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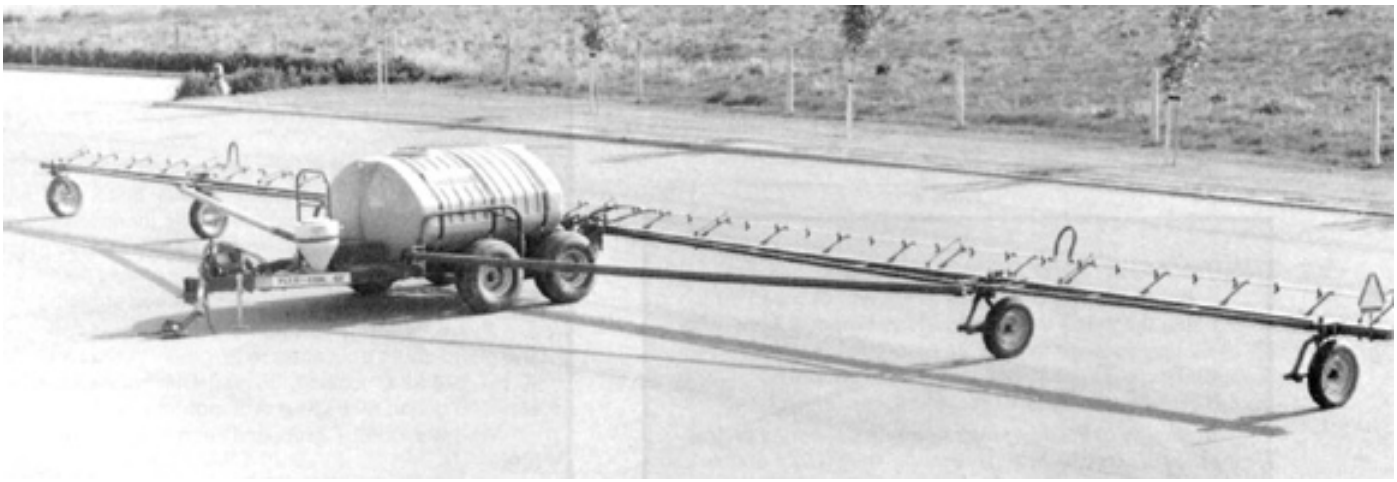


Flexi-coil Model S62 Field Sprayer

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

FLEXI-COIL MODEL S62 FIELD SPRAYER

MANUFACTURER AND DISTRIBUTOR:

Flexi-coil Ltd.
1000-71 St. E.
Saskatoon, Saskatchewan
S7K 3S5

RETAIL PRICE: $13,680.70 (June, 1987, f.o.b. Lethbridge, Alberta. Set-up is extra).

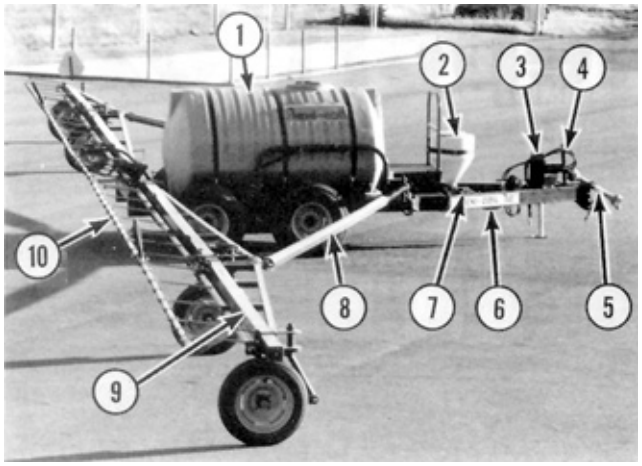


FIGURE 1. Flexi-Coil Model S62 Field Sprayer: (1) Spray Tank, (2) Chemical Inductor Tank, (3) Pump Step-Up Pulley, (4) Spray Boom Hydraulic Hoses, (5) PTO Shaft, (6) Reload and Agitator Plumbing System, (7) Solenoid and Pressure Regulating Valves, (8) Boom Radius Arm, (9) Square Boom, (10) Spray Boom and Nozzle Body Assemblies.

SUMMARY AND CONCLUSIONS

Rate of Work: Operating at speeds of 5 and 6 mph (8.0 and 9.7 km/h) resulted in instantaneous work rates of 50 and 59 ac/hr (20 and 24 ha/hr), respectively. At an application rate of 10 gal/ac (111 L/ha), about 83 ac (33.6 ha) could be sprayed with a full spray tank.

Quality of Work: Application rate depended on tractor speed, nozzle size and pressure. The 8002VS stainless steel nozzles supplied delivered 10 gal/ac (111 L/ha) at a forward speed of 5 mph (8 km/h) and nozzle pressure of 40 psi (276 kPa).

The delivery rate of the new 8002VS nozzles was the same as specified by the nozzle manufacturer. Delivery of the used 8002VS nozzles increased less than 1.5% after 107 hours of use. Variability among individual nozzle deliveries was low when comparing new and used.

Nozzle distribution patterns were very uniform above 32 psi (221 kPa) with the TeeJet 8002VS nozzles. The high capacity 8002VS nozzles produced large spray droplets and operated at 18 in (457 mm) heights that helped minimize spray drift.

Pressure losses were negligible using the nozzles recommended by the manufacturer. The pressure gauge was accurate and reliable.

The strainers were good and adequately prevented nozzle plugging.

The heavy duty 4 in (102 mm) square tubing and the suspension system on the castor wheels reduced boom bounce significantly. Reduced boom movement improved spray distribution and application rate uniformity.

Ease of Operation and Adjustment: The sprayer was equipped with a Raven remote control system to operate sprayer controls from the tractor seat. Flow to the spray booms was easily controlled by the solenoid valves. Nozzle pressure was adjusted by the butterfly valve. The valve was difficult to adjust until the operator gained experience.

The castor wheels had to be adjusted for proper boom operation. The adjustments were a trial and error procedure and were easy to perform. Sprayer maneuverability was very good in both field and transport position. The booms were automatically placed into transport or field position which allowed getting in and out of fields quickly.

Nozzle height was controlled hydraulically and could be adjusted from about 15 to 41 in (381 to 1041 mm). Nozzle angle was adjusted manually to a maximum forward angle of 30 degrees. The quick-disconnect and self-aligning nozzle caps made nozzle changing quick and easy.

