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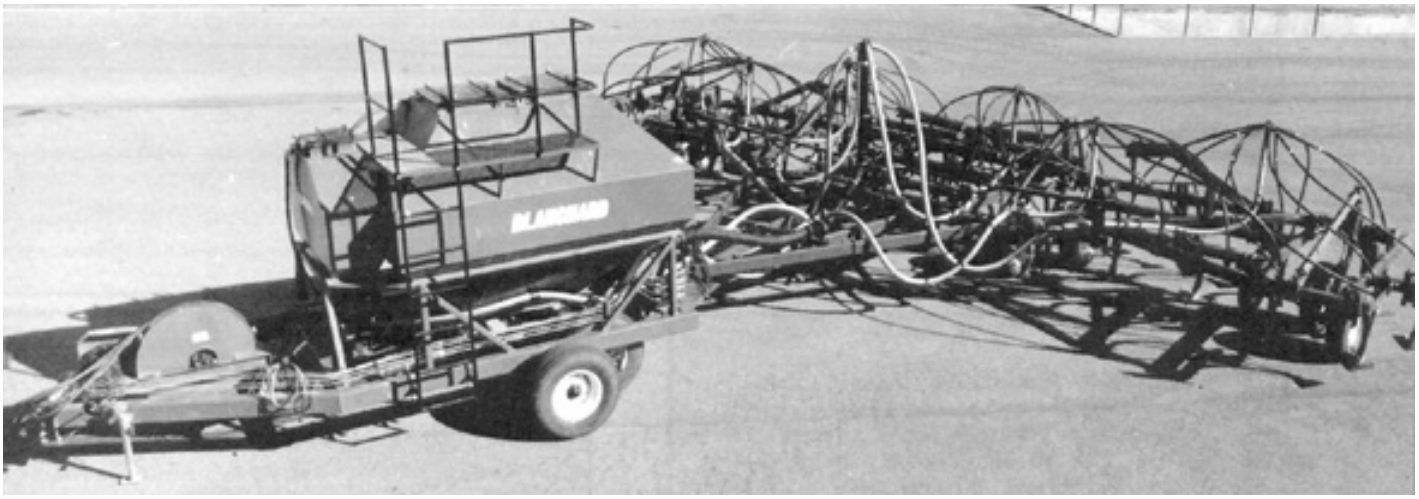
Evaluation Report 501



Blanchard 5-Way Air Seeder

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

BLANCHARD 5-WAY AIR SEEDER

MANUFACTURER AND DISTRIBUTOR:

Blanchard
P.O. Box 1444
Saskatoon, Saskatchewan
S7K 3P7

RETAIL PRICE:

(June, 1986, f.o.b. Lethbridge, Alberta).

(a) Blanchard 5-Way Air Seeder $17,495.00. Air package to feed 37 shanks $2,325.00. Seed boots at $12.00 each $444.00.

(b) Case International Model 5500, 36.7 ft (11.2 m) chisel plow $19,000.00.

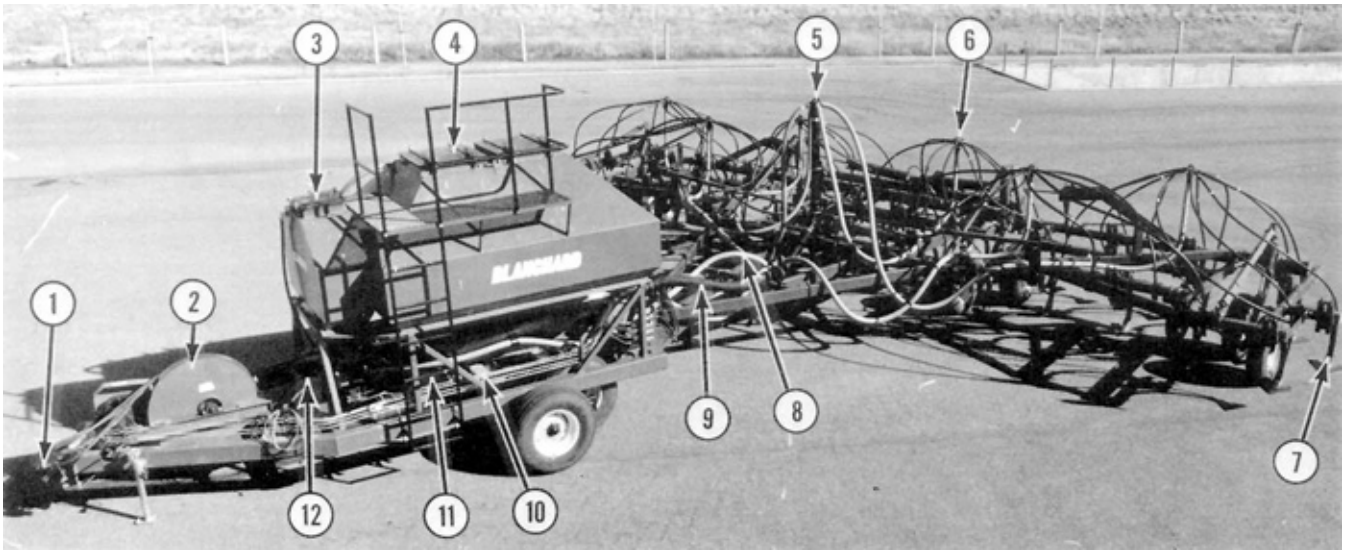


FIGURE 1. Blanchard 5-Way Air Seeder: (1) PTO Drive, (2) Fan, (3) Granular Tank, (4) Main Tanks, (5) Primary Header, (6) Secondary Headers, (7) Seed Boot, (8) Granular Primary Hoses, (9) Primary Hose, (10) Main Meter Rate Adjustment, (11) Ladder, (12) Granular Rate Adjustment.

SUMMARY

Functional Performance: Performance of the Blanchard 5-Way air seeder was good for seeding and fertilizer banding in all types of conditions. When operated with the 36.7 ft (11.2 m) Case International 5500 chisel plow, the Blanchard was suitable for seeding and fertilizer banding in light primary and secondary field conditions. The Blanchard 5-Way was suitable for banding fertilizer at application rates up to 234 lb/ac (266 kg/ha) at 5.5 mph (9.0 km/h) with the sprocket combinations supplied. Higher rates are possible with other sprocket combinations. The light shank spring characteristics of the cultivator limited the suitability of fhe unit for seeding and banding fertilizer under heavy primary conditions. Other heavy duty cultivators, with more rigid shank characteristics, could be used in conjunction with the Blanchard for heavy primary tillage conditions.

Meter Calibrations: The calibration charts for wheat, barley, canola, fertilizer and granular were updated due to the changes in the distribution system.

Distribution Uniformity: Distribution uniformity across the seeding width was acceptable in wheat, barley, canola and fertilizer. Distribution uniformity in Avadex Bw and Treflan QR5 was acceptable over the normal range of application rates.

Effect of Field Variables: Field bounce had little effect on metering rates. Field slope and ground speed had only a small effect on metering rates. Distribution uniformity was only slightly affected by field slope.

Grain Damage: Grain damage by the metering and distribution system was within acceptable limits at normal fan speeds for cereal grains but was excessive in canola at normal fan speeds.

Seed Placement: Seed placement was good in most conditions. Variation in seed depth was similar to a conventional hoe drill when measured in the same fields under the same seeding conditions. Row spacing and seed band width behind each seed boot provided ample stubble for good windrow support, providing light crops were laid across the rows rather than parallel to them. Good cultivator frame levelling was critical in obtaining a uniform seed depth and subsequent good crop emergence.

Ease of Adjustment and Operation: Seeding rate was sometimes difficult to adjust. Tank and meter cleanout convenience was fair. Tank filling required the use of a drill fill or auger. Twenty-one grease fittings required periodic greasing.

Operator visibility of the cultivator was obstructed by the tanks. The Blanchard 5-Way with Case International 5500 chisel plow could be placed in transport position in less than five minutes.

Rate of Work: The rate of work usually ranged from 19 to 24 ac/hr (7.7 to 9.7 ha/hr). About 100 ac (40 ha) could be seeded before refilling both tanks when seeding wheat at a normal seeding rate. Using only one tank, 70 ac (28 ha) could be seeded before refilling.

Power Requirements: Tractor size depended on soil conditions, seeding depth, ground speed, cultivator width and soil finishing attachments. In light primary tillage at a 3 in (75 mm) depth and 5 mph (8 km/h), a 146 hp (110 kW) tractor was required to operate the applicator-cultivator combination. In heavy primary tillage, at the

same depth and speed, a 165 hp (124 kW) tractor was needed.

Safety: The Blanchard was safe to operate provided normal safety procedures were followed. All moving parts were shielded.

Operator's Manual: The operator's manual contained useful information on safety, adjustment, assembly, operations, lubrication and maintenance. A detailed parts list was also included.

