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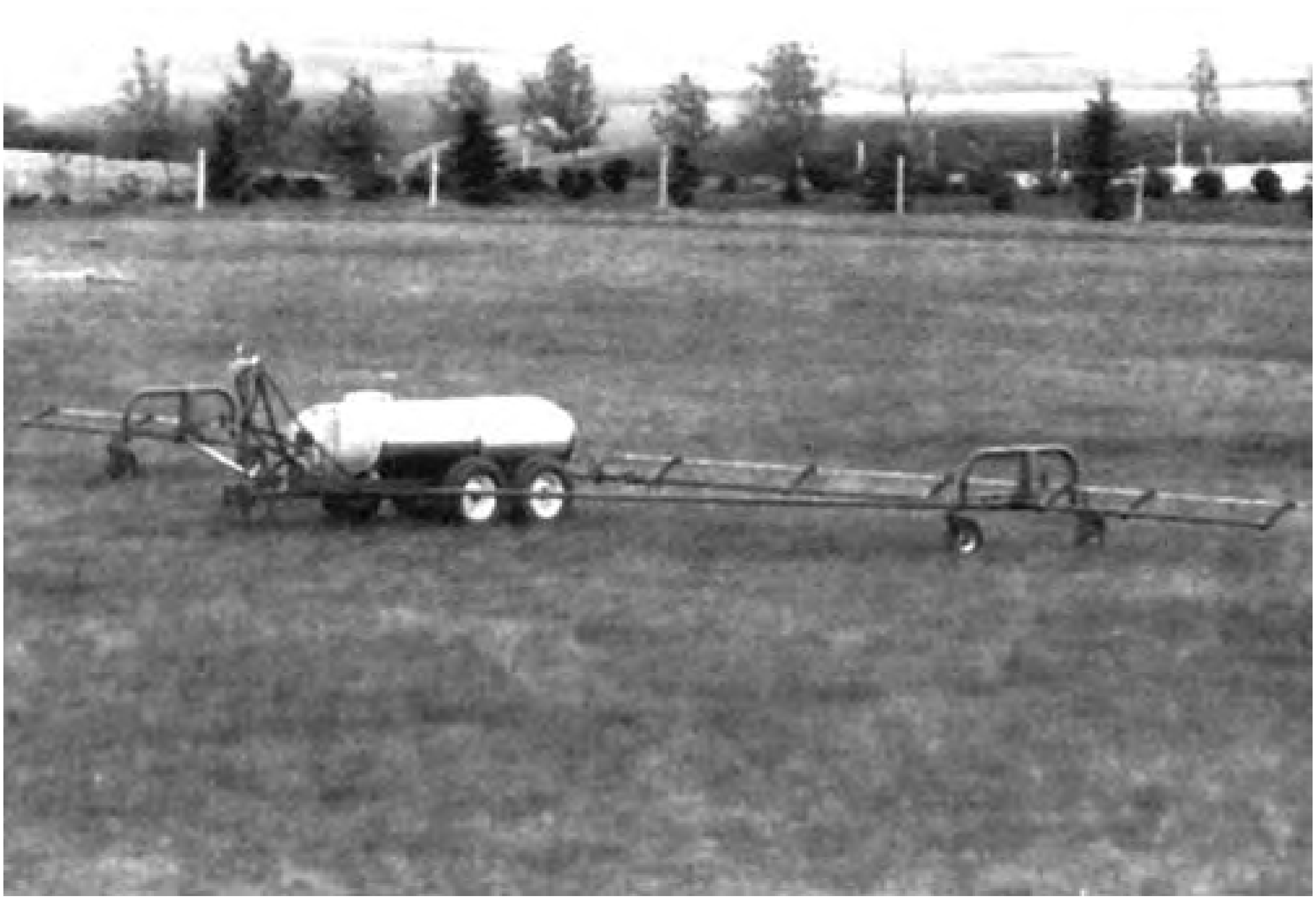
Evaluation Report 88



George White Model SW480 Field Sprayer

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

GEORGE WHITE MODEL SW480 FIELD SPRAYER

MANUFACTURER:
George White & Sons Company Limited
P.O. Box 5129
London, Ontario
N6A 4L6

DISTRIBUTOR:
Alberta - Alberta Wheat Pool, United Farmers of Alberta, Wheat Belt Industries
Saskatchewan - Saskatchewan Wheat Pool Manitoba - Superior Tire N6A 4L6

RETAIL PRICE:
$2800.00 (May, 1978, f.o.b. Lethbridge, complete with B60W boom, suction header kit and Hypro CI 700 roller pump.)

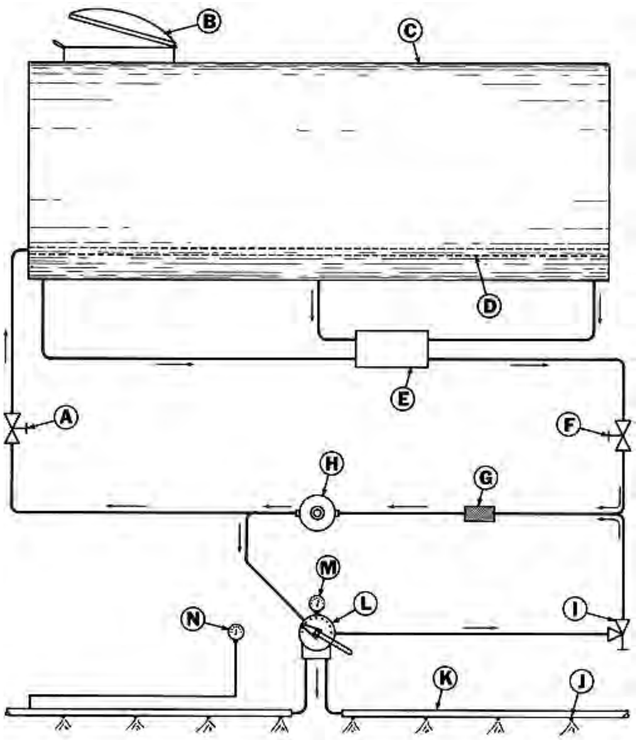


FIGURE 1. Flow Diagram for George White Model SW480: (A) Agitator Valve, (B) Lid, (C) Tank, (D) Agitator, (E) Header, (F) Shut-off Valve, (G) line Strainer, (H) Pump, (I) Pressure Regulator, (J) Nozzle, (K) Boom, (L) Boom Control, (M) Control Pressure Gauge, (N) Boom Pressure Gauge.

SUMMARY AND CONCLUSIONS

Functional performance of the George White Model SW480 sprayer was good. Functional performance was reduced by interference between the boom and tank, and boom height adjusting handle when transporting, and difficulty for some operators to reach the controls.