Utilization of the inboard pump and reload system made spray tank reloading quick. Care had to be exercised to prevent liquid from the spray tank entering the water supply source and running the pump dry during the reloading process. The spray tank was easily drained and the tank sump allowed for complete liquid removal.

Ease of inducting chemical was fair. Although the chemical inductor tank was easily accessible, chemical splashing occurred during pouring. Inducting chemical during reloading was fast and allowed immediate chemical agitation. The pump inlet hose usually collapsed during chemical induction.

Ease of hitching was very good. The hitch jack provided was safe and the hitch was adjustable for levelling the tank trailer.

Ease of cleaning was fair. Removing the nozzle caps for nozzle and strainer cleaning was quick and easy, however, removing the strainers was inconvenient and messy. Cleaning the main line strainer was also messy.

Ease of lubrication was good. The grease points were easily accessible but 20 of the 29 required greasing daily.

Pump Performance: Pump capacity was very good. The pump could deliver up to 27 gal/min (123 L/min) at a 40 psi (276 kPa) nozzle pressure. This was adequate to apply 33 gal/ac (370 L/ha) at 5 mph (8 km/h).

Agitator output exceeded recommended agitation rates.

Operator Safety: The operator's manual emphasized operator safety. The sprayer was safe to operate if normai safety and chemical precautions were taken.

Operator's Manual: The operator's manual provided useful illustrations and information on safety, sprayer operation, maintenance, adjustments and parts.

Mechanical History: A few mechanical and plumbing problems occurred during the test. The plumbing components leaked and had to be removed and retightened. A few spray boom supports failed and were reinforced.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying the pump inlet hose to prevent it from collapsing during tank reloading and chemical induction.
2. Modifying the spray boom inlet hoses to prevent them from coming off the boom connectors and interfering with the trailer wheels.
3. Modifying the spray boom universal joint to prevent interference with the boom pivot pin.

Station Manager: R. P. Atkins
Project Engineer: L. B. Storozynsky

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. All pump inlet hoses are specified as wire reinforced which eliminates this problem.
2. Shortening the hoses to prevent contact with the trailer wheels has remedied this problem.
3. The design of the sprayboom universal joint was changed in the fall of 1986.

GENERAL DESCRIPTION

The Flexi-coil model S62 is a trailing, boom-type field sprayer. The trailer is mounted on a tandem walking beam axle with each boom supported by two castor wheels, both near the outer end of each boom section. The booms automatically fold back for transport. The 830 gal (3773 L) plastic tank is equipped with hydraulic agitation, fluid level indicator, drain hose and a filler opening with strainer.

The Flexi-coil S62 has 49 split-eyelet quick Tee Jet nozzle assemblies with diaphragm check valves, spaced at 20 in (508 mm) giving a spraying width of 81.7 ft (24.9 m). Nozzle height is hydraulically controlled. Nozzle angle is adjustable and remains constant throughout the height range.

The Flexi-coil S62 is equipped with a chemical inductor, filler opening access platform, remote control and reload systems. The reload system utilizes the inboard centrifugal pump. The pump is belt driven from a 1000 rpm tractor power take-off and operates at 4670 rpm. The remote control console mounts on the tractor and contains a pressure gauge and control switches to operate the pressure regulating and boom solenoid valves.

FIGURE 1 shows the location of the sprayer's major components while detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Flexi-coil S62 was operated for 107 hours in the conditions shown in TABLES 1 and 2 while spraying about 3623 acres (1467 ha). It was evaluated for rate of work, quality of work, ease of operation and adjustment, pump performance, operator safety and suitability of the operator's manual.

During the test, Spraying Systems TeeJet flat fan 8002VS stainless steel nozzle tips supplied with the sprayer were used.

TABLE 1. Operating Conditions.

CHEMICAL APPLIED	FIELD	HOURS	SPEED mph	SPEED (km/h)	FIELD AREA ac	FIELD AREA (ha)
2,4-D	Wheat	15	6	(9.7)	612	(248)
2,4-D	Summerfallow	9	6	(9.7)	420	(170)
2,4-D/Banvel	Wheat	5	5	(8)	160	(65)
2,4-D/Banvel	Wheat	9	6	(9.7)	421	(170)
2,4-D/Banvel	Summerfallow	12	6	(9.7)	465	(188)
Sabre	Fall rye	5	5	(8)	200	(81)
Decis	Wheat/Oats	2	5	(8)	70	(28)
Buctril M	Oats	2	5	(8)	50	(20)
Buctril M	Wheat	7	5	(8)	260	(105)
Buctril M	Flax	4	5	(8)	105	(43)
Hoegrass 284	Wheat	2	6	(9.7)	100	(40)
Hoegrass 284/Torch DS	Wheat	4	5	(8)	170	(69)
Hoegrass 284/Torch DS	Barley	2	5	(8)	55	(22)
Stampede/MCPA	Barley	2	5	(8)	85	(34)
Stampede/2,4-D	Wheat	3	5	(8)	110	(45)
Poast	Canola	4	5	(8)	130	(53)
Tropodox	Wheat	5	3.9	(6.3)	130	(53)
Target	Wheat	3	5	(8)	80	(33)
Road Transport		12				
TOTAL		107			3623	(1467)

TABLE 2.

TOPOGRAPHY	HOURS	FIELD AREA ac	FIELD AREA (ha)
Level	40	1482	(600)
Undulating	48	1401	(567)
Rolling	19	740	(300)
TOTAL	107	3623	(1467)

RESULTS AND DISCUSSION

RATE OF WORK

During field testing, the Flexi-coil was operated at speeds of 5 and 6 mph (8.0 and 9.7 km/h) resulting in instantaneous workrates of 50 and 59 ac/hr (20 and 24 ha/hr), respectively. Actual workrates were less depending on operator skill and reloading time. With a full spray tank, about 83 ac (33.6 ha) could be sprayed at 10 gal/ac (111 L/ha) before refilling.

