjustable and it was impossible to level the hitch with some tractors, making it necessary to remove the rear wheel before operation (FIGURE 7). With the rear wheel removed, the applicator had to be blocked at the rear when unhitching to prevent it from tipping backwards. Modifications are recommended to permit the hitch to be adjusted to suit various tractor drawbar heights.

FIGURE 7. Tilting Frame Necessitating Rear Wheel Removal when Attached to Tractors with High Drawbars

Hopper: The hopper was convenient to Icad from the back of a truck. It was too high for easy loading while standing on the ground.

The hopper held about 260 kg (570 lb) of Avadex BW which was sufficient to cover about 19 ha (48 ac) before refilling, when applying 13.5 kg/ha (12.0 lb/ac). The hopper emptied uniformly with only about 2.5 kg (5.5 lb) of granules remaining in the hopper. Plugs at the rear of each metering mechanism were easily removed for hopper cleaning. The hopper lid was weathertight. No leakage of rain into the hopper occurred during the test.

Setting the Application Rate: Application rate was adjusted either by changing sprockets on the meter drive (FIGURE 8) or changing the tractor gear. This was a complicated procedure. Tractor forward speed in the desired working gear had to be determined for an engine speed giving 540 rpm power take-off speed. The meter drive sprockets then had to be selected to match the desired application rate at that tractor forward speed. Since the metering mechanisms were driven from the tractor power take-off, tractor engine speed did not affect the application rate while working in the same tractor gear. Changing tractor gears, however, affected the application rate. It is recommended that the manufacturer consider incorporation of a ground drive for the metering mechanism to improve ease of calibration.

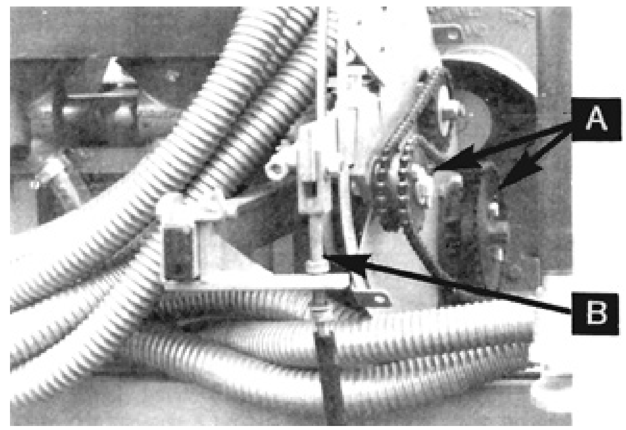

FIGURE 8. Meter Drive: (A) Change Sprockets. (B) Chain Tightener Bolt.

Adjustments: Meter drive sprockets were easy to change with wrenches. The chain tightener bolt (FIGURE 8) did not have a sufficient range of adjustment to accommodate all sprocket combinations. When using the 28 and 34 tooth sprocket combination the bolt could not be shortened enough and links had to be added to the chain. When using the 19 and 22 tooth sprocket combination, the bolt could not be lengthened sufficiently and links had to be removed from the chain to avoid chain interference with the metering shaft. Chain tightener modification is recommended to avoid these problems.

Weight of material in the hopper also affected metering chain tension. If chain tension was adjusted with a full hopper, the chain became too tight as the hopper emptied, due to downward flexing of the hopper under Icad.

Drive belt and meter clutch adjustment were inconvenient, since the drive shields were difficult to remove to gain access.

Field Operation: The Horstine applicator performed well on smooth, soft fields at speeds up to 13 km/h (8 mph), resulting in a maximum field capacity of 13 ha/h (31 ac/h). Common sense had to be used when selecting a field speed as severe boom bouncing occurred on rough fields. Due to the hopper and boom weight concentration behind the wheels, the applicator weaved back and forth, especially on rough fields. Considerable boom height variation occurred on rolling fields, since no boom support wheels were used. The use of boom support wheels and a floating boom' assembly would have appreciably improved performance on rough and rolling fields.

The meter drive clutch could be conveniently started or stopped from the tractor when turning corners, finishing fields or to avoid double application on headlands. The meter drive clutch did not work as delivered, but functioned well after cable adjustment.

A marking system had to be used to ensure proper overlap between successive applicator passes, since the only marks left in the field were those made by the tractor wheels near the centre of the spreading width.