Mechanical Problems: A couple of mechanical problems occurred during the evaluation. A number of applicator and distribution system changes were made by the manufacturer to improve distribution and metering.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Providing symmetrical headers to ensure uniform distribution.
2. Providing a suggested setting for fan speed to reduce crackage when seeding canola.
3. Improving access to the granular tank to allow for easier filling.
4. Providing, as optional equipment, a monitoring system to monitor material flow.
5. Improving the slide gate movement, decreasing the play in hand crank and improving the meter scale.
6. Supplying a slow moving vehicle sign as standard equipment.
7. Improving the seal between the secondary headers and header pipe to prevent air leakage.

Station Manager/Senior Engineer:. E. H. Wiens
Project Technologist: G. A. Magyar

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Changes have already been made to fabrication procedures to ensure headers are symmetrical.
2. A recommendation will be included in the operator's manual concerning the operation of the fan with fine seeds that are susceptible to shattering.
3. This recommendation has been noted and will be considered in future designs.
4. Two optional monitoring systems are now available for past and current models.
5. Changes have already been made to 1986 models. A new crank assembly and meter indicator have improved the operation and adjustment of the metering gates.
6. This will be standard equipment.
7. This recommendation has been noted and will be considered in future designs.

MANUFACTURER'S ADDITIONAL COMMENTS

To reduce maintenance on the drag chain in the metering box, a spring-loaded tightener will be incorporated in all future machines. Ali air seeders now have a tire assembly option. Rather than the walking beam setup, single 12.5L-15 8 ply tires will be available.

GENERAL DESCRIPTION

The Blanchard 5-Way air seeder is a pneumatic seed, fertilizer and granular applicator designed for use with varying makes and models of cultivators.

The cultivator is attached to the rear of the applicator with the standard cultivator hitch. The applicator is supported by four wheels mounted on tandem walking beam axles.

Seed and fertilizer are pneumatically distributed from the two main tanks through a network of tubes to seed boots attached to the rear of the cultivator shanks. Granules are pneumatically distributed from the granular tank by two outlets to deflectors located across the width of the implement. The applicator can be used for seeding, for combined seeding and fertilizing, for combined seeding, fertilizing and granular application, for granular application and for fertilizer banding.

Seed, fertilizer and granules are metered by varying the gate opening above a drag chain. The meters are driven by a series of chains and sprockets from a ground drive wheel. A 1000 rpm power take-off drive fan forces the metered material through the distribution system. The distribution system for the main tanks consists of a four-part primary header feeding two eight-port, one ten-port and one eleven-port secondary headers mounted on the cultivator frame. Other combinations of secondary headers are available for any width of cultivator. Tubes from the secondary headers connect to the seed boots. The distribution system for the granular tank consists of two hoses each feeding an eight-port header mounted on the cultivator. The tubes from the granular headers connect to the deflectors. The deflector spacing equalled the distance between the ground and frame.

The test machine was used with a Case International model 5500 chisel plow. This cultivator was 36.7 ft (11.2 m) wide with a 13 ft (4.0 m) center frame and two 12 ft (3.7 m) wing sections. It was equipped with 37 spring cushioned shanks spaced at 12 in (305 mm) arranged in four rows. A tractor with three remote hydraulic controls was required to operate the Blanchard 5-Way air seeder with the Case International model 5500 chisel plow.

Detailed specifications for the air seeder and chisel plow are given in APPENDIX I, while FIGURE 1 shows the location of major components.

SCOPE OF TEST

The Blanchard air seeder was operated in clay loam and silt loam soils in the field conditions shown in TABLE 1 for approximately 110 hours while processing about 2020 ac (818 ha). It was evaluated for quality of work, ease of operation and adjustment, rate of work, power requirements, safety and suitability of the operator's manual.

TABLE 1. Operating Conditions.

CROP	FIELD TILLAGE CONDITIONS	STONE CONDITIONS	FIELD AREA ac	(ha)	HOURS
Barley on Summerfallow	Secondary	Stone Free	260	(105)	13
Barley and Oats on Summerfallow	Secondary	Occasional Stones	130	(53)	7
Canola on Summerfallow	Secondary	Stone Free	260	(105)	11
Soft Wheat on Summerfallow	Secondary	Stone Free	130	(53)	7
Winter Wheat on Summerfallow	Secondary	Stone Free	160	(65)	9
Treflan on Stubble	Primary	Stone Free	160	(65)	9
Banding Fertilizer with Sweeps	Primary	Stone Free	520	(211)	29
Banding Fertilizer with Knives	Primary	Occasional Stones	300	(121)	17
Banding Fertilizer with Knives	Secondary	Occasional Stones	100	(41)	8
TOTAL			2020	(818)	110

RESULTS AND DISCUSSION

QUALITY OF WORK

Metering Accuracy: The grain, fertilizer and granular metering system was calibrated in the laboratory. Since actual seeding rates for certain settings depended on things such as seed size, density and moisture content, it is not possible for a manufacturer to present charts to include all the varieties of seed. Field calibration checks may be necessary for seed with properties differing from those dsed in establishing the manufacturer's charts. Research has shown, however, that small variations in seeding rates will not significantly affect grain crop yields.

The Blanchard 5-Way air seeder had four sprocket combinations (TABLE 2) which could be used to achieve various speed ranges for the main metering system. Sprocket combination 1 was used for cereal grains, fertilizer and granular products. Sprocket combination 2 was used for high cereal grain rates and fertilizer rates up to 200 lb/ac (225 kg/ha). Sprocket combination 3 was used to apply fertilizer rates over 200 lb/ac (225 kg/ha) and sprocket combination 4 was used for small seeds such as canola.

TABLE 2. Sprocket Combination.

NUMBER	TRANSFER SHAFT WHEEL SPROCKET	MAIN METER BOX SPROCKETS		SPROCKETS
1	16	16	16	32
2	16	16	32	32
3	16	16	32	16
4	16	32	16	64

The metering rate was varied by adjusting the sliding gate to the correct setting as determined from the calibration charts provided.

Calibration curves for wheat, barley, canola, fertilizer, Avadex BW and Treflan QR5 are given in FIGURES 2 to 7. Operating on slopes, up to 10 degrees, variation in ground speed and field bounce had little effect on metering rates.

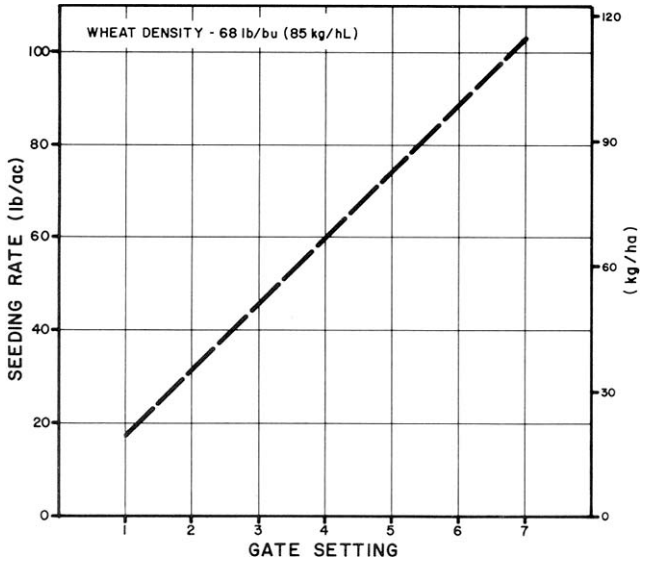


FIGURE 2. Metering Accuracy in Wheat.

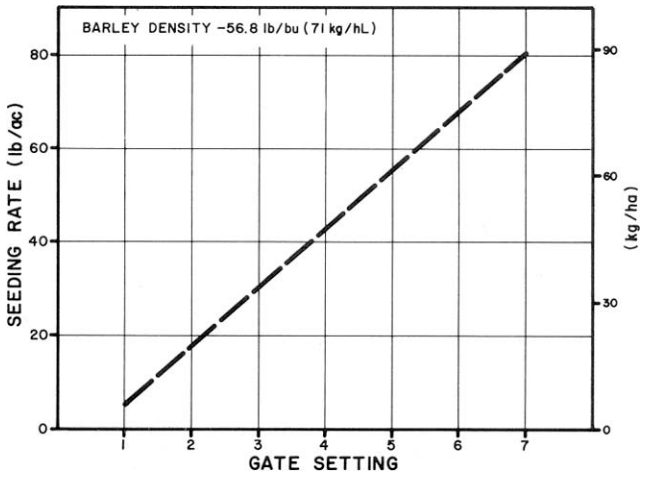


FIGURE 3. Metering Accuracy in Barley.

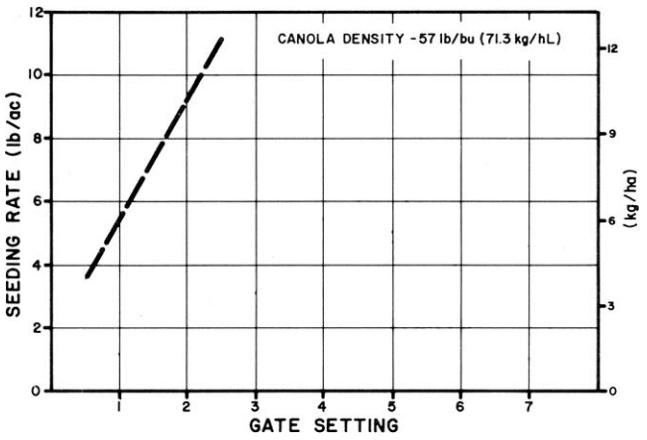


FIGURE 4. Metering Accuracy in Canola.