The George White SW480 performed satisfactorily at field speeds up to 12 km/h (7.5 mph) resulting in a maximum field capacity of 22 ha/h (54 ac/h). The tandem boom castor wheel assemblies performed well, especially on rough fields.

Nozzle distribution patterns were very uniform as pressures above 250 kPa (36 psi) with the TeeJet 6502, 65° brass nozzle tips supplied with the sprayer. Nozzle delivery increased 6.4% after 56 hours of operation.

Pump capacity was adequate to apply and agitate most commonly used chemicals. Plumbing system pressure loss was minimal. Strainer and nozzle plugging was infrequent but pressure gauges supplied with the sprayer were inaccurate.

Controls were difficult to reach from the tractor seat. Nozzle height was easily adjusted without tools and nozzle angle adjustment was convenient. Hitching was convenient and grease fittings were readily accessible. Cleaning the header and the rear of the tank was difficult. No drain plug was provided on the tank or header. Folding to transport was inconvenient since the radius braces had to be held when moving the booms. The 3.7 m (12.2 ft) transport width caused difficulty when going through narrow gates. Brief operating instructions were provided on the tank but an operator's manual was not available for evaluation.

Several mechanical problems occurred during 71 hours of field operation. Vibration caused the pressure gauges to fail. Hoses were not adequately fastened, causing them to drag on the ground. The 64 mm (2.5 in) boom rails were weak and sagged after 50 hours of operation. A 76 mm (3 in) boom rail assembly was supplied and is now standard equipment. Interference between the booms and other sprayer components caused damage to the boom assembly. The front radius rod bracket was damaged by the tractor tire while turning. Spray boom connections leaked and several nozzle clamp bolts broke during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying more accurate, better quality pressure gauges and including metric or dual calibrated scales or a suitable conversion chart to facilitate sprayer operation after conversion to the SI system.
2. Modifications to permit convenient adjustment of controls from the tractor seat.
3. Relocating the line strainer to prevent chemical from splashing on the operator's hands.
4. Supplying a high capacity 100 mesh strainer at the tank filler opening.
5. Modifications to reduce transport width.
6. Supplying a slow moving vehicle sign.
7. Supplying an operator's manual.
8. Lengthening the boom pressure gauge hose and fastening it to prevent the hose from dragging on the ground.
9. Modifications to prevent the boom hoses from dragging on the ground in transport.
10. Providing a drain plug to drain the tank and header.
11. Modifications to eliminate interference between the front radius rod bracket and tractor tire.
12. Modifications to eliminate leaking at the threaded boom pipe couplers.
13. Modifications to eliminate boom damage caused by boom interference in transport.
14. Modifications to prevent bending of the hitch pin clips on the transport tie bar.

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Senior Engineer: E. H. Wiens
Project Engineer: K. W. Drever

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Better quality oil filled pressure gauges are now supplied with production models of this sprayer. Future units will be metric.
2. Modifications of the control post are under consideration for 1979 production.
3. The line strainer has been re-orientated to eliminate this problem.
4. An optional 25 mesh strainer for the tank filler opening is available.
5. A change in transport width is not being considered at this time.
6. A slow moving vehicle sign bracket is now provided. The sign will be standard equipment on 1979 production models.
7. A complete operator's manual in both English and SI units will be supplied.
8. The boom pressure gauge hose has been lengthened and tie straps are supplied to hold it in position.
9. Tie straps are now supplied to hold the boom hoses in position.
10. A drain plug will be incorporated in the suction header on 1979 production units. This in turn provides drainage for the tank.

11. Stops have been added to the radius rod bracket mounts to prevent this problem.
12. A hose coupling will be featured on 1979 production models.
13. The boom handle has been modified to eliminate this problem.
14. Hitch pin clips will be replaced with snap pins on 1979 production booms.

GENERAL DESCRIPTION

The George White Model SW480 is a trailing, boom type sprayer. The trailer is mounted on tandem axles while each boom is supported by a tandem walking beam castor assembly. The low profile 1818 L (400 gal) aluminum tank is equipped with hydraulic agitation and a fluid level indicator.

The George White SW480 has 36 nozzles spaced at 508 mm (20 in) giving a spraying width of 18.3m (60 ft). Boom height and spray angle are adjustable. The booms fold back for transport. The pressure regulator, boom control valve and pressure gauges are mounted on an adjustable stand near the front of the trailer hitch. The 540 rpm teflon roller pump is driven from the tractor power take-off.

FIGURE 1 presents a flow diagram for the George White SW480, while detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The George White SW480 was operated for 71 hours in the conditions shown in TABLE 1 while spraying about 1337 ha (3304 ac). It was evaluated for quality of work, pump capacity, ease of operation, operator safety and suitability of the operator's manual. The standard TeeJet 6502 brass nozzle tips were replaced with TeeJet 8001 brass nozzle tips for 15 hours of operation.

TABLE 1. Operating Conditions

Chemical Applied	Hours	Speed		Spraying Rate		Field Area	
		km/h	mph	ha/h	ac/h	ha	ac
2, 4-D	30	11	7	20	50	607	1500
2, 4-D, Banvel mixture	38	10	6	18	44	677	1672
Avenge/ Buctril M mixture	3	10	6	18	44	63	132
TOTAL	71					1337	3304

The sprayer submitted for evaluation was a prototype model. Two boom support rail assemblies were tested. A 64 mm (2.5 in) boom support rail initially supplied with the sprayer was used for all field evaluations. A 76 mm (3 in) boom support rail assembly was later submitted for comparison of boom stability to the 64 mm (2.5 in) rail. The 76 mm (3 in) boom support rail will be standard equipment with all 1978 production models of the SW480 with B60W booms.

RESULTS AND DISCUSSION

QUALITY OF WORK

Distribution Patterns: FIGURES 2 and 3 show the spray distribution pattern along the boom when equipped with the 65° TeeJet 6502 brass nozzles which were supplied with the sprayer. The coefficient of variation (CV)[1] at 140 kPa (20 psi) was 24% with application rates along the boom varying from 48 to 119 L/ha (4.3 to 10.6 gal/ac) at 8 km/h (5 mph). High spray concentration occurred below each nozzle with inadequate coverage between nozzles. Although low pressures are not recommended, the distribution pattern at the 140 kPa (20 psi) boom pressure is shown to illustrate the poor patterns typical at low pressure. At 275 kPa (40 psi) the distribution pattern improved considerably, reducing the CV to 9%.

Application rates along the boom varied from 91 to 134 L/ha (8.1 to 11.9 gal/ac) at 8 km/h (5 mph). Higher pressure improved distribution by increasing the overlap among nozzles. Higher pressure, however, usually causes more spray drift.