QUALITY OF WORK

Application Rate: Application rate depended on tractor speed, nozzle size and pressure. The 8002VS nozzles supplied with the Flexi-coil sprayer delivered 10 gal/ac (111 L/ha) at a forward speed of 5 mph (8 km/h) and a nozzle pressure of 40 psi (276 kPa). Changes to forward speed or nozzle pressure resulted in different application rates as shown in FIGURE 2. For example, at a nozzle pressure of 40 psi (276 kPa), reducing speed from 5 to 4 mph (8 to 6.4 km/h) increased application rate from 10 to 12.5 gal/ac (111 to 139 L/ha). To ensure uniform application rates it is recommended that the desired speed and pressure be kept constant.

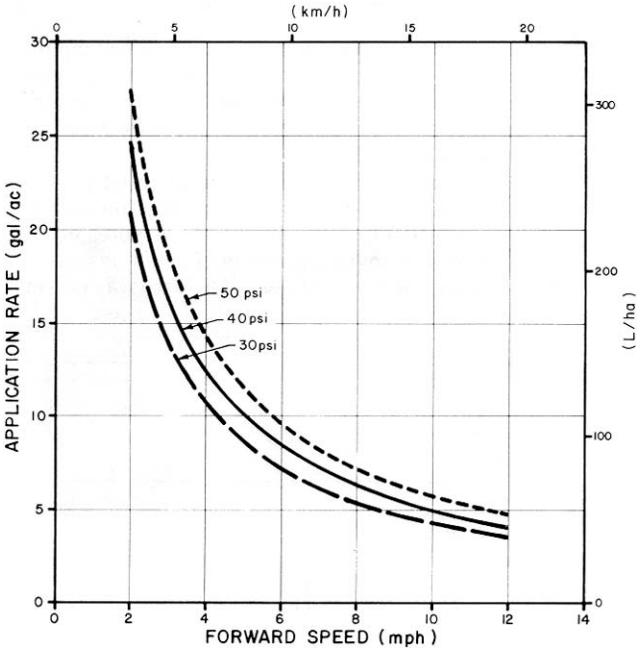


FIGURE 2. Application Rates at Various Forward Speeds and Pressures Using TeeJet 8002VS Nozzles.

Nozzle Calibration: FIGURE 3 shows the average delivery of Spraying Systems TeeJet 8002VS nozzle tips over a range of nozzle pressures. Measured delivery of the new 8002VS nozzle tips agreed with Spraying Systems rated output.

The delivery rate of used 8002VS nozzle tips increased less than 1.5% after 107 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.

Variability among individual nozzle deliveries for the TeeJet 8002VS nozzles was low. A low coefficient of variation (CV)[1] indicates similar discharge rates for all nozzles while a high CV

indicates larger variability among individual nozzle deliveries. The CV of nozzle deliveries of the 8002VS nozzles was 1.5% for both new and used nozzles.

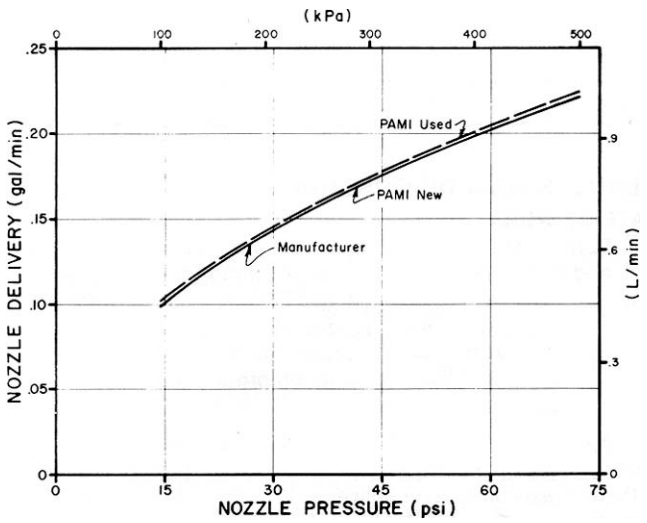


FIGURE 3. Delivery Rates for Tee Jet 8002VS Stainless Steel Nozzles.

Distribution Patterns: FIGURES 4 and 5 show spray distribution patterns along the boom with TeeJet 8002VS nozzles when operated at an 18 in (457 mm) nozzle height. The CV at 15 psi (100 kPa) (FIGURE 4) was 39.0%, with application rates along the boom varying from 3.4 to 12.3 gal/ac (38 to 137 L/ha) at 5 mph (8 km/h). High spray concentrations occurred below each nozzle with inadequate coverage between nozzles. At 44 psi (300 kPa) (FIGURE 5) the distribution pattern improved considerably, reducing the CV to 6.0%. Application rate along the boom varied from 9.0 to 12.3 gal/ac (100 to 137 L/ha) at 5 mph (8 km/h). High pressures improved distribution by increasing the overlap and capacity among nozzles. Higher pressure, however, usually causes more spray drift.

FIGURE 6 shows how nozzle pressure affected pattern uniformity for the TeeJet 8002VS flat fan nozzles. The nozzles produced acceptable distribution patterns at pressures above 27 psi (186 kPa) and very uniform patterns at pressures above 32 psi (221 kPa). After 106 hours of field use, there was no significant change in spray pattern uniformity.

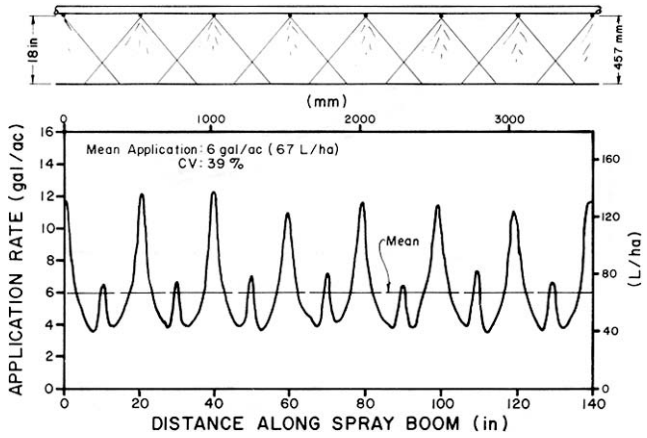


FIGURE 4. Typical Distribution Pattern Along the Boom at 15 psi (100 kPa) with Spraying Systems Tee Jet 8002VS Stainless Steel Nozzles, at an 18 in (457 mm) Nozzle Height and at 5 mph (8 km/h).