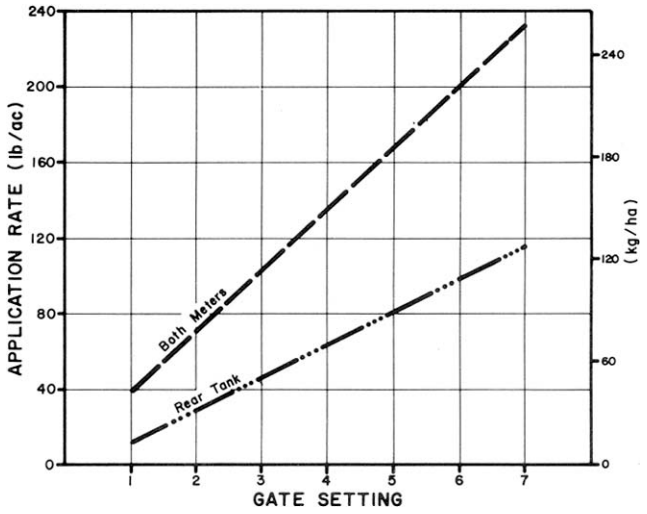


FIGURE 5. Metering Accuracy in Fertilizer.

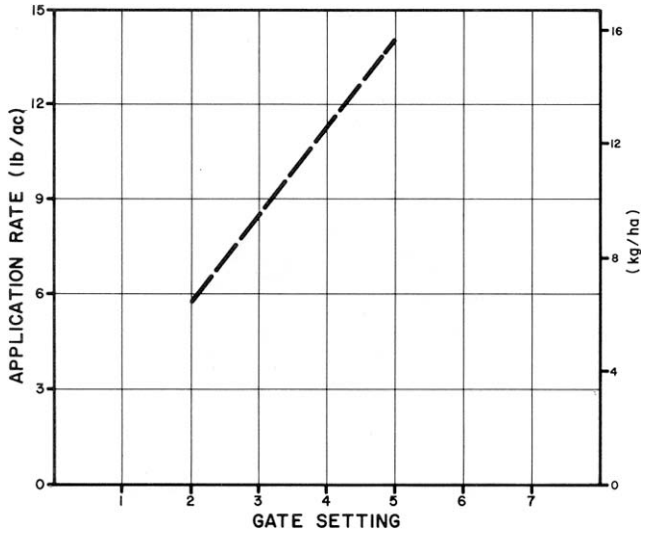


FIGURE 6. Metering Accuracy in Avadex BW.

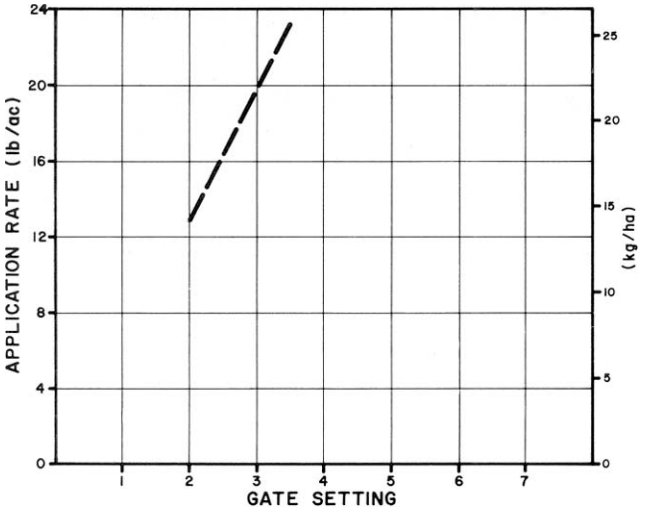


FIGURE 7. Metering Accuracy in Treflan QR5.

DistribUtion Uniformity: FIGURE 8 gives seeding distribution uniformity for the Blanchard 5-Way air seeder in wheat and barley. Distribution was uniform over the full range of seeding rates at a fan speed of 3250 rpm. For example, at a seeding rate of 70 lb/ac (79 kg/ha), the coefficient of variation[1] (CV) was 6.2% for wheat and 7.2% for barley. FIGURE 9 shows a typical seedIng distribution pattern obtained in wheat at a seeding rate of 75 lb/ac (84 kg/ha). The application rate from each shank across the width of the air seeder varied from 65 to 80 lb/ac (73 to 90 kg/ha). This resulted in acceptable distribution uniformity with a CV of 8.6%.

FIGURE 10 shows a typical distribution pattern obtained in canola at a seeding rate of 6.4 lb/ac (7.2 kg/ha) at a fan speed of 2050 rpm. The application rate across the width of the air seeder varied from 4.9 to 7.5 lb/ac (5.5 to 8.4 kg/ha), which resulted in acceptable distribution uniformity with a CV of 10.2%. Distribution uniformity was acceptable over the full range of canola seeding rates with CV's ranging from 9.6 to 13.0% (FIGURE 11).

Distribution uniformity in 11-51-00 fertilizer was acceptable over the full application range with a CV ranging from 7.1 to 12.6% (FIGURE 12). Rates higher than 234 lb/ac (266 kg/ha) were not possible due to the sprocket combinations supplied for the metering system. Other sprocket combinations are available for higher rates of fertilizer application.

[1]The coefficient of variation (CV) is the standard deviation of seeding or application rates expressed as a percent of the mean seeding or application rate. A low CV represents uniform application whereas a high CV indicates non-uniform application. An accepted variation for seeding grain or applying fertilizer is a CV value not greater than 15%, whereas an acceptable CV for applying granular product should be not greater than 10%.

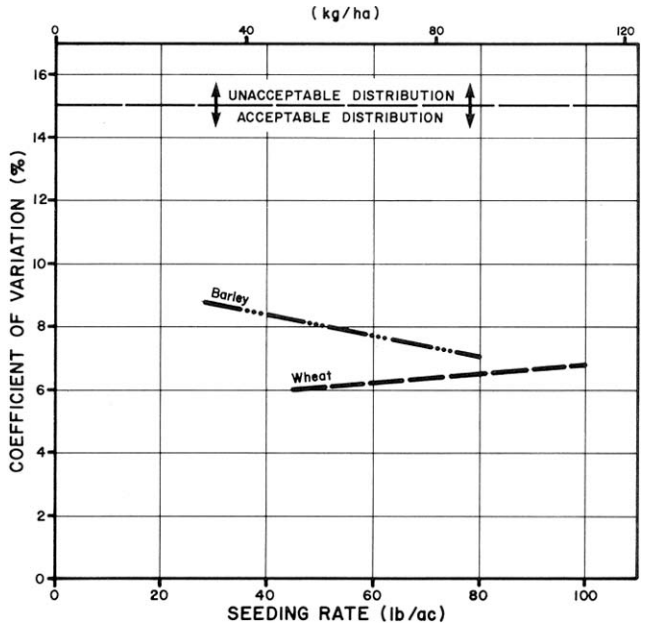


FIGURE 8. Distribution Uniformity in Cereal Grains over a Range of Seeding Rates at 5.5 mph (9 km/h) and a Fan Speed of 3250 rpm.

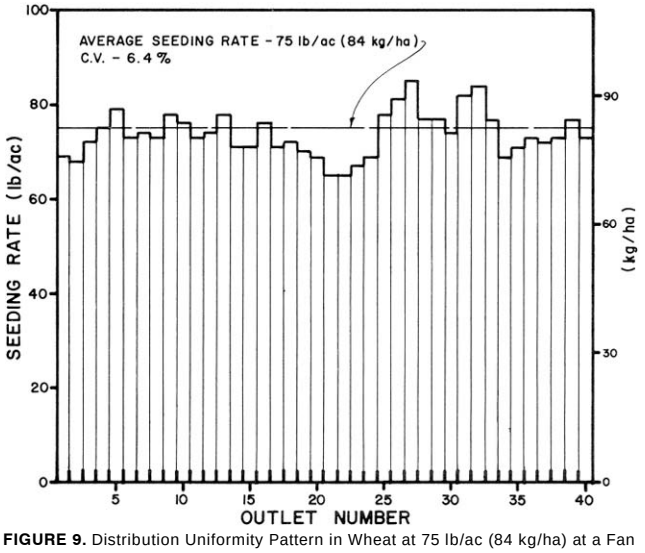


FIGURE 9. Distribution Uniformity Pattern in Wheat at 75 lb/ac (84 kg/ha) at a Fan Speed of 3250 rpm.

