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Evaluation Report 724

Flexi-coil Model 65 Auto-Fold Field Sprayer

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

FLEXI-COIL MODEL 65 AUTO-FOLD FIELD SPRAYER

MANUFACTURER AND DISTRIBUTOR:

Flexi-coil Ltd.
P.O. Box 1928
1000 71 Street East
Saskatoon, SK S7K 3S5
Phone: 306/934-3500

RETAIL PRICE: $26,867.60 (April 1996, f.o.b. Lethbridge, Alberta) for Flexi-coil Model 65 Auto-Fold Field Sprayer.

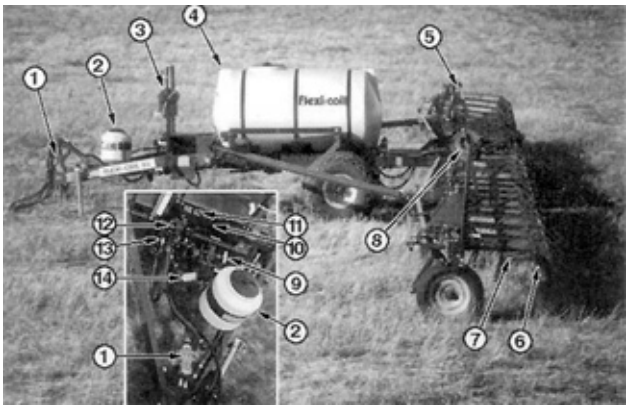

Figure 1. Flexi-coil Model 65 Auto-Fold Field Sprayer: (1) Hydraulic Motor and Pump, (2) Easy-Fill Chemical Tank, (3) Fresh Water Container, (4) Spray Tank, (5) Boom Hydraulic Lift Assembly, (6) Windscreen, (7) Wet Spray Boom, (8) End Marker, (9) Reload Line and Valve, (10) Agitation Valve (11) Boom Solenoid Valves, (12) Flow Sensor, (13) Motorized Control Valve, and (14)Pump Strainer.

SUMMARY

RATE OF WORK

Operating the sprayer between 4 and 9 mph (6 and 15 km/h) resulted in instantaneous work rates between 44 and 98 ac/h (18 and 40 ha/h). At an application rate of 5 and 10 gal/ac (55 and 110 L/ha), 166 and 83 ac (67 and 33 ha) was sprayed with a full tank, respectively.

QUALITY OF WORK

Application rates were accurate within one percent of actual when the controller speed and flow sensors were calibrated. Calibrating the flow and speed sensors was easy by following procedures in the operator's manual or steps shown on the monitor display. Flow from six nozzles were measured to calibrate the flow sensor. The speed sensor was calibrated by pulling the sprayer a distance of at least 50 ft (15 m). The controller stabilized the application rate within four seconds when spraying speed changed. The automatic rate controller kept application rate constant from 4 to 10 mph (6 to 16 km/h), resulting in spraying pressures from 12 to 63 psi (80 to 435 kPa), Nozzle pressures were kept above 20 psi (150 kPa) and spraying speeds above 5 mph (8 km/h) to ensure adequate spray coverage.

Delivery from the extended range (ER) 80° Combo-Jet stainless steel nozzles was within 3% of Combo-Jet's rated output. Variability (CV) among individual nozzle deliveries was 1.5 and 2.3% for the ER80-03 and ER80-015 nozzles, respectively. Acceptable spray patterns occurred (CV's below 15%) at nozzle heights above 15 in (380 mm) and nozzle pressures above 35 psi (250 kPa),

In 20 mph (32 km/h) crosswinds, the windscreens reduced spray drift from 11.3 to 2% operating ER80-015 extended range nozzles at a 18 in (460 mm) height and 40 psi (275 kPa) nozzle pressure, Average spray drip volume ranged from 0.6 to 2.8% of the application rate in chemfallow conditions.

Pressure losses across the boom were less than 1 psi (7 kPa). The pressure sensor showed 4 psi (25 kPa) low, The mechanical pressure gauge was accurate.

Strainers prevented nozzles from plugging. The suspension system on the boom wheels reduced boom bounce. Crop damage was small since the trailer and boom wheels travelled 2.5 and 2% of the total field area sprayed, respectively.. The end marker discs caused some crop damage, but damage was considered insignificant.

EASE OF OPERATION AND ADJUSTMENT

Ease of adjusting application rates was very good. The monitor/controller, Combo-Jet's dual nozzle body assembhes and programming three application rates made it easy to adjust and change application rates. Ease of operating Flexi-coil's Model SP655 monitor/controller was very good.

Ease of adjusting the middle boom wheels was very good. Sprayer maneuverability was very good in both transport and field position. Turning into tight approaches was easy because the castor wheels followed the tank trailer tracks closely. Ease of boom positioning was very good. The sprayer folded into transport position in less than 15 seconds allowing reloading from a central location. Transporting the sprayer on the road was safe because the sprayer width was only 9 ft (2.8 m). The sprayer was placed into field position in 1.5 minutes. A distance of 92 ft (28.m) was needed before the booms unfolded to field position.

Ease of adjusting nozzle angle and height was. good. Nozzle angle was manually adjusted 20° forward to prevent spray from contacting the windscreens or castor wheels. Nozzle. height was controlled hydraulically after setting the hydraulic cylinder stops to the desired spray height. Nozzle height ranged from 15 to.45 in (380 to 1140 mm) above the ground.