[1]The coefficient of variation (CV) is the standard deviation of application rates for successive 0.63 in (16 mm) 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. The CV's above were determined in stationary laboratory tests. In the field, CV's may differ 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 while other chemicals may have a narrow range.

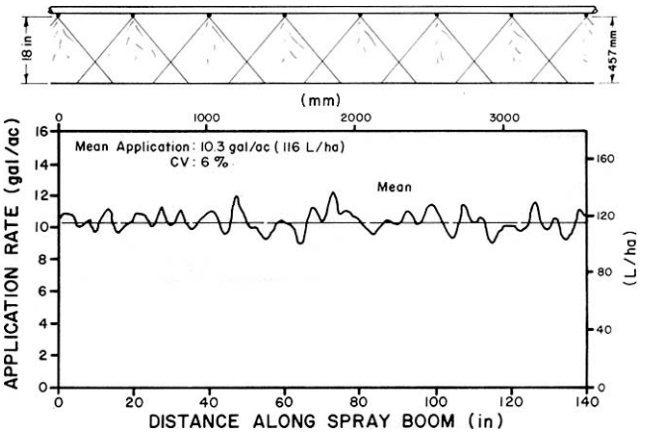


FIGURE 5. Typical Distribution Pattern Along the Boom at 44 psi (300 kPa) with Spraying Systems Tee Jet 8002VS Stainless Steel Nozzles, at an 18 in (457 mm) Nozzle Height and at 5 mph (8 km/h).

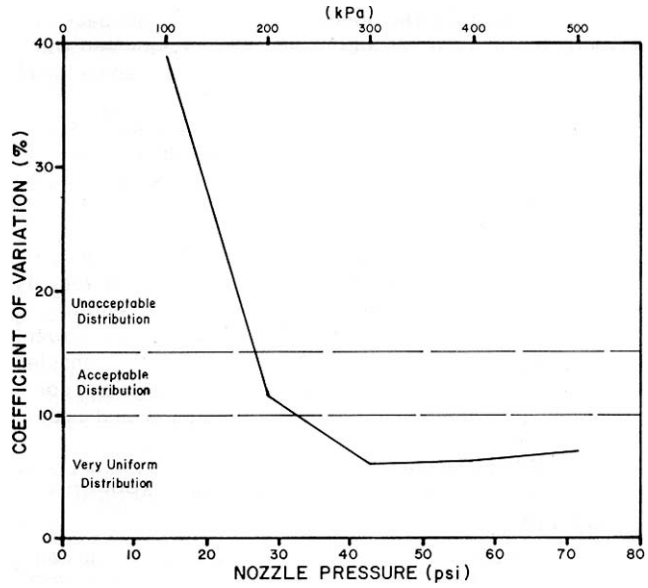


FIGURE 6. Spray Pattern Uniformity for Tee Jet 8002VS Stainless Steel Nozzles Operated at an 18 in (457 mm) Nozzle Height.

Spray Drift: There were no tests conducted to evaluate spray drift but work by the Saskatchewan Research Council[2] indicates that off-swath drift from the 8002 TeeJet nozzle operated at 30 psi (207 kPa) and at an 18 in (508 mm) height was generally below 1% of the emitted material in 13 mph (21 km/h) winds. The low drift was contributed to the nozzles high capacity, coarse droplets and low nozzle height operation.

Pressure Losses In Plumbing System: Pressures in the plumbing system were measured at the pump, the controller and the booms using different sized nozzles. Higher pressure losses occurred when using large nozzles; however, pressure losses were negligible when using nozzles specified in the operator's manual.

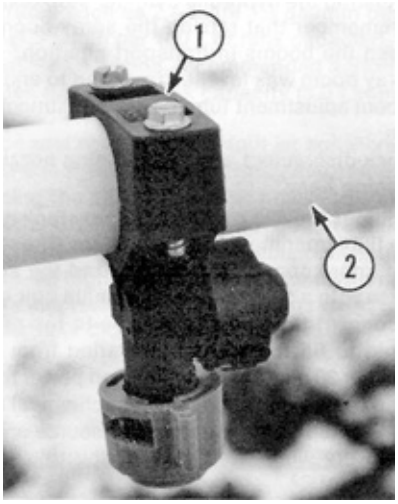
The pressure gauge was reliable and accurate throughout the test.

Use of Optional Nozzles: The split-eyelet quick Tee Jet nozzle assemblies (FIGURE 7) accepted a wide range of standard nozzle tips. Nozzle height and angle were adjustable permitting the use of flat, flood or cone nozzle tips.

System Strainers: The tank filler opening and pump inlet hose were equipped with 16 and 50 mesh strainers, respectively. The 50 mesh nozzle strainers effectively prevented the Tee Jet

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

8002VS nozzles from plugging. The operator is advised to strain all the foreign particles from the water supply when using the reload system.



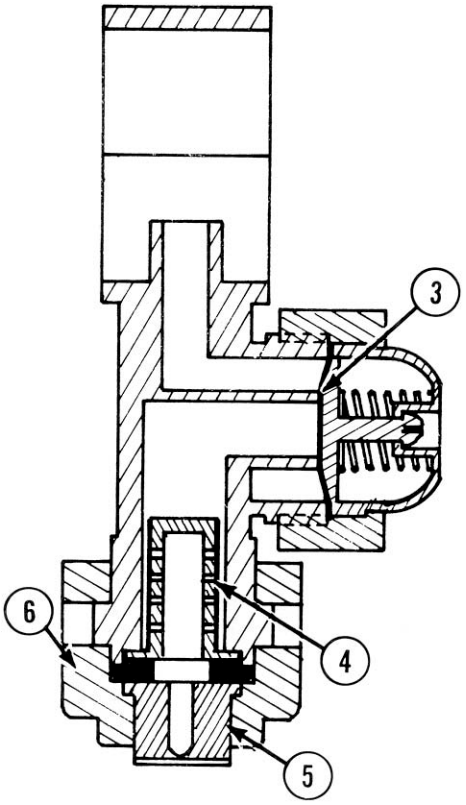


FIGURE 7. Split-Eyelet Quick Tee Jet Nozzle Assembly: (1) Split-Eyelet Clamp, (2) Spray Boom, (3) Diaphragm Check Valve, (4) Strainer, (5) Nozzle Tip, and (6) Quick-Disconnect and Self-Aligning Nozzle Cap.