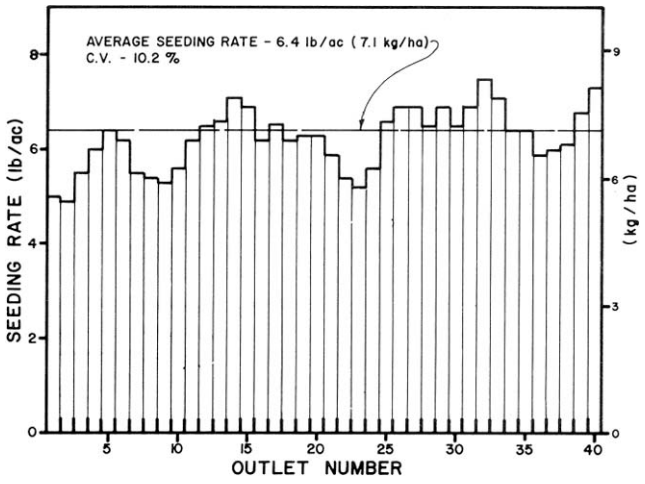


FIGURE 10. Distribution Uniformity Pattern in Canola at 6.4 lb/ac (7.2 kg/ha) at a Fan Speed of 2050 rpm.

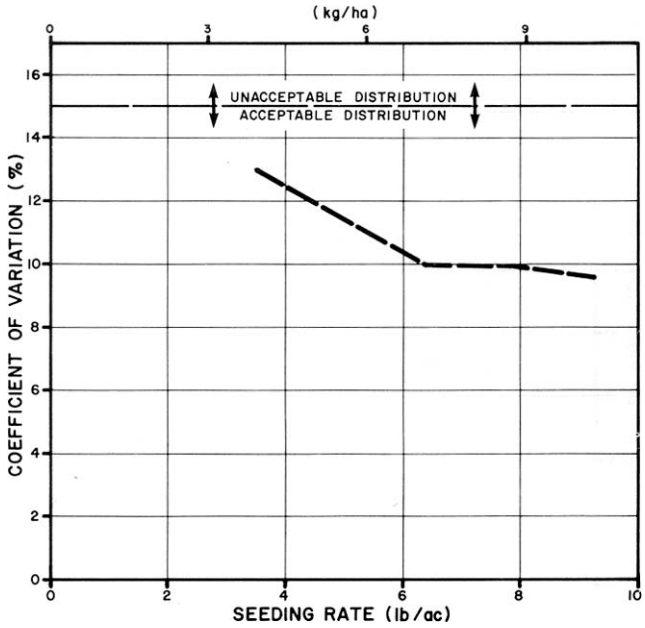


FIGURE 11. Distribution Uniformity in Canola over a Range of Seeding Rates at 5.5 mph (9 km/h) and a Fan Speed of 2050 rpm.

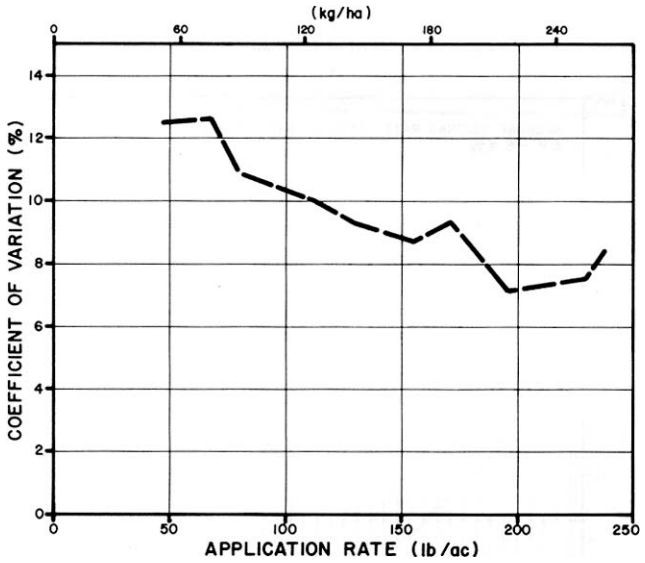


FIGURE 12. Distribution Uniformity in Fertilizer over a Range of Application Rates at 5.5 mph (9 km/h).

Changes in distribution pattern uniformity could occur at different forward speeds or for different machine widths due to different volumes of material being introduced into the constant volume of air supplied by the fan.

Changes in fan speed and operation in hilly terrain had only a small effect on distribution uniformity.

Spreading Uniformity: Granules delivered by the 16 outlets were pneumatically conveyed across the width of the machine and were discharged onto horizontally mounted deflector plates (FIGURE 13). For optimum distribution uniformity, a deflector plate spacing of 20 in (508 mm) is recommended. The deflector plate discharge height was equal to the cultivator frame to ground clearance.

FIGURE 14 shows a typical distribution of Avadex BW when applying 11.3 lb/ac (12.7 kg/ha) at 5.5 mph (9 km/h), with deflectors mounted horizontally, using a 20 in (508 mm) deflector spacing and a ground clearance of 27 in (686 mm). Application rates varied from 10.6 to 15.1 lb/ac (11.9 to 17.0 kg/ha) across the spreading width, resulting in an acceptable pattern with a CV of 8.9%. Spreading uniformity of Avadex BW was not influenced by the application rates over the normal range of application rates.

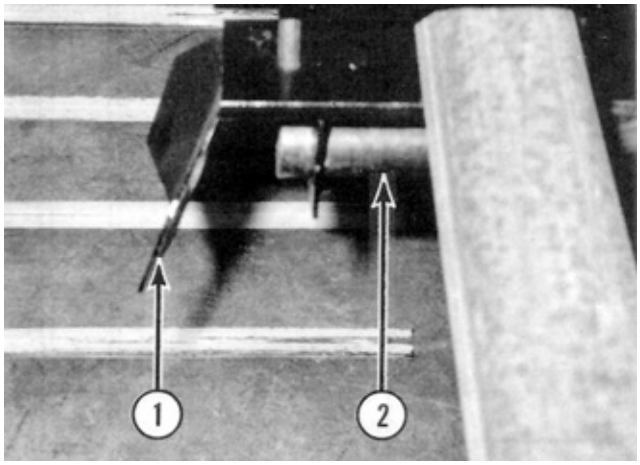


FIGURE 13. Distribution Systems: (1) Deflector Plate, (2) Outlet Hose.

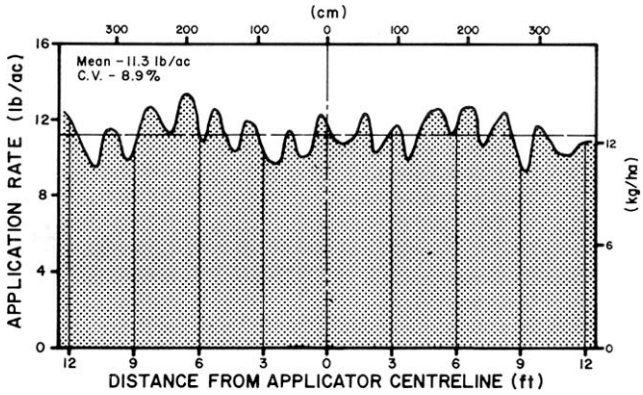


FIGURE 14. Typical Distribution Pattern when Applying 11.3 lb/ac (12.7 kg/ha) of Avadex BW at 5.5 mph (9 km/h) using 20 in (508 mm) Deflector Spacing and a 27 in (868 mm) Deflector Discharge Height.

FIGURE 15 shows a typical distribution pattern of Treflan QR5 when applying 18.3 lb/ac (20.6 kg/ha) at 5.5 mph (9 km/h), with deflectors mounted horizontally, using a 20 in (508 mm) deflector spacing and 27 in (686 mm) ground clearance. Application rates varied from 17.3 to 24.9 lb/ac (19.4 to 28.0 kg/ha) across the spreading width, resulting in an acceptable distribution pattern with a CV of 9.4%. Distribution uniformity was not influenced by the application rate over the normal range of application rates.

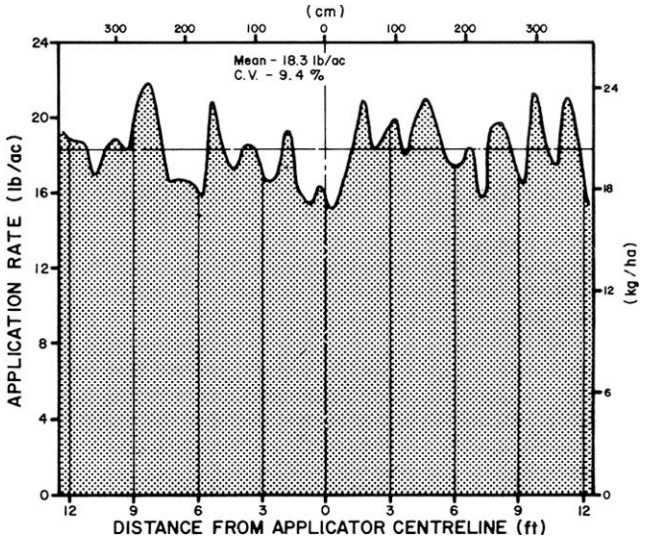


FIGURE 15. Typical Distribution Pattern when Applying 18.3 lb/ac (20.6 kg/ha) of Treflan QR5 at 5.5 mph (9 km/h) using 20 in (508 mm) Deflector Spacing and a 27 in (868 mm) Deflector Discharge Height.