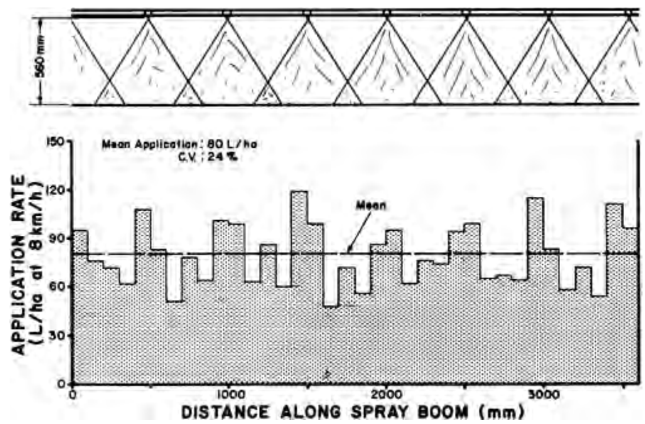

FIGURE 2. Typical Distribution Pattern along the Boom at 140 kPa (20 psi) with TeeJet 6502 (65°) Nozzles, at a Nozzle Height of 560 mm (22 in).

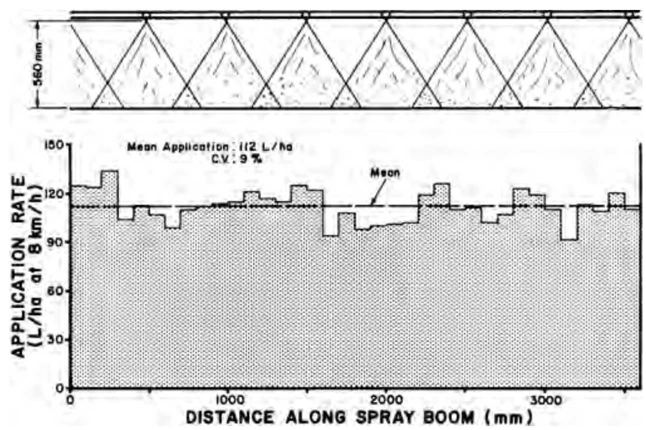

FIGURE 3. Typical Distribution Pattern along the Boom at 275 kPa (40 psi) with TeeJet 6502 (65°) Nozzles, at a Nozzle Height of 560 mm (22 in).

FIGURE 4 shows how boom pressure affects spray pattern uniformity for 65°, TeeJet 6502 brass nozzles such as those supplied with the sprayer. Two different batches of nozzles, representing two different nozzle manufacturing times are shown. Both batches produced acceptable distributions at pressures above 180 kPa (26 psi) while one batch produced very uniform distribution at pressures above 205 kPa (30 psi) and the other at pressures above 250 kPa (36 psi). This indicates some variation between batches of nozzles.

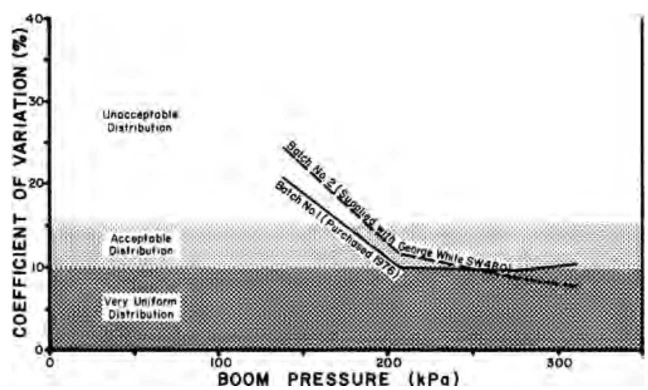

FIGURE 4. Spray Pattern Quality Variation Between Two Different Batches of New TeeJet 6502 Brass Nozzles Operated at a Nozzle Height of 560 mm (22 in).

FIGURE 5 shows the effect of boom pressure on spray pattern uniformity for 80°, TeeJet 8002 stainless steel nozzles. These nozzles have the same capacity as the 6502 nozzles, which were supplied with the sprayer but have an 80° spray angle rather than a 65° angle. Three different batches of nozzles, representing different manufacturing times are shown. As can be seen, variations in pattern uniformity can be expected for 80° TeeJet 8002 stainless steel nozzles. For example, one batch of new nozzles produced

[1]The coefficient of variation (CV) is the standard deviation of application rates for successive 100 mm (4 in) sections along the boom expressed as a percent of the mean application rate. The lower the CV, the more uniform is the spray coverage. A CV below 10% indicates very uniform coverage while a CV above 15% indicates inadequate uniformity for chemicals having a narrow application range. The CV's above were determined in stationary laboratory tests. In the field, CV's may be up to 10% higher, due to boom vibration and wind. Different chemicals vary as to the acceptable range of application rates. For example, 2,4-D solutions have a fairly wide acceptable range (±14%) while chemicals such as Buctril M have a very narrow range.

acceptable distribution patterns at pressures above 150 kPa (22 psi) and very uniform patterns at pressures above 170 kPa (25 psi) while another batch of new nozzles produced acceptable distribution only at pressures above 200 kPa (29 psi) and very uniform distribution at pressures above 250 kPa (36 psi). Although researchers have reported that 80° nozzles usually produce better spray distribution than 65° nozzles, it can be seen that the variation among different batches produced by the nozzle manufacturer are greater than the variation between Tee Jet 6502 and Tee Jet 8002 nozzles.

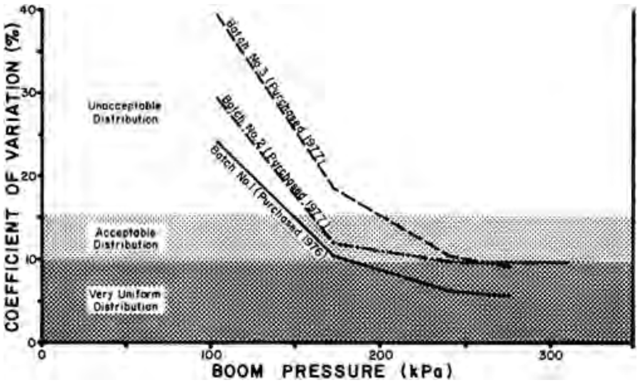

FIGURE 5. Spray Pattern Quality Variation Among Three Different Batches of New Tee Jet 8002 Stainless Steel Nozzles Operated at a Nozzle Height of 460 mm (18 in).