Boom Stability: Field observations indicated that the booms remained stable in the field conditions encountered (TABLE 2) during the test. The heavy square tubing used for boom rail construction and the suspension system on the castor wheels reduced boom bounce on rough fields. The truss construction in front of the boom rail reduced horizontal boom movement. The joint near the middle of the boom kept the entire boom the same height above the ground on rolling terrain. Reduced boom movement in the field improved spray distribution pattern and application rate uniformity. Boom operation across gullies was also very good.

Soil Compaction and Crop Damage: The trailer and castor wheels travelled over about 3.5% of the total field area sprayed. The wheel tread of the trailer was adjustable to correspond 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 about 1.5% of the total area sprayed. Soil contact pressure beneath the castor wheels was less than 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 3.

TABLE 3. Soil Compaction by Sprayer Wheels.

	TIRE TRACK WIDTH		AVERAGE SOIL CONTACT PRESSURE	
	in	(mm)	psi	(kPa)
Trailer Wheels	9.5	(241)	27	(186)
Inner Boom Wheels	.4.5	(114)	13	(90)
Outer Boom Wheels	3.5	(89)	12	(83)

* For comparative purposes, an unloaded one-half ton truck has a soil contact pressure of about 30 psi (207 kPa).

EASE OF OPERATION AND ADJUSTMENT

Controls: The Flexi-coil sprayer was equipped with a Raven remote control system (FIGURE 8) to operate sprayer controls from the tractor seat. The remote control system included a pressure gauge to monitor nozzle pressure, boom solenoid valve switches to control flow to the booms and a pressure regulating switch to control nozzle pressure. The desired nozzle pressure was difficult to adjust. Depending on the butterfly valve position, small adjustments of the pressure switch resulted in small or large pressure changes. With experience, nozzle pressure became easier to adjust. The pressure switch was a large toggle switch which was easy to use in rough fields.

The agitator control valve could not be operated from the tractor seat. The valve was normally fully open during spraying and only had to be opened once.

The tank level indicator gave only a rough indication of liquid level. The tank liquid level indicator was accurate above the 300 gal (1364 L) reading and only reliable when the sprayer was stopped on level ground.

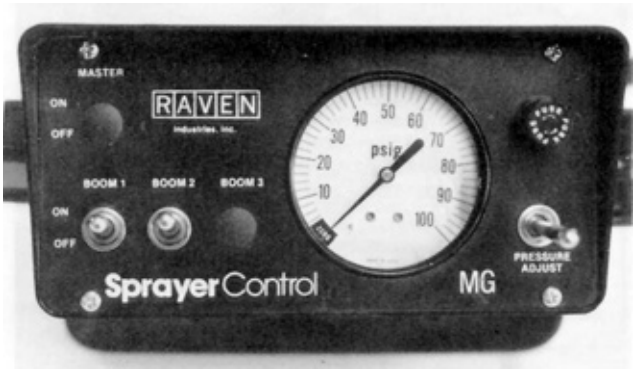


FIGURE 8. Raven Remote Control Console.

Castor Wheel Adjustments: The castor wheels had to be adjusted for proper boom maneuverability and positioning. The adjustments were a trial and error procedure requiring tools. The adjustments were easy to perform and once adjusted, they would not normally have to be readjusted.

Maneuverability: The sprayer towed very well in both field and transport position. The sprayer had a turning radius of 22 ft (6.7 m)in transport position providing good maneuveribility. Cornering was easy since the boom wheels followed the trailer closely eliminating the need to swing out during cornering. Backing up the sprayer was a procedure used to unfold the sprayer booms, therefore operators should avoid circumstances requiring backing up.

Boom Positioning: The Flexi-coil sprayer booms were placed into transport or field position automatically without the operator leaving the tractor. Positioning the booms from the tractor seat was an excellent feature and allowed getting in and out of fields quickly and conveniently.

The booms were placed into field position by backing up the sprayer. Care had to be exercised to ensure both booms folded out equally and to prevent the boom radius arm ends from striking the trailer platform. With the radius arms at the specified position, lowering the spray booms and driving forward secured the sprayer in field position.

The booms folded into transport position (FIGURE 9) by raising the spray boom and driving forward. Raising the spray boom unlatched the boom radius arms from the trailer frame and driving forward caused the booms to move inwards until the middle coastor wheels locked.

The transport width was 14.3 ft (4.37 mm) and could be conveniently reduced to 10.4 ft (3.18 m) for high speed road transport (FIGURE 9), by manually disconnecting and securing the radius and pivot arms to the sprayer.

The operator's manual suggested that castor wheel tire pressures be increased from 10 psi (69 kPa) to 20 psi (138 kPa) for high speed transport.

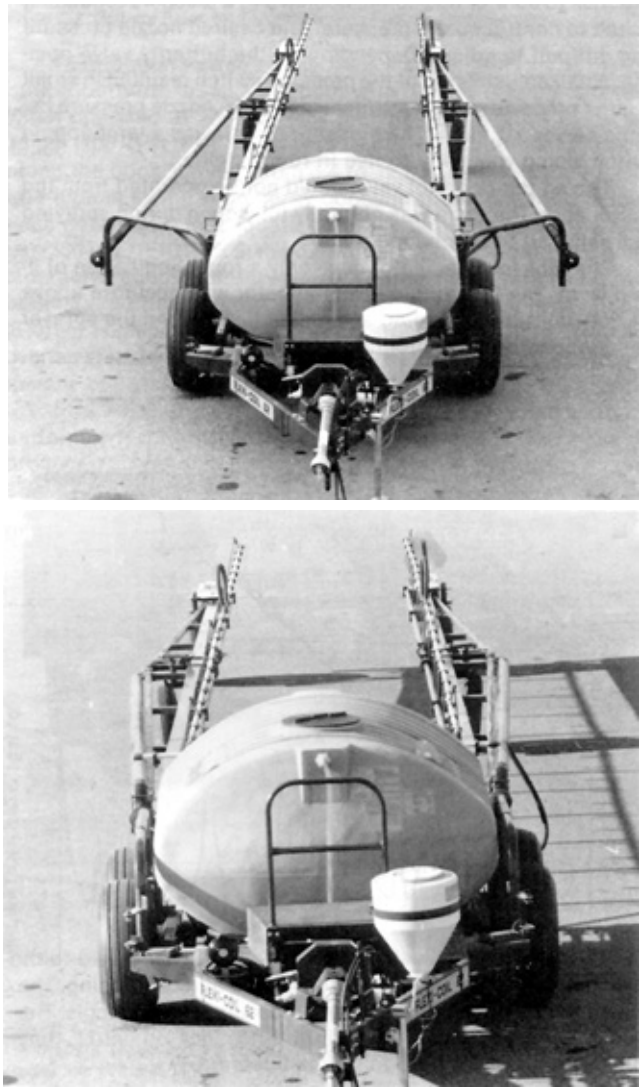


FIGURE 9. Flexi-coil in Transport Position: (Upper) Partial Transport; (Lower) Complete Transport.