The distribution patterns shown in FIGURES 14 and 15 represent operation on smooth level fields on calm days. High winds could result in patterns different than those shown. Deflector height variation due to rough fields was not a probleto with the cultivator mounted applicator.

It should be noted that the symmetry of the distribution heads affected the distribution patterns. FIGURE 16 shows the differences in the fabrication of the distribution heads which can cause the poor patterns. It is recommended that the manufacturer consider providing symmetrical headers to ensure uniform distribution.

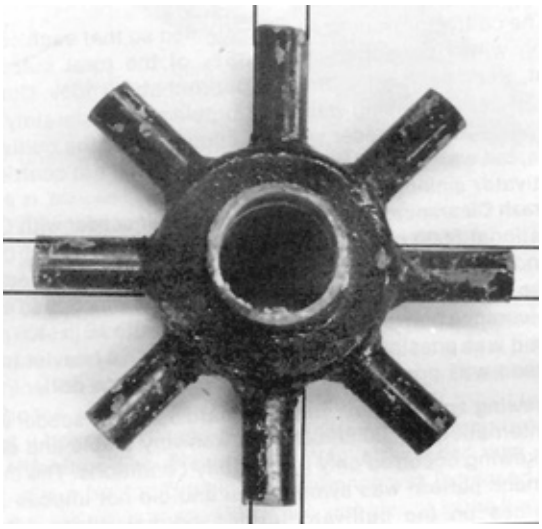


FIGURE 15. Differences Between Distribution Headers Which Can Cause Poor Distribution Patterns.

Grain Damage: Grain damage by the metering and distribution system was within acceptable limits for cereal grains at a fan speed of 3250 rpm or lower. For example, in dry Neepawa wheat, at an 11% moisture content and a fan speed of 3250 rpm, only 0.5% crackage occurred. Wheat crackage with the same moisture content increased to 2.1% at a fan speed of 3450 rpm. Grain crackage in canola was significantly higher than in cereal grains. For example, in dry canola at a moisture content of 7%, crackage at a fan speed of 3000 was 11.8%. Reducing fan speed to 2000 rpm reduced canola damage to 2.2%. Due to excessive canola damage at recommended fan speed, it is recommended that the manufacturer consider providing a suggested setting for a fan speed to reduce crackage when seeding canola.

Seed Placement: Each seed boot was equipped with a V-shaped spreader (FIGURE 17) to spread the seed behind each cultivator sweep. Plants emerged in distinct rows in band widths ranging from 3.5 to 6.0 in (89 to 152 mm) (FIGURE 18). With 12 in (305 mm) cultivator shank spacing, distances between rows varied from 6.0 to 8.5 in (152 to 216 mm). This row spacing provided adequate windrow support providing light crops were laid across the rows rather than parallel to them.

Although seeds were usually placed on the furrow bottom at the working depth of each individual cultivator sweep, depth across the width of the machine varied due to cultivator frame geometry and non-uniform field surfaces. On level and gently rolling fields, vertical seed distribution was quite uniform. For example, at an average seeding depth of 2.2 in (56 mm), seedlng depth across the width of the machine varied from 1.6 to 3.0 in (40 to 75 mm) with most of the seeds placed within 0.5 in (13 mm) of the average cultivator sweep working depth. This compares to seed being placed from 0.5 to 0.6 in (12 to 15 mm) from average seeding depth for a hoe drill in similar conditions.

In fields with sharp hill crests or gullies, seed depth variation became much greater than for a hoe drill, due to the greater distances between shank rows on a cultivator than on a hoe drill.

In heavy primary tillage conditions, seed depth variation increased due to soil forces exceeding the shank spring preload

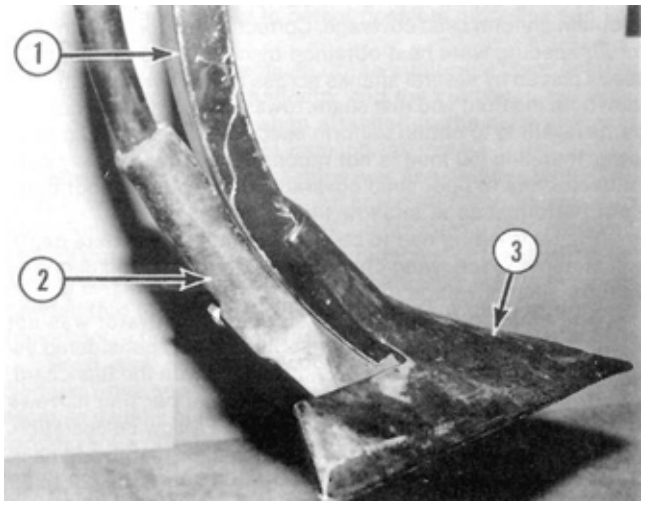


FIGURE 17. Blanchard Seed Boot: (1) Shank, (2) Seed Boot, (3) Sweep.

FIGURE 18. Uniform Wheat Emergence (Upper: 30 Days After Seeding; Lower: At Harvest).

setting. Therefore, seeding in heavy primary tillage conditions using a Case International Model 5500 chisel plow is not recommended.

Plant Emergence: As with most seeding implements, time and uniformity of plant emergence depended on seedbed preparation, soil moisture and seed placement. Uniform emergence resulted as long as machine settings were carefully adjusted to place seed in moist soil at the correct depth and providing loose seedbeds were packed after seeding. FIGURE 18 shows good wheat emergence when wheat was seeded directly into summerfallow as the first spring operation.

Careful cultivator frame levelling was important in obtaining uniform emergence across the cultivator width. Due to the rigidity of heavy duty cultivator frames, improper sideways levelling and fore-and-aft levelling can both result in rows of shanks operating at different depths.

Seeding Depth: It is very important to seed deep enough to obtain uniform seed coverage. Correct cultivator adjustments for ai,r seeding were best obtained by comparing the depth of seeds placed by several shanks across the cultivator width and from both the front and rear shank rows. This permitted accurate frame levelling to obtain uniform seed coverage. Seeding shallower than 2 in (50 mm) is not recommended for a heavy duty cultivator due to poor seed coverage and generally poor cultivator performance at shallow tillage depths.

Frame levelling had to be checked and appropriate depth adjustments made when changing fields to ensure adequate, uniform seed coverage.

Soil Finishing: The Case International cultivator was not equipped with harrows or packers. Since it was considered essential to level and pack most fields seeded with the Blanchard, a harrow-packer drawbar equipped with five bar tine harrows and trailing steel coil packers was used as a follow-up operation.

The harrow-packer combination served to smooth and pack the seedbed, leaving packer ridges from 0.9 to 1.1 in (22 to 28 mm). To obtain a smooth firm seedbed in dry conditions required packer-drawbar operations in two directions. Care had to be used in moist conditions to avoid over-packing the seedbed. FIGURE 20 shows a typical seedbed after seeding into stubble, both before and after use of the packer drawbar.

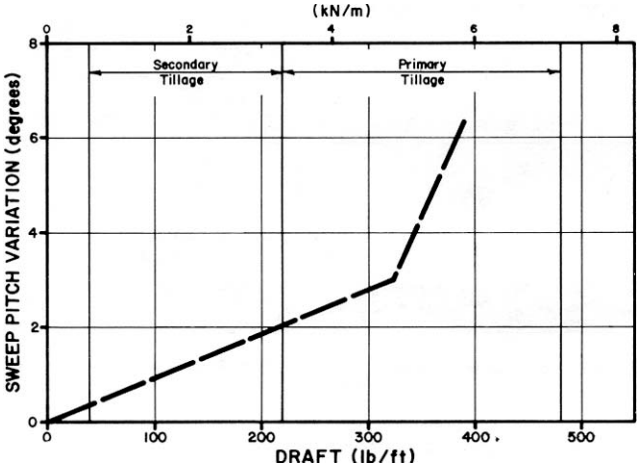


FIGURE 19. Sweep Pitch Variation Over a Normal Range of Draft with 12 in (305 mm) Shank Spacing.

FIGURE 20. Blanchard Seedbed (Right: Before Packing; Left: After Packing).

Shank Characteristics: The Case International model 5500 chisel plow was equipped with adjustable spring cushioned shank holders. During the evaluation it was used with 16 in (406 mm) wide Edwards sweeps with a 43 degree stem angle, giving a no-load sweep pitch of 1 degree. Sweep pitch (FIGURE 19) varied 2.0 degrees over the range of draft (drawbar pull) normally encountered in secondary field conditions.

Cushioning spring perload was exceeded at drafts greater than 325 lb/ft (4.9 kN/m) occurring midway in the range of normai primary tillage. This shows that the Case International 5500 chisel plow was suitable only for secondary and light primary tillage. In heavy primary tillage, sweep pitch became excessive, resulting in non-uniform seeding depth and furrow bottom ridging.

Penetration: When equipped with 43 degree, 16 in (406 mm). sweeps, penetration was very good in most field conditions and it was easy to obtain correct seeding depth. Correct seeding depth could not be obtained in hard conditions such as dry, baked slough bottoms or in fields with abnormally hard furrow bottoms. Penetration was uniform across the cultivator width provided all depth control linkages and hitch height were kept properly adjusted.