Granules leaving the discharge nozzles could not be seen from the tractor, however, meter rotation was visible from the tractor seat and could be used as a field check on distributor operation.

Transporting: The Horstine applicator could easily be folded into transport or field position by one man in about one minute. No tools were needed. The operator had to be careful not to stand directly beneath the boom when folding it to avoid being caught between the inner and outer boom sections (FIGURE 9).

FIGURE 9. Possibility of Being Caught Between Boom Sections when Folding into Transport Position

The Horstine applicator trailed well behind a one-half ton truck when the hopper was empty. With a full hopper, the hitch had a 195 kg (430 lb) upward force, making the applicator unstable to transport.

Lubrication: The Horstine applicator had only two grease fittings requiring daily lubrication. Both were accessible.

Fasteners: The Horstine applicator contained both metric and English fasteners, requiring a complete set of tools for servicing and adjustment.

POWER REQUIREMENTS

The power input required to drive the distribution fans was only 1.1 kW (1.5 hp) at 540 rpm power take-off speed.

OPERATOR SAFETY

Except for the lack of hitch adjustment, necessitating removal of the rear support wheel with tractors having high drawbars, the Horstine applicator was safe to operate if normal safety procedures were followed. With the rear wheel removed, the rear of the applicator was unsupported, causing it to tip backward when unhitched.

Due to the large negative hitch weight, a jack had to be used at the rear of the applicator when hitching to a tractor. It was necessary to block the wheels to ensure that the jack did not slip.

The Horstine applicator towed well in transport position only with an empty hopper. Towing with a full hopper, was hazardous as whipping occurred even at moderate speeds. It is recommended that the manufacturer consider redesigning the trailer to improve weight distribution, thereby eliminating tipping hazards when hitching and whipping when transporting.

All moving parts were well shielded. Most shields were quite difficult to remove and replace, thereby encouraging the operator to not use them.

The Horstine applicator was not equipped with a sJow moving vehicle sign. It is recommended that a sign be supplied to comply with provincial safety regulations.

OPERATOR'S MANUAL

Operating instructions consisted only of a series of individual sheets describing several components. Calibration charts were supplied only for 12 and 15 lb/ac application rates of granular Avadex BW at 520, 540 and 560 rpm power take-off speeds at various forward speeds. These charts were inaccurate (FIGURE 2) and of limited use since settings for other application rates were not given. It is recommended that the manufacturer consider providing more comprehensive, accurate and complete calibration charts and that a copy be permanently affixed to the applicator for convenient field reference.

The operating instructions included details on meter maintenance, nozzle and meter adjustments and tips on field use.

Operating instructions and calibration charts were prepared only in English units. It is recommended that they also be prepared using SI (metric) units to facilitate applicator operation after conversion to the SI system.

MECHANICAL PROBLEMS

TABLE 1 outlines the mechanical history of the Horstine granular applicator during 22 hours of operation while spreading Avadex BW on about 240 ha (590 ac). The intent of the test was evaluation of functional performance. The following failures represent only those which occurred during the functional testing. An extended durability evaluation was not conducted.

TABLE 1. Mechanical History

Item	Operating Hours	Equivalent Field Area ha	(ac)
Trailer Assembly			
The power take-off shaft transport bracket bent at		Beginning of Test	
- The rear wheel bearing was worn, requiring replacement at	3, 20	33, 217	(81. 537)
- The right axle broke and was replaced at	10	109	(269)
Drive Assembly			
- The meter chain drive sprockets needed alignment at		Beginning of Test	
- The drive shaft pin sheared and was replaced at	' 9	98	(242)
- One of the primary drive belts was damaged due to frame interference and was replaced at	9	98	(242)
- The power take-off shaft shield was damaged due to hitch interference at	12	130	{322)
- The set screw on the gear box sprocket loosened and was tightened at	12	130	(322)
Fan Assembly			
- The set screw in the left rear fan loosened and was retightened at	9	98	(242)
Hopper-Meter Assembly			
- The bolt securing the front of the hopper to the applicator frame was bent and was replaced at	4	43	(107)
- The bolts connecting the hopper to the meters loosened, and were retightened at	13	141	(349)
- The hopper lid spring clips had deformed at		End of Test	
- Several fatigue cracks had developed in the hopper bottom at		End of Test	
Booms			
- The left boom could not be completely lowered due to interference between the stop bracket and the trailer frame at		Beginning of Test	
- The left air hoses interfered with the left trailer wheel and were rerouted at		Beginning of Test	
- The right upper boom U-clamp pin loosened, causing the boom cable to release and the right boom to fall to the ground at	4	43	(107)
The other U-clamp pins had also loosened and were tightened at	4	43	(107)
- The right boom frame had cracked and was reinforced and welded at	9	98	(242)