Nozzle Adjustment: Nozzle angle was easily adjusted by loosening the bolts on the spray boom clamps and rotating the spray boom. To prevent spray interference with the castor wheels, forward nozzle angle should not be adjusted more than 30 degrees. Nozzle angle remained constant at all boom heights.

Nozzle height was conveniently controlled hydraulically from the tractor and could be adjusted from about 15 to 41 in (381 to 1041 mm). The desired nozzle height could be conveniently set by adjusting the hydraulic cylinder stop collar. It was important to remember that raising the spray boom completely upright folded the booms in transport position.

The spray boom was levelled from end to end by adjusting the spray boom adjustment tubes. This adjustment required the use of tools.

The quick-disconnect and self-aligning nozzle caps made nozzle changing easy.

Tank Filling: The 830 gal (3773 L) spray tank could be filled utilizing the filler opening or reload system. The reload system was quicker, more convenient and utilized the sprayer pump. A supply hose with a 1-1/2 in (38 mm) female quick coupler was needed to connect the nurse tank hose to the reload system. Time required to fill the spray tank varied from less than 10 minutes to about 20 minutes depending on power take-off speed.

Care had to be exercised to prevent chemical solution from the spray tank entering the water supply source and running the sprayer pump dry when starting and shutting off the reload system.

Chemical Induction: The Flexi-coil was equipped with a chemical inductor which made it easy to add chemical to the spray tank. The inductor tank filler opening was low and easily accessible. Normal caution was still needed to prevent chemical splashing.

Chemical could be added during reloading water or during agitation. Preference depended operator skill, time and chemical susceptibility to foaming. Inducting chemical during agitation was more convenient and less foaming occurred, but took more time. Inducting chemical during reloading was faster and allowed immediate chemical agitation.

Tank reloading and chemical inducting was quicker at high power take-off speeds but resulted in collapsed pump inlet hose. It is recommended that the manufacturer consider modifying the pump inlet hose to prevent it from collapsing during tank reloading and chemical induction.

Hitching: The Flexi-coil sprayer was easily hitched to a tractor. The hitch jack provided was safe and convenient to use. The hitch was adjustable to level the spray tank trailer. Hitching also included the hook-up of two hydraulic lines, an electronic coupler with pressure line for the remote control system and connecting the power take-off shaft.

Cleaning: Removing nozzle caps from the TeeJet nozzle assemblies for cleaning was quick and convenient. Removing the strainers from the Tee Jet nozzle assemblies was difficult at times. The top of the nozzle assembly had to be tapped or the strainer pried with a screwdriver, causing chemical solution to splatter on the operator.

The pump inlet hose strainer was difficult to remove at times requiring the use of a tool. The strainer should be positioned near a horizontal position to reduce chemical contact during removal. The spray and chemical inductor tank were easily flushed using the reload system.

Draining: The spray tank completely drained through the sump at the bottom of the tank. Draining was convenient since the drain valve was easily accessible from the side of the trailer frame. The pump cavity was easily drained by opening the cock at the bottom of the pump. Draining the hoses was easily done by loosening the ring clamps and removing the hose ends.

Lubrication: The Flexi-coil sprayer had 29 pressure grease fittings. Twenty required greasing daily and were easily accessible. The other nine required grease annually.

PUMP PERFORMANCE

Output: The Hypro 9203C centrifugal pump operated at about 4670 rpm at a power take-off speed of 1000 rpm. In the Flexi-coil plumbing system the maximum pump delivery to the booms was 27 gal/min (123 L/min) at a 40 psi (276 kPa) nozzle

pressure. This was adequate to apply 33 gal/ac (370 L/ha) at a forward speed of 5 mph (8 km/h), which was more than adequate in the prairie provinces.

Agitation: Normally recommended agitation rates for emulsifiable concentrates such as 2,4-D are 1.5 gal/min per 100 gal of tank capacity (1.5 L/min per 100 L of tank capacity). For wettable powders such as Atrazine, recommended agitation rates are 3.0 gal/min per 100 gal of tank capacity (3.0 L/min per 100 L of tank capacity.

The Flexi-coil was equipped with four jet agitators. TABLE 4 shows the Flexi-coil agitator output during idle, reloading and field spraying using the blue jet agitator nozzle tips at various spraying operations. The Flexi-coil agitator output exceeded the recommended agitation rates for emulsifiable concentrates and wettable powders. At high agitation rates, foaming may occur with some chemicals. However, the agitation rate could easily be reduced by partially closing the agitator valve.

TABLE 4. Agitator Output.

	PTO SPEED rpm	AGITATOR OUTPUT gal/min	(L/min)
Engine Idle	500	28.0	(127)
Reloading	750	40.3	(183)
Field Spraying (8002VS)	1000	52.1	(237)

OPERATOR SAFETY

The operator's manual emphasized operator safety. The Flexi-coil had warning decals to indicate dangerous areas. The pump drive system was well shielded. The sprayer was equipped with a slow moving vehicle sign.

Caution: Operators 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

The operator's manual was very useful. It was clearly written and well illustrated. It provided useful information on safety, machine specifications, sprayer operation, maintenance, adjustments, trouble shooting, optional equipment and parts.

MECHANICAL PROBLEMS

TABLE 5 outlines the mechanical history of the Flexi-coil S62 during 107 hours of operation while spraying about 3623 ac (1467 ha). The intent of the test was evaluation of functional performance. An extended durability evaluation was not conducted.

TABLE 5. Mechanical History.