The cultivator wheels were positioned so that each center section wheel supported about 15% of the total cultivator weight, while each wing wheel supported about 10%. Cultivator or air seeder sinking was not a problem in moderately soft soils. Since the air seeder was not supported by the cultivator wheels, but was carried on its own wheels, it did not contribute to cultivator sinking in soft soils.

Trash Clearance: The Blanchard 5-Way air seeder with Case International 5500 chisel plow cultivator had very good trash clearance. In heavy, loose trash plugging sometimes occurred between the wing wheels and outer shank. This was due to minimum clearance between the shank and tire. With 16 in (406 mm) sweeps it was possible to operate in fields with a heavier trash cover than was possible with a conventional hoe drill.

Skewing and Stability: The Blanchard 5-Way air seeder with Case International 5500 chisel plow was very stable and sideways skewing occurred only in very hilly conditions. The cultivator shank pattern was symmetrical and did not impose any side forces on the cultivator during normal tillage. When equipped with 16 in (406 mm) sweeps, the cultivator had to skew more than 2.5 degrees to miss weeds. Throughout the evaluation period, in normal seeding conditions, skewing was never serious enough to cause weeds to be missed.

Reasonable care had to be observed on steep hillsides due to the high centre of gravity of the air seeder, especially with full grain and fertilizer tanks.

Weed Kill: Weed kill was good when equipped with 16 in (406 mm) sweeps. The 12 in (305 mm) shank spacing resulted in 4 in (102 mm) sweep overlap. Considerable sweep wear could occur before weeds were missed. However, to ensure adequate sweep lift is maintained for proper seed placement, sweeps should be replaced before significant wear is evident.

Fertilizer Banding: The Blanchard air seeder could be used for two types of fertilizer applications. It could be used for normal fertilizer application at seeding time by metering fertilizer from one tank and grain from the other and applying both through the same seed boots. When equipped with banding knives (FIGURE 21), it could also be used for fertilizer banding.

Experimental results suggest that placing fertilizer in compact bands from 1.5 in (35 mm) below seed depth to twice seeding depth is desirable for fall fertilizer application. This requires the use of banding knives to obtain sufficient depth and minimize soil disturbance and fertilizer spreading.

The Blanchard 5-Way worked well for fertilizer banding. Fertilizer granules were placed in a band about 0.75 in (19 mm) wide, with fertilizer depth ranging from near knife tip depth to 0.40 in (10 mm) above knife tip depth. The fertilizer band width and thickness was not affected by knife wear.

When using the front or rear meter only, fertilizer application rates of 115 lb/ac (131 kg/ha) were possible. When using both tanks and changing the sprocket combination, a maximum application rate of 234 lb/ac (266 kg/ha) with the 35 ft (11.3 m) cultivator at 5.5 mph (9.0 km/h) was possible.

The Blanchard 5-Way air seeder tanks and metering system were sealed against moisture entry. However, when exposed to driving rain some moisture entered the metering system, causing the fertilizer to cake. The metering system should be checked after rainfall for any caking of fertilizer to avoid errors in appli-

cation rates. To prevent corrosion, all unprotected components should be cleaned and oiled periodically when applying fertilizer.

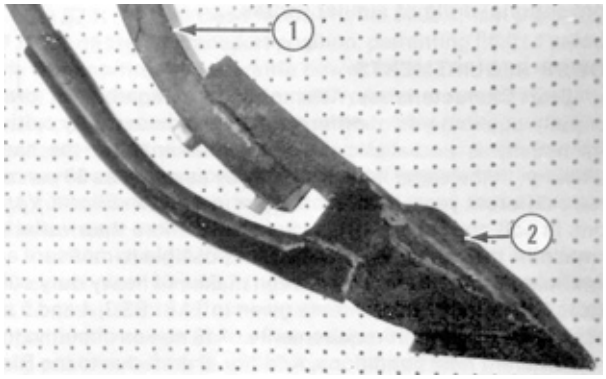


FIGURE 21. Blanchard Banding Knife: (1) Shank, (2) Knife.

EASE OF OPERATION

Dual Purpose Operation: The Blanchard 5-Way air seeder could be detached from the cultivator by one man in less than 15 minutes, providing the headers and hoses were left on the cultivator, allowing the cultivator to be used as a dual purpose machine for both seeding and seasonal tillage. If all headers and hoses were removed from the cultivator, it took two men about 2 hours to detach the applicator from the cultivator.

Hitching: The Blanchard 5-Way air seeder was easily hitched to a tractor. Hitching convenience was increased by the fact that the clevis shaped hitch link was always in the horizontal position. Hitching also included the hook-up of six hydraulic lines with quick couplers, an electronic coupler for the electronic monitoring system, and the connecting of the power take-off shaft.

Filling: A drill fill or grain auger was needed to fill the grain and fertilizer tanks. Because the filler openings were located 8.6 ft (2.6 m) above ground level, hand filling was impractical as it necessitated carrying the grain or fertilizer up the access ladder. The granular tank was filled by hand because granular product is usually pumhased by the bag. It is recommended that the manufacturer consider improving access to the granular tank to allow easier filling (FIGURE 22). The large 20 x 21 in (508 x 533 mm) front and rear main tank openings gave ample room for auger filling.

The filler lids were hinged and were latched by a simple hinged friction lock.

The granular tank held 15 ft^3 (0.42 m^3) while the main front tank held 87 bu (3167 L) and the main rear tank held 43 bu (1565 L).

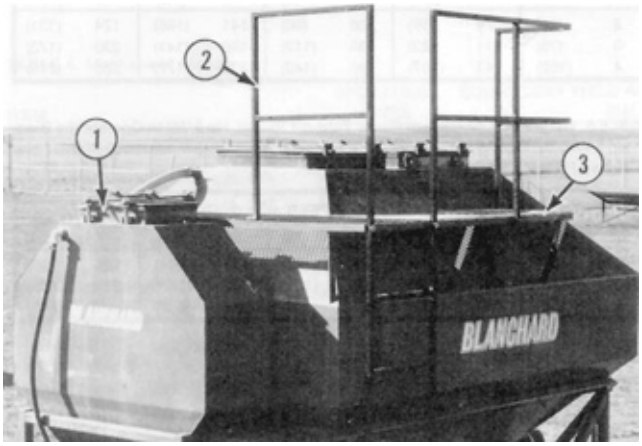


FIGURE 22. Poor Access to Granular Tank: (1) Granular Tank Lid, (2) Railing, (3) Platform.

Visibility: Visibility of the cultivator mainframe section was obstructed by the tanks. Care had to be observed when operating the Blanchard 5-Way to detect possible problems such as mainframe plugging.

Manueverability: Because of the additional pivot point at the hitch between the applicator and the cultivator, the Blanchard 5-Way air seeder, when attached to the cultivator, was difficult to maneuver while backing up.

Monitoring: The test machine was not supplied with a material flow monitoring system. An acremeter monitor was supplied. Functions included "speed", "area rate", "area covered", and "distance covered". Because plugging of the distribution system was difficult to detect from the tractor seat, it is recommended that the manufacturer consider providing, as optional equipment, a flow monitoring system to monitor material flow.

Seed and Fertilizer Boots: The occasional seed boot plugged while seeding. Plugged boots were difficult to detect because usually only half of the V-shaped boot would plug. No banding knife plugging problems were encountered while banding fertilizer.

Cleaning: Access and cleaning of the meter box was possible with full tanks. This was accomplished by closing the slide gate between the tank and meter box and removing the front and back cover plate. Each tank was equipped with a cleanout door, which was located about 1.5 in (38 mm) above the bottom of the tank. Collection of material from the tank cleanout.was inconvenient. A vacuum cleaner was needed for thorough cleaning of the three tanks. Access into the tanks was possible by removal of the tank opening screens. The screens could be removed without tools.

Area Meter: The Blanchard 5-Way air seeder was equipped with an electronic area meter. The meter could measure area in either acres of hectares. The acremeter was accurate and recorded to the nearest tenth acre. The acremeter gave an area reading about 2% low.

Transporting: The Blanchard 5-Way air seeder and Case International 5500 chisel plow were easily placed in transport position in less than five minutes (FIGURE 23). One hydraulic cylinder raised the cultivator wings to the upright position. The meter drive was conveniently engaged and disengaged hydraulically from the tractor seat.

The assembly towed well in transport position. Overall transport height and width were 17.7 ft (5.4 m) and 15.7 ft (4.8 m) respectively, requiring care when travelling on public roads.

EASE OF ADJUSTMENT

Lubrication: Not all lubrication points were easily accessible. Twenty-one fittings on the applicator and forty-nine on the cultivator required servicing. Four wheels on the applicator and eight on the cultivator required servicing. A servicing schedule was supplied in the operator's manual.

Application Rate: Application rate was changed by turning a hand crank which adjusted the size of gate opening above the drag chain. With increased use, the changing of the application rate became difficult due to binding of the slide gate and play in the hand crank. The meter scale on the main tanks also became difficult to read. It is recommended that the manufacturer consider improving the slide gate movement, decreasing the play in the hand crank and improving the meter scale (FIGURE 24).