Spray Drift: To obtain acceptable spray distribution the George White SW460 had to be operated above 180 kPa (26 psi) with the nozzles that were supplied with the sprayer. Work by the Saskatchewan Research Council[2] indicates that drift at the edge of the spray pattern was about 3% at 170 kPa (25 psi) and about 6% at 275 kPa (40 psi) using nozzles that applied 56 L/ha (5 gal/ac). The drift was decreased by a factor of four when using larger capacity 60° nozzles similar to those supplied on the George White SW480. More recent tests indicate that Tee Jet 8002 nozzles are also effective in reducing spray drift especially at higher wind speeds due to lower boom height[3]. Therefore, for drift control higher capacity nozzles such as those supplied with the George White SW480 are desirable.

Nozzle Calibration: FIGURE 6 shows the delivery of the Tee Jet 6502 brass nozzles, which were supplied with the sprayer. New nozzles delivered the manufacturer's rated capacity. Nozzle delivery increased 6.4% after 56 hours of field use. Some researchers indicate that a nozzle needs replacement once delivery has increased by more than 10%. Nozzle wear depends on the type of chemicals sprayed and water cleanliness.

FIGURE 6 also shows the variability among individual nozzles. The shaded areas represent the range over which the deliveries from 10 nozzles varied when new and after field tests. A narrow range and low CV indicates that nozzle discharges are very similar while a wider range indicates more variability among individual nozzle deliveries. Variability among individual nozzle deliveries on the George White SW480 was low. The CV of nozzle deliveries was 3.5% when new and only 1.7% when used.

Use of Optional Nozzles: The nozzle clamp assembly (FIGURE 7) accepted a wide range of standard nozzle tips. The nozzle height and angle was adjustable permitting the use of flat fan, flood or cone nozzles.

Booms: Two boom assemblies were submitted for evaluation. One had a 64 mm (2.5 in) boom support rail. The second boom assembly was very similar but the boom support rail was constructed of 76 mm (3 in) tubing. Stability of both booms was assessed by driving over a series of standard obstacles[4]. FIGURE 8 shows vertical boom bounce when the 76 mm (3 in) boom support rail wheels were driven over three different obstacle sizes at 9 km/h (5.6 mph). The maximum boom end movement was a 130 mm (5.1 in) lift and a 90 mm (3.5 in) drop. This resulted in a boom height variation from 470 mm to 690 mm (18.5 to 27.2 in) compared to the correct 560 mm (22 in) boom height. FIGURE 9 compares nozzle overlap at these three boom heights.

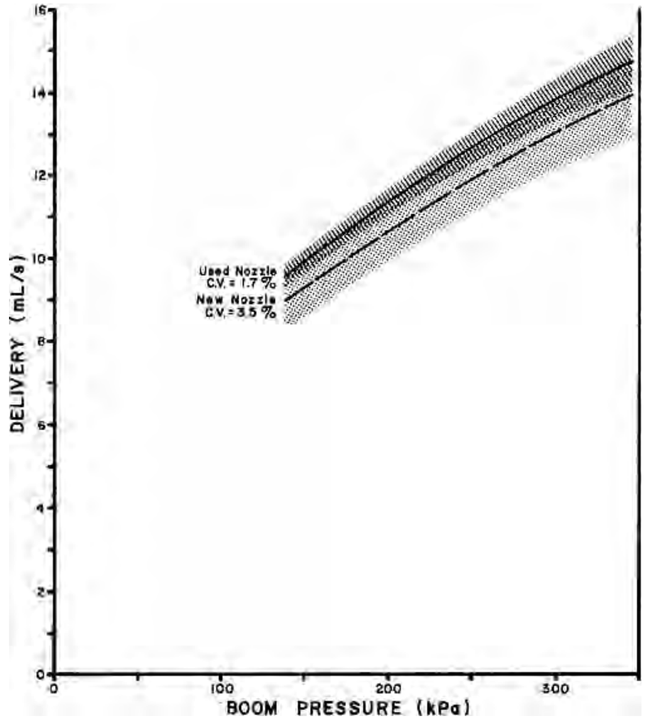

FIGURE 6. Delivery Rates of TeeJet 6502 Brass Nozzles - New and Used 56 Hours.

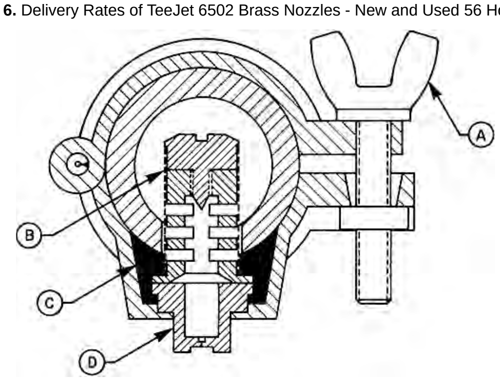

FIGURE 7. Cross Section of Nozzle: (A) Thumb Screw, (B) Strainer, (C) Washer, (D) Nozzle Tip.

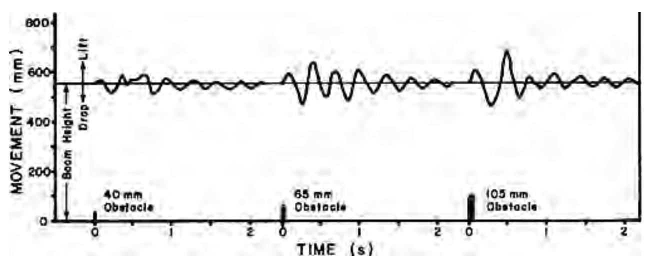

FIGURE 8. Typical Vertical Movement at Boom End when the 76 mm (3 in) Boom Support Rail Wheels are Driven over Different Obstacles at a Forward Speed of 9 km/h (5.6 mph).

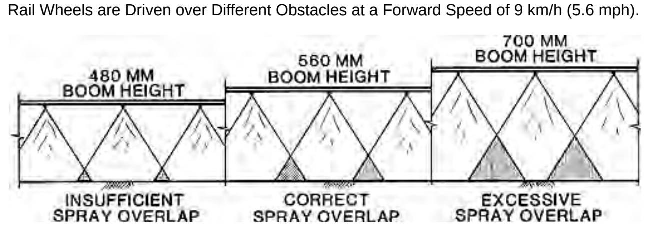

FIGURE 9. The Effect of Boom Lift and Drop on Spray Overlap.