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA ac	(ha)
Plumbing			
- plumbing components leaked and were tightened at	beginning of test		
- repositioned main line strainer at	beginning of test		
- pressure line broke near the solenoid valves and was repaired at	14	550	(233)
- left spray boom inlet hose interfered with the rear trailer wheel was re-routed at	18	650	(263)
- left spray boom inlet hose slipped off at	25	975	(395)
	62	2510	(1016)
- pump discharge hose slipped off and was replaced at	42	1625	(658)
- spray boom inlet hoses interfered with the rear trailer wheels and were shortened at	42	1625	(658)
Trailer			
- radius arm latch assembly cable loosened and was tightened at	26	975	(395)
Boom			
- spray boom supports sagged and were straightened by hand at	25	975	(395)
	50	1825	(739)
- spray boom universal joints slipped and were adjusted at	18	650	(263)
	36	1365	(553)
- right inner spray boom universal joint bent at	88	3253	(1317)
- spray boom supports broke and were welded at	94	3383	(1370)
	98	3438	(1392)
- all spray boom universal joint assemblies were replaced at	end of test		
- pressure relief valve assembly was installed for the hydraulic cylinder at	end of test		

DISCUSSION OF MECHANICAL PROBLEMS

Plumbing: The plumbing components at the remote control valve, agitator valve, inductor valve and main line leaked at one time or another during the first 40 hours of operation. The components were removed, teflon tape put on and retightened. As a result, three hoses had to be replaced, because the length between components increased after being tightened.

The pressure line at the solenoid valves was low and dragged on taller weeds and obstacles. As a result, the line broke. The pressure line elbow was repositioned which raised the line off the ground.

The spray boom inlet hoses were long and interfered with the rear trailer wheels. The inlet hoses were also heavy and slipped off the spray boom connectors. It is recommended that the manufacturer consider modifying the spray boom inlet hoses to prevent them from slipping off the boom connectors and interfering with the trailer wheels.

Boom: A couple of spray boom supports failed (FIGURE 10) near the end of the field test. The supports that failed were near the parallel linkage bar.

Manufacturer's Modifications to the Sprayer: Three modification packages were supplied at the end of the test, but were not evaluated under field conditions. The spray boom supports were strengthened by welding gussets (FIGURE 11). The spray boom universal joints were replaced. The universal joints were larger and the outer universal joints interfered with the boom pivot pins (FIGURE 12). It is recommended that the manufacturer consider modifying the adjusting boom universal joint to prevent interference with the boom pivot pin.

A pressure relief system was installed to the spray boom hydraulic cylinder. This prevented sprayer component damage due to excessive tractor hydraulic pressure to the hydraulic cylinder.

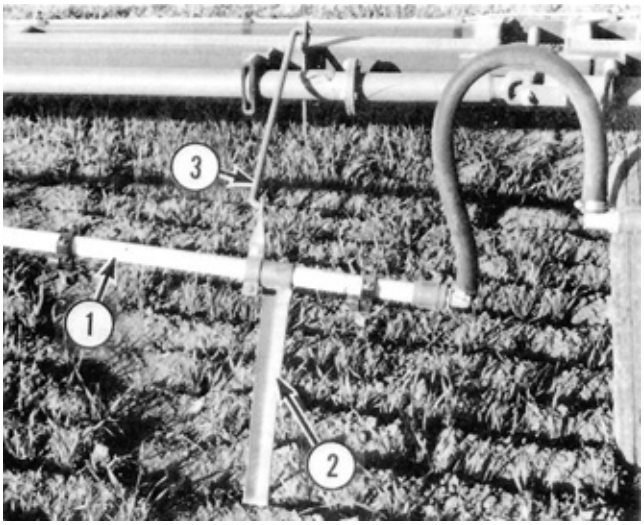


FIGURE 10. Failed Spray Boom Support: (1) Spray Boom, (2) Boom Support, (3) Parallel Linkage Bar.

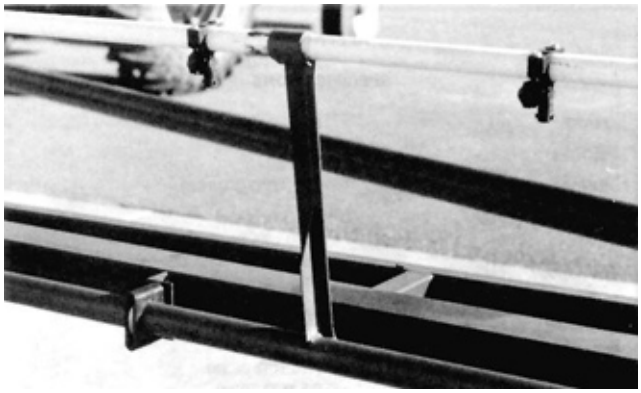


FIGURE 11. Reinforced Spray Boom Support.

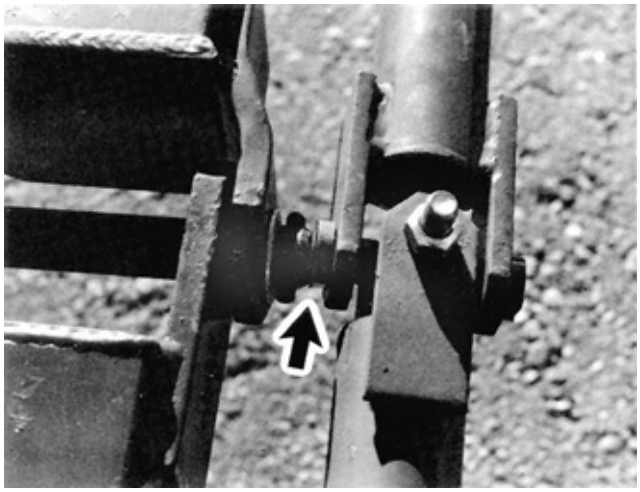


FIGURE 12. Spray Boom Universal Joint and Boom Pivot Pin.