DISCUSSION OF MECHANICAL PROBLEMS

TRAILER ASSEMBLY

Power Take-off Shaft: The power take-off shaft could not be connected to the tractor at delivery since it interfered with the transport bracket (FIGURE 10). The transport bracket had to be bent out of the way to permit connection to the tractor. Modifications are required to eliminate this interference. The power take-off shield also interfered with the hitch (FIGURE 10) when attached to tractors with high drawbars. A modified hitch is needed on the applicator to eliminate this problem.

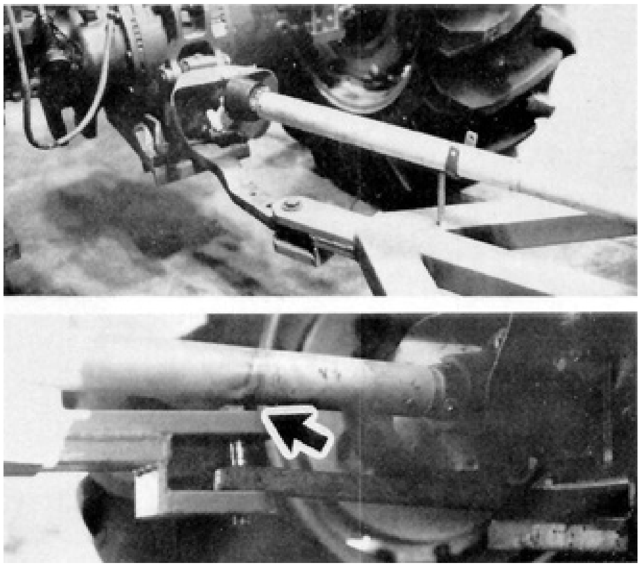

FIGURE 10. Interference Among the Hitch, Transport Bracket and Power Take-off Shaft.

Rear Wheel Bearing: The bearing on the rear support wheel wore out twice during the test. Wear was caused by field operation with a high tractor drawbar, causing hopper weight to be transferred to the support wheel. The extra weight on the rear wheel caused rapid bearing failure.

Axle: The right axle spindle broke, between the inner and outer bearings, when transporting the applicator with 45 kg (100 lb) of Avadex BW in the hopper at 50 km/h (30 mph) on a paved highway. Spindle failure was attrributed to the instability and whipping of the applicator when towed at transport speeds with material in the hopper. The spindle was replaced and caution was exercised when transporting the applicator with material in the hopper.

DRIVE ASSEMBLY

Meter Drive Sprockets: The meter drive sprockets were out of alignment at delivery. Sprockets could be aligned only by bending the jack shaft brace.

Miscellaneous: The drive shaft pin sheared due to overloading. The set screws on the primary drive shaft bearings loosened, allowing the front pulley to rub against the frame and subsequently jam, causing the pin to shear. This also damaged the rear drive belt, necessitating its replacement.

HOPPER-METER ASSEMBLY

Hopper: The hopper was not adequately fastened to the applicator frame. The bolt securing the front of the hopper to the applicator frame bent and the front of the hopper deformed during field use. Fatigue cracks also occurred in the hopper bottom (FIGURE 11) at the rear of each meter assembly, extending about one-quarter of the way around each meter opening. Modifications are required to prevent premature hopper failure.

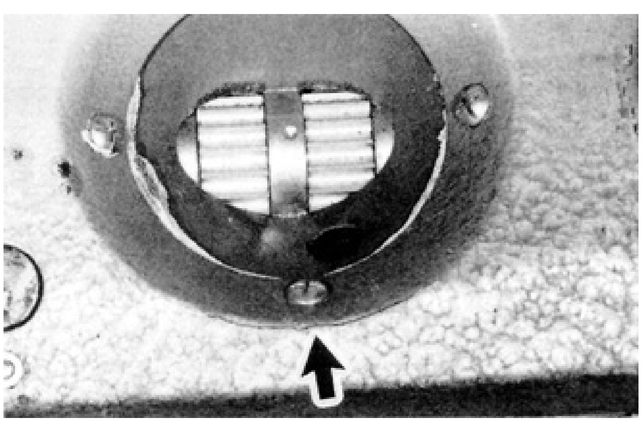

FIGURE 11. Fatigue Cracks in Hopper Bottom.