FIGURE 23. Transport Position.

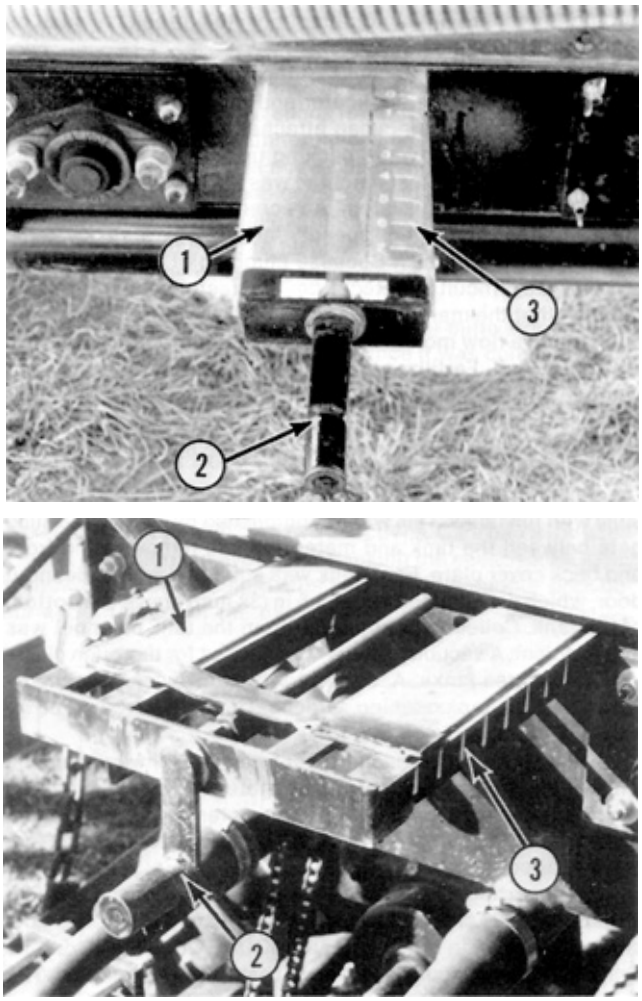


FIGURE 24. Application Rate Adjustment (Upper) Main Meters: (1) Slide Gate, (2) Hand Crank, (3) Gate Opening Scale; (Lower) Granular Meter: (1) Slide Gate, (2) Hand Crank, (3) Gate Opening Scale.

The gate opening adjustment was calibrated in increments of 0.50 from 0 to 7. Calibration charts, in pounds per acre, were shown in the operator's manual. Changing sprocket combinations allowed for speciality crops and higher application rates.

Adjusting for precise seeding rates in small grains was difficult due to the relatively large scale divisions. For example, in Westar canola, each 0.5 in (13 mm) scale increment changed the seeding rate by about 2 lb/ac (2.27 kg/ha).

Depth Adjustment: Seeding depth was conveniently adjusted by four hydraulic cylinders; one master cylinder on each side of the mainframe and a slave cylinder, in series with the master cylinder, on each wing. An adjustable sleeve on the master cylinders could be used to set maximum depth. As is common with series hydraulic systems, to maintain the center and wing frames at the same height, periodic synchronization of the cylinders by completely extending them to the fully raised position was necessary.

The Case International cultivator frame was levelled from front to back by positioning the hitch stop bolts in one of seven positions and from side to side by adjusting threaded connectors on each depth cylinder. The adjustments required the use of tools. Cultivator levelling adjustments were adequate to suit all field conditions encountered throughout the evaluation.

RATE OF WORK

The Blanchard air seeder was operated at speeds ranging from 3 to 7 mph (5 to 11 km/h). Overall best performance in terms of weed kill and seed placement was obtained at speeds of 4.5 to 5.5 mph (7 to 9 km/h). This resulted in field work rates for the 37 ft (11.2 m) unit ranging from 19.0 to 24 ac/hr (7.7 to 9.7 ha/hr). Using both tanks when seeding wheat at a rate of 75 lb/ac (85 kg/ha), about 100 ac (40 ha) could be seeded before refilling. This compares to 42 to 65 ac (17 to 26 ha) between refills for most conventional drills of similar widths.

POWER REQUIREMENTS

Draft Characteristics: Attempting to compare draft (drawbar pull) requirements of different makes of heavy duty cultivators usually is unrealistic. Draft requirements for the same cultivator, in the same field, may vary by as much as 30 percent in two different years, due to changes in soil conditions. Variations in soil conditions affect draft much more than variation in machine make, usually making it impossible to measure any significant draft difference between makes of heavy duty cultivators. The power requirements given in TABLES 3, 4 and 5 are based on average draft requirements of 18 makes of cultivators in 52 different field conditions. Additional draft due to the Blanchard 5-Way air seeder with full tanks has been included.

Tractor Size: TABLES 3 to 5 show tractor sizes needed to operate the Blanchard 5-Way air seeder and Case International 5500 chisel plow in light and heavy secondary tillage was well as in primary tillage. Tractor sizes have been adjusted to include tractive efficiency and represent a tractor operating at 80 percent of maximum power on a level field. The sizes presented in the tables are the maximum power take-off rating as deter-

Tractor size may be determined by selecting the desired tillage depth and speed from the appropriate table. For example, in light secondary tillage at 3 in (75 mm) depth and 5 mph (8 km/h), a 104 hp (78 kW) tractor is needed to operate the seeding unit. In heavy secondary or light primary tillage at the same depth and speed, a 146 hp (110 kW) tractor is needed, while in heavy primary tillage a 165 hp (124 kW) tractor is required.

TABLE 3. Tractor Size (Maximum Power Take-off Rating, hp (kW)) to Operate the Blanchard 5-Way Air Seeder, with 37 ft (11.2 m) Case international Model 5500 Chisel Plow in Light Secondary Tillage.

DEPTH		SPEED mph (km/h)							
in	(mm)	4	(6.4)	5	(8)	6	(9.6)	7	(11.2)
2	(50)	51	(38)	71	(53)	95	(71)	122	(92)
3	(75)	77	(58)	104	(78)	134	(101)	168	(126)
4	(102)	95	(71)	137	(103)	174	(131)	214	(161)

TABLE 4. Tractor Size (Maximum Power Take-off Rating, hp (kW)) to Operate the Blanchard 5-Way Air Seeder, with 37 ft (11.2 m) Case International Model 5500 Chisel Plow in Heavy Secondary or Light Primary Tillage.

DEPTH		SPEED mph (km/h)							
in	(mm)	4	(6.4)	5	(8)	6	(9.6)	7	(11.2)
2	(50)	79	(59)	106	(80)	141	(106)	174	(131)
3	(75)	111	(83)	146	(110)	188	(141)	230	(173)
4	(102)	143	(107)	186	(140)	236	(177)	286	(215)

TABLE 5. Tractor Size (Maximum Power Take-off Rating, hp (kW)) to Operate the Blanchard 5-Way Air Seeder, with 37 ft (11.2 m) Case International Model 5500 Chisel Plow in Heavy Primary Tillage.

DEPTH		SPEED mph (km/h)							
in	(mm)	4	(6.4)	5	(8)	6	(9.6)	7	(11.2)
2	(50)	80	(60)	97	(73)	112	(84)	128	(96)
3	(75)	134	(101)	165	(124)	195	(146)	239	(179)
4	(102)	189	(142)	234	(176)	278	(209)	320	(240)

OPERATOR SAFETY

The Blanchard 5-Way tank access ladder was convenient and safe. A safety rail was provided along the upper walkway.

Extreme caution is needed in transporting most folding cultivators to avoid contacting power lines. Minimum power line heights vary in the three prairie provinces. In Saskatchewan the energized line may be as low as 17 ft (5.2 m) over farmland or

over secondary roads. In Alberta and Manitoba, the neutral ground wire may be as low as 15.7 ft (4.8 m) over farmland. In all three provinces, power lines in farmyards may be as low as 15 ft (4.6 m).

The 37 ft (11.2 m) Case International 5500 chisel plow was 15.7 ft (4.8 m) high in transport position, permitting limited safety while transporting under prairie power lines. The legal responsibility for safe passage under utility lines rests with the machinery operator and not with the power utility or the machinery manufacturer. All provinces have regulations governing maximum permissible equipment heights on various public roads. If height limits are exceeded, the operator must contact power and telephone utilities before moving.

The Blanchard 5-Way air seeder with Case International 5500 chisel plow was 17.7 ft (5.4 m) wide in transport position. This necessitated caution when towing on public roads, over bridges and through gates. The center frame was held in the raised position by pushing the stop collars against the stop pins on the master cylinders and locking the collars in position. An automatic hydraulic lock was provided to lock the wings in transport position.

A slow moving vehicle sign was not provided on the rear of the applicator for transport. It is recommended that the manufacturer consider supplying a slow moving vehicle sign as standard equipment.

The Blanchard 5-Way air seeder with Case International model 5500 chisel plow, towed well at speeds up to 17 mph (28 km/h).