APPENDIX I

SPECIFICATIONS

MAKE:	Flexi-coil
MODEL:	S62
SERIAL NUMBER:	S62.A000-G011629
MANUFACTURER:	Flexi-coil Ltd. 1000 - 71 St. E. Saskatoon, Saskatchewan S7K 3S5

OVERALL DIMENSIONS:	
- wheel tread	
- trailer	7.75 ft (2.36 m)
- inner boom wheels	8.5 ft (2.59 m)
- outer boom wheels	8.0 ft (244 m)
- wheel base	
- trailer	3.5 ft (1.07 m)
- boom	13.75 ft (4.19 m)
- transport height	5.83 ft (1.78 m)
- transport length	54.58 ft (16.64 m)
- transport width	
- partial	14.33 ft (4.37 m)
- complete	10.42 ft (3.17 m)
- field height	5.83 ft (1.78 m)
- field length	17.17 ft (5.23 m)
- field width	81.42 ft (24.82 m)
- clearance height	10 in (254 mm)
- turning radius	22.0 ft (6.71 m)

TIRES:	
- trailer	4, 12.5 L - 15, 8 ply
- boom	4, 5.00 - 15

WEIGHT:

TRANSPORT POSITION

	Empty		Loaded	
- left trailer wheels	1350 lb	(612 kg)	5190 l b	(2354 kg)
- right trailer wheels	1350 lb	(612 kg)	5190 lb	(2354 kg)
- inner boom wheels - left	440 lb	(200 kg)	440 lb	(200 kg)
- right	440 lb	(200 kg)	440 lb	(200 kg)
- outer boom wheels - left	200 lb	(91 kg)	200 lb	(91 kg)
- right	200 l b	(91 kg)	200 lb	(91 kg)
- hitch	190 lb	(86 kg)	810 lb	(367 kg)
Total	4170 l b	(1892 kg)	12470 lb	(5656 kg)

FIELD POSITION

	Empty		Loaded	
- left trailer wheels	1260 lb	(572 kg)	5100 lb	(2313 kg)
- right trailer wheels	1260 lb	(572 kg)	5100 lb	(2313 kg)
- inner boom wheels - left	450 ib	(204 kg)	450 lb	(204 kg)
- right	450 lb	(204 kg)	450 lb	(204 kg)
- outer boom wheels - left	210 lb	(95 kg)	210 lb	(95 kg)
- right	210 lb	(95 kg)	210 lb	(95 kg)
- hitch	330 lb	(150 kg)	950 lb	(431 kg)
Total	4170 lb	(1892 kg)	12470 lb	(5655 kg)

SPRAY TANK:	
- material	plastic
- capacity	830 gal (3773 L)
- agitation	hydraulic, 4 jet agitators

FILLER OPENING:	
- shape	round
- size	
- small	4.75 in (121 mm) I.D.
-large	15.75 in (400 mm) I.D.
- location	top, centre
- height above ground	70 in (1778 mm)

CHEMICAL INDUCTOR:	
- capacity	12.5 gal (57 L)
- strainer	13 mesh
- opening	10.25 in (260 mm) I.D.
- height above ground	44 in (1118 mm)

STRAINERS:	
- pump inlet hose	1, 50 mesh
- nozzle assembly	49, 50 mesh
- spray tank	1, 16 mesh

PUMP:	
- make	Hypro
- model	9203C
- type	centrifugal

- operating speed	4670 rpm
- type of drive	belt
CONTROL MONITOR:	
- make	Raven Industries Inc.
- model	SCS202
- pressure gauge	dial, 0-100 psi (0-689 kPa)
SOLENOID VALVES:	
- make	Spraying Systems Co.
- model	8547
- size	2, 1 in (25.4 mm) NPT, 12 VDC, 35 watt
SPRAY BOOM:	
- material	PVC
- size	1 in (25.4 mm) Schedule 80
- height adjustment	
- type	hydraulic
- range	15 to 41 in (381 to 1041 mm)
- angle adjustment	
- type	manual rotation
- range	30° forward
- nozzle assembly	
. make	Spraying Systems
- type	split-eyelet diaphragm check valve
- number	49
- spacing	20 in (508 mm)
- cap	quick-connect, color coded, self-aligning
- effective spraying width	81.7 ft (24.9 m)

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)
feet (ft) x 0.305	= metres (m)
Imperial gallons (gal) x 4.55	= litres (L)
Imperial gallons per acre (gal/ac) x 11.23	= litres/hectare (L/ha)
inches (in) x 25.4	= millimetres (mm)
miles/hour (mph) x 1.61	= kilometres/hour (km/h)
pounds force per square inch (psi) x 6.89	= kilopascals (kPa)
pounds mass (lb) x 0.45	= kilograms (kg)

SUMMARY CHART
FLEXI-COIL MODEL S62 FIELD SPRAYER

RETAIL PRICE:	$13,680.70 (June, 1987, f.o.b. Lethbridge)
RATE OF WORK:	- 59 ac/hr (24 ha/hr) @ 6 mph (9.7 km/hr)
QUALITY OF WORK:	
Application Rate	- depended on tractor speed, nozzle size and pressure
Nozzle Calibration	
- delivery	- very good; same as manufacturer's
- wear	- very good; less than 2% after 107 hours
- coefficient of variation	- very good; about 1.5%
Spray Distribution	- very good; acceptable above 27 psi.(186 kPa) and very uniform above 32 psi (221 kPa)
Spray Drift	- good; reduced using 8002 nozzles
Pressure	
-loss	- very good; negligible
- gauge	- very good; reliable
Straining	- good; 50 mesh nozzle strainers were effective
Boom Stability	- very good; heavy duty square tubing with suspension castor wheels
EASE OF OPERATION AND ADJUSTMENT:	
Controls	- good; pressure regulating valve was difficult to control at first
Castor Wheel Adjustments	- good; trial and error
Maneuverability	- very good; turning in transport position was easy
Boom Positioning	- excellent; automatic
Nozzle Adjustments	- very good; nozzle height hydraulically controlled
Tank Filling	- good; care had to be exercised
Chemical Inducting	- fair; splashing occurred, pump inlet hose collapsed
Hitching	- very good; hitch jack was safe and hitch was adjustable
Cleaning	- fair; strainers difficult to remove and messy
Draining	- very good; easily accessible
Lubrication	- good; twenty grease points required greasing daily
PUMP PERFORMANCE:	- very good; adequate capacity for nozzles and agitation
OPERATOR SAFETY:	- normal precautions should be taken when handling chemical
OPERATOR'S MANUAL:	- very good; detailed; stressed chemical safety
MECHANICAL HISTORY:	- plumbing leaked, spray boom support brackets failed

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