The lift and drop at the end of the 64 mm (2.5 in) boom support rail was slightly less than that at the end of the 76 mm (3.0 in) boom support rail. Boom bounce at the centre of the larger boom support rail was slightly less than half that at the end. Bounce was greater at the centre of the 64 mm (2.5 in) boom support rail than at the centre

[2]*Maybank, J., Yoshida, K., "Droplet Deposition and Drift from Herbicide Sprays - Analysis of the 1973 Ground-Rig Trials", Saskatchewan Research Council Report No. P73-16, December, 1973, p. 65.*

[3]*Maybank, J., Yoshida, K., Shewchuk, S. R., "Comparison of Swath Deposit and Drift Characteristics of Ground-Rig and Aircraft Spray Systems -Report of the 1975 Field Trials", Saskatchewan Research Council Report No. P76-1, January, 1976, p. 16.*

[4]*PAMI T764-R78, Detailed Test Procedures for Field Sprayers*

of the larger boom support rail. Boom bounce was similar at 6, 9 and 12 km/h (3.7, 5.6 and 7.5 mph).

Driving over an obstacle with the boom wheels also caused the forward speed of the boom to vary in relation to the tractor speed since the boom initially deflects rearward and then springs forward. FIGURE 10 shows the forward boom end speed, relative to the ground when the 76 mm (3 in) boom support rail wheels were driven over the standard obstacles. Boom speed determines the application rate. For a fixed boom pressure, high application occurs at low speeds and low application occurs at high speeds. Large variations in application rate can result from horizontal boom movement on rough ground. For example, driving over a 65 mm (2.6 in) obstacle at 9 km/h (5.6 mph) caused boom end speed to vary from 10.8 to 6.8 km/h (6.7 to 4.2 mph). Resulting application rates could vary from 93 L/ha to 148 L/ha (8.2 to 13.2 gal/ac). Variation in boom end speed occurred in only two-tenth second, while the sprayer travelled 500 mm (20 in). Boom end speed variations were similar at operating speeds of 6 and 9 km/h (3.7 and 5.6 mph). At 12 km/h (7.5 mph) speed variations were about 1.5 times larger.

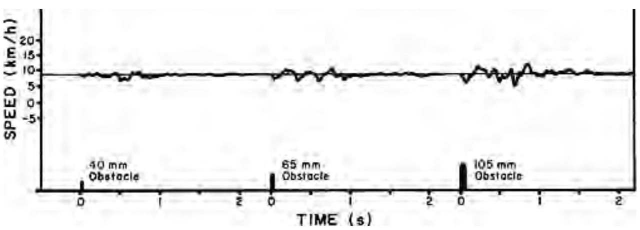

FIGURE 10. Typical Variation in Boom Speed when the Boom Castor Wheels are Driven over Different Obstacles at an Average Forward Speed of 9 km/h (5.6 mph).

Measurements of boom stability and field observations comparing the 64 and 76 mm (2.5 and 3 in) boom support rails indicated that the larger boom support rail was more stable from the castor wheels to the trailer, but slightly less stable at the outer end. However, the heavier boom would result in a more durable boom support assembly.

There was excessive vibration at the unsupported, inner section of the 64 mm (2.5 in) boom support rail assembly (FIGURE 11). The boom upright (FIGURE 12) at the centre of the 76 mm (3 in) boom support rail provided more support and reduced the movement at the inner ends of the booms.

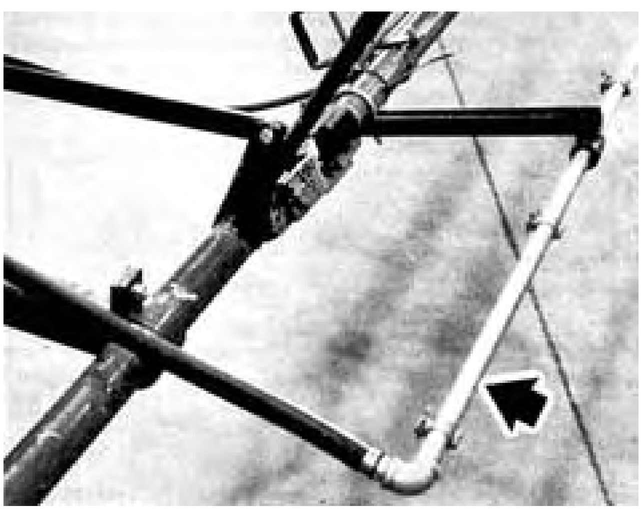

FIGURE 11. Unsupported Section at Centre of 64 mm (2.5 in) Boom Support Rail Assembly.

Boom Wheels: The castor wheel assemblies operated satisfactorily in all field conditions. The walking beam was effective in reducing boom movement on rough fields and operated well when crossing gullies or on rolling terrain.

Field Speeds: The George White SW480 performed satisfactorily at speeds up to 12 km/h (7.5 mph), resulting in a field capacity of 22 ha/h (54 ac/h).

Pressure Losses in the Plumbing System: Pressure drops through the plumbing system were negligible with commonly used nozzles, indicating that hose and fitting sizes were adequate.

FIGURE 12. Extra Support at Inner Ends of 76 mm (3 in) Boom Support Rail Assembly.

Header: Outlets at the front, centre and rear of the tank, leading to the header (FIGURE 1) ensured that there was always liquid at the pump inlet, even when operating on hilly land with a nearly empty tank.

Pressure Gauges: Two pressure gauges were supplied, one for the control valve and one for the right boom. The gauges supplied with the sprayer were of poor quality since one was only accurate to within 35 kPa (5 psi) and the other to within 14 kPa (2 psi) of the correct reading.

The pressure gauges were calibrated only in psi. To facilitate conversion to the metric system, it is recommended that gauges be calibrated in both psi and kPa, or suitable conversion tables be supplied.

Tank Strainer: No strainer was provided at the tank filler opening. A 100 mesh high capacity strainer would be desirable to remove foreign particles before they could enter the sprayer tank.

Line Strainer: The 50 mesh screen located in the line strainer adequately removed most particles that could damage the pump. Water containing .ne sand, which could pass through the 50 mesh screen, could cause pump damage. The plastic strainer bowl was removed for cleaning without tools. However, chemical spilled on the operator's hands since the strainer bowl was mounted in a vertical position. Mounting the line strainer at an angle would allow strainer bowl removal without undue exposure to chemicals.

Nozzle Strainers: The 50 mesh nozzle strainers effectively prevented nozzle plugging.

Soil Compaction and Crop Damage: The trailer and boom wheels travelled over about 2.3% of the total field area sprayed. The wheel tread of the trailer was 1770 mm (5.8 ft), corresponding to the wheel tread on most tractors. The only crop damage in addition to that caused by the tractor wheels was that caused by the castor wheels. This was only 0.8% of the total area sprayed. Soil contact pressure beneath the castor wheels was less than half that of an unloaded one half ton truck. The average soil contact pressures under the sprayer wheels with a full tank are given in TABLE 2.

Soil contact pressures and tire track width were about the same with both the 64 and 76 mm (2.5 and 3 in) boom support rails.