BOOMS

Stop Bracket Interference: At the beginning of the test it was impossible to completely lower the left boom due to interference between the stop bracket and the trailer frame (FIGURE 12). The stop bracket was ground off to allow the boom to be lowered.

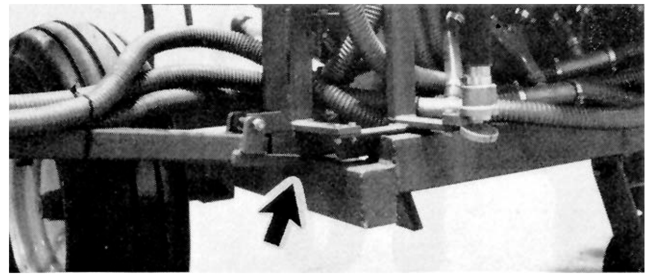

FIGURE 12. Interference Between Stop Bracket and Trailer Frame.

Boom Frame: The right boom frame cracked (FIGURE 13). Failure probably occurred due to operation with the boom frame support turnbuckle insufficiently tightened. No further problems occurred after welding the boom and tightening the boom support turnbuckle.

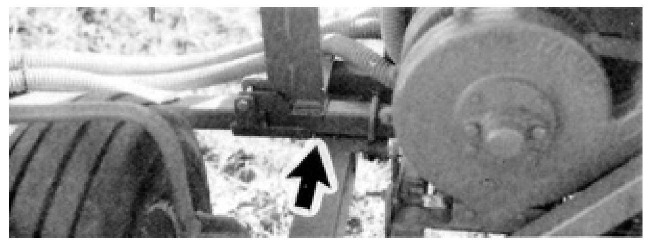

FIGURE 13. Boom Frame Failure.

APPENDIX I

SPECIFICATIONS

MAKE: Horstine Airflow Granular Applicator

MODEL: TMA 4, 10 m (32 ft)

SERIAL NUMBER: 253331

OVERALL DIMENSIONS:	Field Position	Transport Position
- width	8610 mm (28.2 ft)	2990 mm (9.8 ft)
- length	2170 mm (7.1 ft)	2170 mm (7.1 ft)
- height	1682 mm (5 5 ft)	2486 mm (8.2 ft)

METERING SYSTEM:

- type	fluted feed
- drive	belt and chain from power take-off
- adjustment	flute speed
- transfer to ground	pneumatic nozzles with impact plates
- fan drive	belts from power take-off
- number of discharge nozzles	8
- nozzle spacing	1220 mm (48 in)
- discharge height	550 mm (22 in)
- effective spreading width	9750 mm (32 ft)

WEIGHTS (with empty hopper):

- leftwheel	230 kg	(510 lb)
- right wheel	220 kg	(490 lb)
- rear support wheel	120 kg	(260 lb)
Total	570 kg	(1260 lb)

WHEELS:

- number	3
- tire size - trailer wheels	9.5L x 15, 6 ply rib implement
- rear support wheel	400 x 4, 4 ply

HOPPER CAPACITY: 0.38 m^3 (13.5 ft^3)

NUMBER OF LUBRICATION POINTS: 2

APPENDIX II

MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

(a) excellent
(b) very good
(c) good
(d) fair
(e) poor
(f) unsatisfactory

APPENDIX III

METRIC UNITS

In keeping with the Canadian metric conversion program this report has been prepared in SI Units. For comparative purposes, the following conversions may be used:

1 kilometre per hour (km/h)	= 0.62 mile per hour (mph)
1 hectare (ha)	= 2.47 acres (ac)
1 kilogram (kg)	= 2.20 pounds (lb)
1 kilogram per hectare (kg/ha)	= 0.89 pound per acre (lb/ac)
1 kilowatt (kW)	= 1.34 horsepower (hp)
1 meter (m) = 1000 millimetres (mm)	= 39.37 inches (in)

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