Total engine and fan noise level at the tractor hitch point was about 95 dbA. This increased the operator station noise level in most modern tractor cabs by only 1 dbA. For example, in one tractor cab, operator station noise level was 77.5 dbA with only the tractor operating and 78.5 dbA with the tractor and pneumatic applicator operating. Suitable ear protectors should be worn if the tractor is not equipped with an appropriate cab.

OPERATOR'S MANUAL

The operator's manual for the Blanchard 5-way air seeder contained useful information on safety, assembly, adjustment, specifications, maintenance and operation. A detailed parts list was also included. Calibration charts, calibrated in pounds per acre, were included in the operator's manual. A conversion chart in SI (metric) units was also included.

MECHANICAL HISTORY

TABLE 6 outlines the mechanical history of the Blanchard 5-Way air seeder during 110 hours of operation while processing about 2020 ac (818 ha). The intent of the test was evaluation of functional performance. An extended durability evaluation was not conducted.

TABLE 8. Mechanical History

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA ac	(ha)
Applicator			
. sealed air leak on header caused by set screw depression in header stand	5	107	(403)
- several seed boots plugged with damp fertilizer at	10, 25, 50, 60, 80	220, 525,1150 1380,1760	(89, 213, 466, 559, 713)
- changed header deflection cap on primary and secondary headers	10	220	(89)
- changed hose running from fan to granular box	10	220	(89)
- repair bent power take-off shaft at	20	435	(176)
- lengthened hydraulic hoses for meter drive wheel	30	643	(260)
- received 64-tooth sprocket to apply canola with main tank at	35	700	(283)
- sealed air leaks around main tank lids and main tank cleanout ports	70	1570	(636)
- magnetic pick-up wore through due to improper adjustment was repaired at	85	1855	(751)
- bolts holding gear box in position were sheared, and replaced at	end of test		
- main meter box drag chain was buckled and replaced at	end of test		
- 3/4" distribution hose was updated to 1" in diameter at	end of test		
- granular deflector plates were changed at	end of test		
Cultivator			
- banding knives were installed at	20, 95	435,1900	(176, 769)

Manufacturer's Modifications to the Applicator's Distribution System: The deflection plates on the primary and secondary headers were modified to be more convex to the air stream which improved the distribution pattern. A 64-tooth sprocket was supplied to be used on the main metering system to allow canola to be metered out of the main tank instead of the granular tank.

The secondary header hose was changed from the original 3/4 inch (19 mm) diameter to a wider one inch (25 mm) diameter hose. Changing the hose to once inch also required changing the secondary headers and seed boots to accommodate the greater diameter hose.

DISCUSSION OF MECHANICAL PROBLEMS

APPLICATOR

Mounting of Secondary Headers: To ensure no movement, the header was locked into position by a set screw. Although the header was stationary the set screw left a depression in the header pipe which allowed air to leak by, thus the header had to be sealed to eliminate the air leak. It is recommended that the manufacturer consider improving the seal between the secondary headers and header pipe to prevent air leakage.

Drag Chain: The drag chain buckled during the test period, due to improper adjustment of chain tension. With use, the drag chain is subject to stretching and requires periodic tightening.

APPENDIX I

SPECIFICATIONS

(A) APPLICATOR:	Blanchard
MODEL:	5-Way
SERIAL NUMBER:	160
MANUFACTURER:	Blanchard Box 1444 Saskatoon, Saskatchewan STK 3P7
DIMENSIONS:	
- width	8.6 ft (2630 mm)
- length	17.4 ft (5290 mm)
- height	9.9 ft (3018 mm)
- maximum ground clearance	
- wheel tread	7.9 ft (2400 mm)
METERING SYSTEM:	
- type	drag chain
- number of meters	3
- drive	chain from independant meter drive wheel
- adjustment	vary gate opening above drag chain
- airstream loading	pressurized tank
- transfer to openers	pneumatic conveyance through divider headers and hoses
TANK CAPACITIES:	
- granular	15 ft³ (0.42 m³)
- front main	87 bu (3167 L)
- rear main	43 bu (1565 L)
FAN:	
- type	centrifugal
- make	Blanchard
- maximum operating speed	4250 rpm
- drive	double V-belt

HITCH:
- vertical adjustment range: 10 in (254 mm) in 4 positions

WHEELS:
- tandem: 4, 11L-15, 8 ply
- meter drive wheel: 1, 7.60-15, 4 ply

NUMBER OF LUBRICATION POINTS: 21 grease fittings
4 wheel bearings

OPTIONAL EQUIPMENT: hydraulic drive system, diesel drive system, tow behind drive system, primary headers (three, five or six port)

(B) CHISEL PLOW

MAKE: Case International

MODEL: 5500 Chisel Plow

SERIAL NUMBER: 7242

MANUFACTURER: J.I. Case Canada
Division of Tenneco Canada Inc.
240 Henderson Drive
Regina, Saskatchewan
S4P 3M3

SHANKS:
- number: 37
- lateral spacing: 12 in (305 mm)
- trash clearance (sweep to frame): 24 in (610 mm)
- number of shank rows: 4
- shank cross section: 2 x 1 in (25 x 51 mm)
- shank stem angle: 43 degrees
- sweep hole spacing: 2-1/4 in (57 mm)
- sweep bolt size: 1/2 in (13 mm)

HITCH:
- vertical adjustment range: 21 in (533 mm) in 7 positions

DEPTH CONTROL: hydraulic

FRAME: 2 x 5 in (51 x 127 mm),4 x 4 in 102 x 102 mm)

TIRES: 8, 9.5L-15, 8 ply

NUMBER OF LUBRICATION POINTS: 49

HYDRAULIC CYLINDERS:
- depth control: 4, 4 x 10 in (102 x 254 mm)
- wing lift: 2, 4 x 36 in (102 x 914 mm)

(C) OVERALL SPECIFICATIONS FOR APPLICATOR-CULTIVATOR ASSEMBLY

DIMENSIONS	FIELD POSITION	TRANSPORT POSITION
- width	36.7 ft (11,200 mm)	17.7 ft (5400 mm)
- length	36.6 ft (11,150 mm)	36.6 ft (11,150 mm)
- height	10.6 ft (3230 mm)	15.7 ft (4775 mm)
- maximum ground clearance	8.0 in (200 mm)	8.0 in (200 mm)
- wheel tread	32.3 ft (9850 mm)	12.1 ft (3700 mm)
- effective seeding width	37.0 ft (11,278 mm)	

WEIGHTS:

APPLICATOR:	TANKS EMPTY	TANKS FULL OF WHEAT/GRANULAR
- hitch	240 lb (109 kg)	790 lb (359 kg)
- left wheel	2050 lb (932 kg)	3820 lb (1736 kg)
- right wheel	2320 lb (1055 kg)	4180 lb (1900 kg)

CULTIVATOR:	FIELD POSITION	TRANSPORT POSITION
- left center tandem wheels	2330 lb (1059 kg)	3710 lb (1686 kg)
- right center tandem wheels	2240 lb (1018 kg)	3960 lb (1800 kg)
- left wing tandem wheels	1520 lb (691 kg)	
- right wing tandem wheels	1580 lb (718 kg)	
TOTAL, TANKS EMPTY	12,280 lb (5582 kg)	
TOTAL, TANKS FULL OF WHEAT/GRANULAR		16,460 lb (7482 kg)

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/hour (km/h)
inches (in) x 25.4	= millimetres (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/bushel (lb/bu) x 1.25	= kilograms/hectolitre (kg/hL)
pounds force/foot (lb/ft) x 0.015	= kilonewtons/metre (kN/m)

SUMMARY CHART
BLANCHARD 5-WAY AIR SEEDER

RETAIL PRICE: $20,264.00 (June 1986, f.o.b. Lethbridge, Alberta) for Air Seeder, Air Package and Seed Boots to feed 37 shanks.

SEEDING
- secondary field conditions: good
- light primary field conditions: good
- heavy primary field conditions: good

FERTILIZER BANDING
- secondary field conditions: good
- light primary field conditions: good
- heavy primary field conditions: good
- application rate (acceptable CV): up to 234 lb/ac (266 kg/ha)

METER CALIBRATION: front and rear tank meters were the same. All calibration charts have been updated.

DISTRIBUTION UNIFORMITY
- wheat: acceptable
- barley: acceptable
- canola: acceptable
- fertilizer: acceptable
- Avadex BW: acceptable
- Treflan QR5: acceptable

EFFECT OF FIELD VARIABLES: field bounce, ground speed, and field slope had little effect on metering rates

GRAIN DAMAGE: high in canola

SEED PLACEMENT: good

EASE OF ADJUSTMENT: seeding rate sometimes difficult to set

RATE OF WORK: 19 to 24 ac/hr (7.7 to 9.7 ha/hr)

POWER REQUIREMENTS
- light primary tillage: at 3 in (75 mm) and 5 mph (8 km/h) -- 146 hp (110 kW)
- heavy primary tillage: at 3 in (75 mm) and 5 mph (8 km/h) -- 165 hp (124 kW)

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