TABLE 2. Soil Compaction by Sprayer Wheels

	Average Soil Contact Pressure*			
	With Tank Full		Tire Track Width	
	kPa	psi	mm	in
Trailer Wheels	207	30	140	5.5
Front Boom Wheels	90	13	71	2.8
Rear Boom Wheels	90	13	65	2.6

**For comparative purposes, an unloaded one half ton truck has a soil contact pressure of about 200 kPa (30 psi).*

PUMP CAPACITY

Agitation Capability: The new pump had a delivery rate of 1.2 L/s (15.8 gal/min) at 275 kPa (40 psi) and 540 rpm (FIGURE 13). This was adequate to apply 182 L/ha (16.2 gal/ac) of emulsifiable concentrates or 71 L/ha (6.3 gal/ac) of wettable powders at 8 km/h and provide sufficient agitation to keep the solution in the tank properly mixed. Normally recommended agitation rates for emulsifiable concentrates such as 2,4-D are 0.03 L/s per 100 L of tank capacity (1.5 gal/min per 100 gal of tank capacity). For wettable powders such as Atrazine and Sevin, recommended agitation rates are 0.05 L/s per 100 L of tank capacity (3.0 gal/min per 100 gal of tank capacity).

Using a pump wear allowance of 20%, a worn pump could apply 133 L/ha (11.8 gal/ac) of emulsifiable concentrates or 21 L/ha (1.9 gal/ac) of wettable powders with sufficient agitation. The pump was adequate for most chemicals when new but was inadequate for wettable powders when worn.

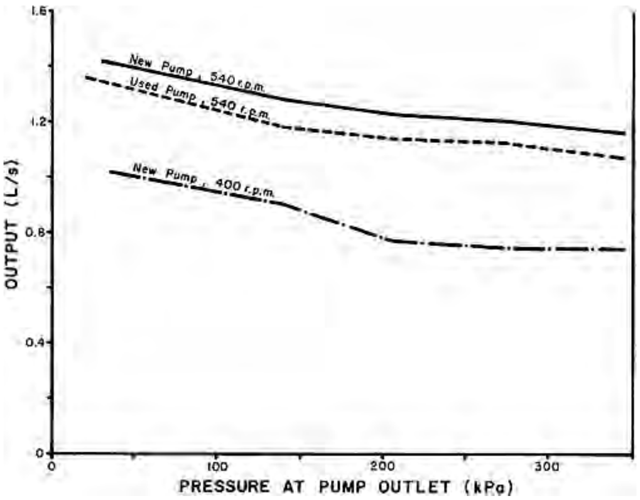

FIGURE 13. Pump Curves.

Operation at Reduced Speed: FIGURE 13 also shows that reducing pump speed from 540 rpm to 400 rpm decreased pump output by 34%. Reduced pump speed would occur when obtaining the correct ground speed to suit nozzle calibration, by reducing engine speed.

Pump Wear: Pump capacity decreased by 6.7% after 71 hours of field use. Pump wear depends upon the type of chemicals sprayed and abrasive materials in the water.

EASE OF OPERATION

Controls: Application rate was controlled by adjusting ground speed and boom pressure. Pressure could be controlled with the pressure regulator or the agitator control valve (FIGURE 14). Chemical flow to the booms was controlled with one lever. The tank shut-off valve was conveniently located at the front of the tank. The pressure gauges were easily read from the tractor seat. The pressure regulator and boom control were inconvenient to reach from the tractor seat (FIGURE 15) while the agitator control valve could not be reached. Relocation of these controls so that they could be conveniently adjusted from the tractor seat would be desirable. The tank liquid level indicator was easy to read when the sprayer was new or if the solution in the tank was opaque. With clear solution such as Banvel, the white ball float was difficult to see after the gauge line clouded with chemical. The gauge gave only a rough indication of fluid level since operation on hills and movement of liquid in the tank caused the indicator reading to fluctuate.

Transport: The George White SW480 could be folded into transport or placed into field position in about five minutes. There was interference between the right radius brace and the boom adjusting linkage (FIGURE 16) unless the brace was unfolded before placing the boom to field position. This was awkward in soft fields where the booms were hard to move.

The George White SW480 had a turning radius of 7.3 m (24 ft) in transport, which provided sufficient maneuverability. The 3.7 m (12.2 ft) transport width caused some difficulty when going through narrow gates and travelling along roads. The sprayer towed well at speeds up to 40 km/h (25 mph).

Backing the sprayer in transport was awkward.

The boom hoses, in transport, had enough slack to allow them to drag on the ground. The boom hoses should be fastened at the rear of the trailer. The boom pressure gauge hose was too short for transport and inadequately fastened for field position, causing it to drag on the ground. It is recommended that the hose be lengthened and properly fastened to the boom to keep it from dragging on the ground.

FIGURE 14. Controls: (A) Pressure Regulator, (B) Boom Control Lever, (C) Shut-off Valve, (D) Agitator Valve, (E) Tank Lid, (F) Liquid Level Indicator.

FIGURE 15. Controls Difficult to Reach from Tractor Seat.

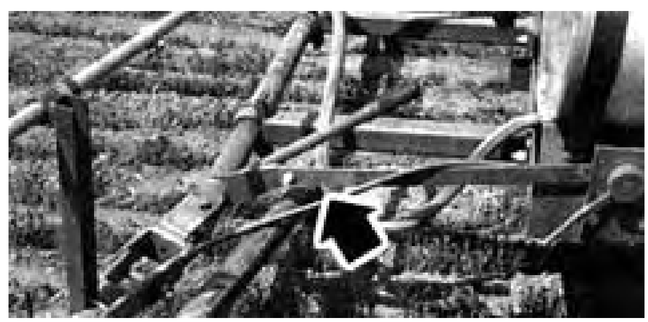

FIGURE 16. Interference Between Radius Brace and Boom Adjusting Linkage.

Tank Filling: The low profile tank was easily filled by gravity from the nurse tank on a farm truck. The 415 mm (16.3 in) opening size was adequate for adding chemicals and water. The low tank and the tank filler opening location (FIGURE 14) made adding chemical to the tank convenient.

Nozzle Adjustment: Nozzle height was adjusted without tools. Occasionally, the boom support rail was hard to rotate, and to gain more leverage, operators lifted the unsupported section of boom at the inner end of the 64 mm (2.5 in) boom support rail (FIGURE 11), causing the boom to bend. This was not a problem with the 76 mm (3 in) boom support rail since the inner end was supported (FIGURE 12). Nozzle angle was conveniently changed by loosening four bolts and rotating the boom.

N ozzle Cleaning: The nozzles were easily removed, without tools, for cleaning.

Hitching: The empty sprayer could be hitched to a tractor without a hitch jack. A jack was needed when the tank was full. A quick disconnect coupling was used to connect the sprayer pump to the power take-off shaft.

Servicing and Cleaning: Lubricating the sprayer was easy since all eight fittings were accessible.

The pump suction hose had to be removed to drain the tank. It is recommended that a drain plug be provided so the tank and header can be conveniently drained.

The baffle at the centre of the tank made cleaning the rear of the tank difficult

OPERATOR BAFETY

Transport: Since the width of the sprayer in transport position was 3.7 m (12.2 ft), caution had to be exercised when transporting the sprayer on roads and highways.

The sprayer was not equipped with a slow moving vehicle sign. This item should be standard equipment to comply with safety regulations.

Caution: Operators of all spraying equipment are cautioned to wear suitable eye protection, respirators and clothing to minimize operator contact with chemicals. Although many commonly used agricultural chemicals appear to be relatively harmless to humans, they may be deadly. In addition, little is known about the long term effects of human exposure to many commonly used chemicals. In some cases the effects may be cumulative, causing harm after continued exposure over a number of years.

OPERATOR'S MANUAL

Brief operating instructions were provided on the front of the tank but no operator's manual was provided.

An operator's manual in both English and SI units should be included with production models of the sprayer, outlining calibration, operation, servicing, lubrication, parts list and optional equipment.

MECHANICAL PROBLEMS

TABLE 3 outlines the mechanical history of the George White SW480 during 71 hours of field operation while spraying about 1337 ha (3304 ac). The problems that are tabulated occurred with the 64 mm (2.5 in) boom support rail assembly. Since 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 3. Mechanical History

		Field Area	
Item	Hours	ha	(ac)
Plumbing Assembly			
-The needle on the boom control pressure gauge fell oft and the screws holding the case to the pressure gauge were lost. One of the screws from the boom pressure gauge was used to repair the boom control gauge at	33	621	(1536)
-The screws on both pressure gauges came loose, causing the pressure gauges to fail apart at	61	1149	(2839)
-The pressure gauges were replaced at	65	1224	(3025)
Tank and Trailer Assembly			
-The tank straps were loose and the threads were damaged, making it impossible to turn the nuts at	12	226	(558)
-The straps were tightened by inserting a spacer at	44	829	(2048)
-Loose tank straps allowed the tank to shift to the right, causing interference between the tank and the boom locking handle. The boom looking handle was bent out to eliminate this interference at	20, 33	377, 621	(931, 1536)
-The four bolts holding the hitch pole to the main frame loosened due to vibration and were tightened at	40	753	(1861)
-The bolts loosened again and the two rear bolts were replaced due to damaged threads at	70	1318	(3257)
-The left radius rod bracket and coupler handle were bent at		End of Test	
-The right rear corner brace weld failed and was re-welded at		End of Test	
Boom Assembly (64 mm (2.5 in) Boom Support Rails)			
-The hitch pin clip on the left radius rod retainer was lost and replaced at		Beginning of Test	
-The left radius rod retainer and hitch pin clip were lost and replaced at	62	1168	(2885)
-The left upper bolt on the parallel linkage connecting rod was lost and replaced at	1	19	(47)
-The right side of the boom centre section failed. It was reinforced and welded at	19	358	(884)
-The inner boom sections were bent slightly at	23	433	(1070)
-The pipe coupler that extended the right boom was leaking and tightened at	26	490	(1210)
It was leaking and tightened again at	33	621	(1536)
It was leaking and repaired with teflon tape at	69	1299	(3211)
-The ends of the booms were sagging at	50	942	(2327)
-The left inner castor wheel lock pin was lost and replaced with a bolt at	69	1299	(3211)
-The booms were pushed back and bent in transport		Throughout the Test	
-Six of the nozzle damp bolts broke due to rust and over tightening		Throughout the Test	
-The hitch pin dips holding the transport bar in place bent		Throughout the Test	
-The retaining clamps that held the radius rod bracket out, moved inwards when pulling a field marker		Throughout the Test	

DISCUSSION OF MECHANICAL PROBLEMS

TANK AND TRAILER ASSEMBLY

Radius Rod Bracket: The front radius rod brackets were free to swing around when the sprayer was in transport. The left radius rod bracket swung ahead while negotiating a left hand turn (FIGURE 17), causing the radius rod bracket and the radius rod coupler handle to be bent by the tractor tire. Modifications are required to prevent this from happening.

FIGURE 17. Interference Between Radius Rod Bracket and Tractor Tire.

BOOM ASSEMBLY

Boom Vibration: Vibration caused the unsupported section of boom at the centre of the 64 mm (2.5 in) boom support rail assembly (FIGURE 11) to bend slightly (FIGURE 18). The 76 mm (3 in) boom support rails, submitted for evaluation, had inner boom uprights (FIGURE 12) that resulted in much less vibration at the inner ends of the booms.

Vibration caused occasional leaking at the threads in the pipe coupler used to extend the right boom. Each time leaking occurred, the outer boom had to be tightened one full revolution to maintain nozzle alignment. Eventually vibration caused the leaking to reoccur. A suggested alternative to the pipe coupler would be a hose connection.

Boom vibration at the outer ends of the 64 mm (2.5 in) boom support rails caused a 50 mm (2 in) sag after 50 hours of operation (FIGURE 19).

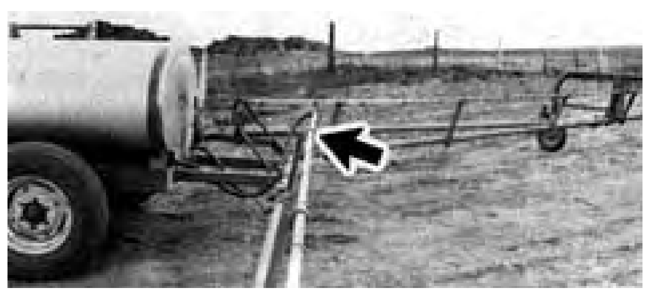

FIGURE 18. Slight Bending at Inner End of 64 mm (25 in) Boom Support Rail Assembly.

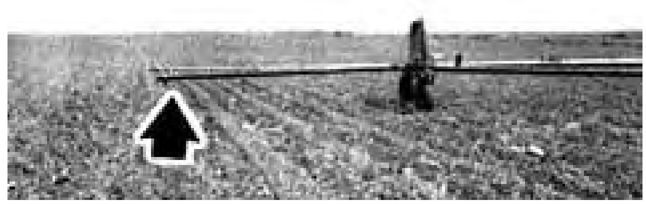

FIGURE 19. Sagging Boom End.

Boom Transport Interference: Interference between the right boom and the boom adjusting handle (FIGURE 20) caused the right boom to bend when turning in transport Interference was eliminated if the adjusting handle was set ahead so the universal joint was angled up (FIGURE 21). However, this caused interference between the boom and tank (FIGURE 22), occasionally pushing the booms back when travelling through a coulee.

The basic configuration of the 64 and 76 mm (2.5 and 3 in) boom support rail assemblies were the same so the same interference problems were encountered with the 76 mm (3 in) assembly. Modifications are required to prevent boom damage caused by interference in transport.

FIGURE 20. Interference Between Boom Adjusting Handle and Right Boom in Transport.

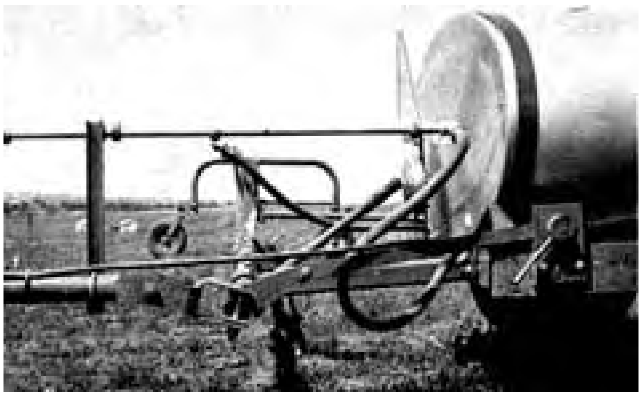

FIGURE 21. Adjusting Handle Set Ahead to Avoid Interference but Universal Joint Angled Up.

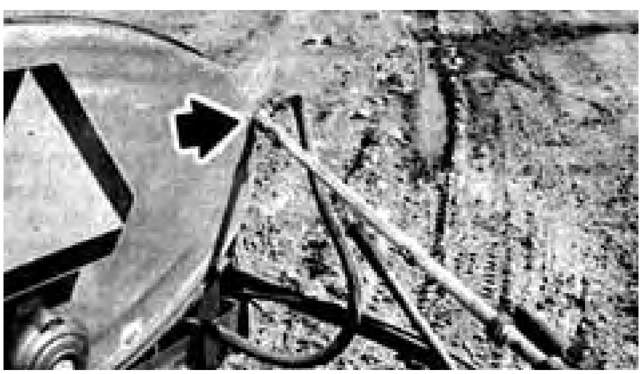

FIGURE 22. Interference Between Boom and Tank.

The hitch pin clips, used to keep the transport bar in place, interfered with the transport bar when turning in transport and bent (FIGURE 23). Modifications are required since the bent hitch pin clips were difficult to remove.

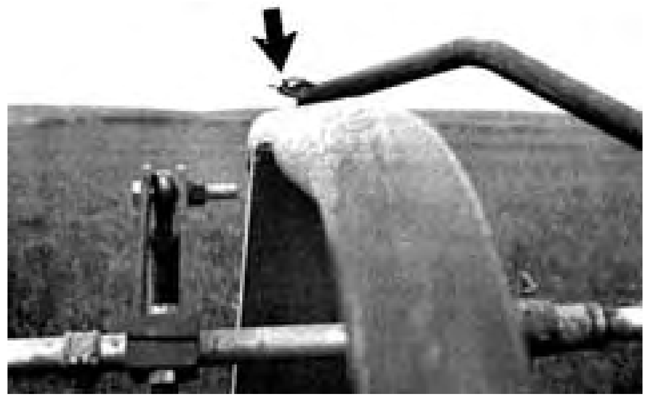

FIGURE 23. Bent Hitch Pin Clip.

APPENDIX I
SPECIFICATIONS

MAKE:	George White Field Sprayer	
MODEL:	SW480	
SERIAL NUMBER:	673872	
	Field Position	**Transport Position**
OVERALL WIDTH:	18,030 mm (59.2 ft)	3710 mm (12.2 ft)
OVERALL LENGTH:	5590 mm (18.3 ft)	12,770 mm (41.9 ft)
OVERALL HEIGHT:	1980 mm (6.5 ft)	1980 mm (6.5ft)
	Trailer	**Castor**
WHEEL BASE:	963 mm (2.8 ft)	1630 mm (5.3 ft)
WHEEL TREAD:	1770mm (5.8 ft)	12,040 mm (39.5 ft)
TIRE SIZE:	4 - 9.5L x 15 8-ply, rib implement	4 - 4.80/4.00 x 8, 4-ply, rib implement
WEIGHTS:	**Tank Empty**	**Tank Full**
-- left trailer wheels	254 kg (560 lb)	1107 kg (2440 lb)
-- right trailer wheels	222 kg (490 lb)	1111 kg (2450 lb)
-- left castor wheels		
-front	64 kg (140 lb)	64 kg (140 lb)
-rear	55 kg (120 lb)	55 kg (120 lb)
-- right castor wheels		
-front	64 kg (140 lb)	64 kg (140 lb)
-rear	55 kg (120 lb)	55 kg (120 lb)
-- hitch	41 kg (90 lb)	181 kg (400 lb)
Total	755 kg (1660 lb)	2637 kg (5810 lb)
TANK:	material - aluminum capacity - 1818 L (400 gal)	
FILTERS:	line strainer - 50 mesh nozzle strainers - 50 mesh	
PUMP: (540 rpm PTO driven)	Hypro C1700 teflon roller	
AGITATION:	Hydraulic	
PRESSURE GAUGES:	US gauge (0 - 160 psi)	
BOOM:	3/4 inch aluminum pipe	
NOZZLES: (Tee-Jet 6502 brass)		
-- number	36	
-- spacing	508 mm (20 in)	
SPRAYING WIDTH:	18,288 mm (60.0 ft)	
BOOM ADJUSTMENT:		
-- height	maximum 810 mm (32 in) minimum 0 angle - 360°	
HITCH HEIGHT ADJUSTMENT:		
-- maximum	525 mm (20.7 in)	
-- minimum	370 mm (14.6 in)	
LUBRICATION POINTS:		
-- trailer tandem beam	2	
-- tandem outrigger	2	
-- castor wheel bearings	4	

APPENDIX II
MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

(a) excellent	(d) fair
(b) very good	(e) poor
(c) good	(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 acre (ac)
1 litre per hectare (L/ha)	= 0.09 Imperial gallon per acre (gal/ac)
1 kilopascal (kPa)	= 0.15 pound per square inch (psi)
1 kilowatt (kW)	= 1.34 horsepower (hp)
1 litre per second (L/s)	= 13.20 Imperial gallons per minute (gal/min)
1 metre (m) = 1000 millimetres (mm)	= 39.37 inches (in)
1 litre (L)	= 0.22 Imperial gallon (gal)

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