Ease of filling the spray tank was very good using the bottom reload system. It took less than 20 minutes to reload the 830 gal (3770 L) spray tank with water and chemical. Ease of adding chemical to the spray tank was good using the Easy-Fill chemical tank, it took less than 30 seconds to induct the chemical from a full Easy-Fill tank. Caution was required to prevent chemical splashing in windy conditions. With the windscreens, spraying in windy weather was prevalent.

Ease of hitching was good. Hitching included the hookup of six hydraulic l ines for the pump hydraulic motor, end marker and secondary boom, and an electronic coupler for the monitor/controller.

Ease of cleaning was good. Nozzle strainers came out of Combo-Jet's nozzle assembly with the nozzle cap, exposing the strainer for rinsing. Some nozzle caps were removed using pliers. The debris and chemical residue on the windscreens required cleaning. Raising the booms exposed the entire underside of the windscreen panels. A wash set-up was needed. Ease of draining was good. Spray tank rinse water was first sprayed on the field and the remainder drained through the reloading line.

Ease of lubrication was good. It took 15 minutes to grease the 36 grease fittings that required greasing daily.

PUMP PERFORMANCE

The sprayer was tested using a Hypro Model 9303C-HM4 and Ace Model BAC-75 Hyd-206 centrifugal pumps. At a pump shut-off pressure of 100 psi (700 kPa), Hypro and Ace pumps delivered a maximum pressure of 49 and 65 psi (340 and 415 kPa) to the ERS0-03 nozzles, respectively. With the hydraulically driven motors, the sprayer was limited to nozzles rated at 0.25 gal/min (1.1 L/min), i.e. ERS0-03, 8003 etc. This was adequate to apply 10 gal/ac (110 L/ha) at 40 psi (275 kPa) at 7.5 mph (12 km/h).

Agitating rates were very good, exceeding recommended agitating rates for emulsifiable concentrates.

END MARKER PERFORMANCE

Mark visibility was good in young cereal crops and poor in chemfallow conditions. In chemfallow conditions, weights were added to the end marker assemblies to make the marks deeper and

more visible. Aligning the sprayer to the mark made on the previous pass was good using the end castor wheel as an aide, Mark durability was good as the marks lasted several days. Controlling the end markers hydraulically was very good. Lowering one end marker on the ground automatically lifted the other off.

OPERATOR SAFETY

The operator's manual emphasized operator safety. The sprayer was safe to operate if normal safety and chemical precautions were taken. The Combo-Jet dual nozzle body assembly reduced operator exposure to chemical solution because the strainer, nozzle tip, and washer were all part of the nozzle cap. A storage tank for clean water made it easy to rinse gloves and hands. The windscreens were coated with debris and chemical residues. Therefore, care was exercised when cleaning strainers, changing nozzles or checking spray patterns.

OPERATOR'S MANUAL

The operator's manual was very good, providing complete information and illustrations on safety, sprayer operation, maintenance and adjustments.

MECHANICAL HISTORY

Greasing the bottom grease fitting on each castor wheel assembly and inserting the locknuts on the windscreen nylon shear bolts was difficult.

RECOMMENDATIONS

The Alberta Farm Machinery Research Centre (AFMRC) recommends the manufacturer:

1. Modify the castor wheel assembly to make it easier to grease the castor wheels.
2. Modify the windscreen panel shear bolts to make it easier to secure the windscreen panels.

Project Technologist: B. L. Storozynsky
Manager: R. P. Atkins, P.Eng.

MANUFACTURER'S REPLIES TO RECOMMENDATIONS

The manufacturer states regarding to recommendation number:

1. The lower pivot of the castor wheel contains two bushings with a spacer between them. The spacer prevents the bushings from running together. If the bushings move inward, they may seal the grease cavity. This can be fixed by removing the spacer and notching each end of the spacer to allow grease to flow to the grease cavity. A different bushing is currently under investigation to eliminate this problem.
2. The purpose of the nylon bolt supporting the windscreen is to allow the front panel to shear the bolt when encountering large objects in the field. From tests conducted at Flexi-coil, attaching the nylon bolt with a standard nut was insufficient as the nut would work loose, thus affecting the operation of the nylon shear bolt. Note: Flexi-coil offers a new style windscreen with a plastic frame. This new windscreen does not use the nylon bolt.

ADDITIONAL MANUFACTURER'S REPLIES

1. A service update kit is available to eliminate the castor wheel assist cable problem. All sprayers manufactured from September 1995 will have the new style assist cable.
2. The two hydraulic boom lift assembly bolts have been modified to reduce the possibility of these bolts breaking. All sprayers manufactured from September 1994 have this change in place.
3. The monitor presure sensor elecronic has been modified to bring the pressure reading within 2 psi (14 kPa) of actual.
4. It should by emphasized that the windscreen is used to reduce off-target spray drift when spraying in windy conditions. The significant reduction in drift will result in some spray drift contacting the windscreen, producing some visible drops that may be wiped onto tall weeds or drip harmlessly on the ground. It should be emphasized that drift, not drip, damages nearby crops, vegetation and contacts the skin and lungs of people to add to the risk of disease. However, as for modifying the windscreen to eliminate spray dripping, the manufacturer states future wind reduction developments will consider drip issues if they do not affect the drift reduction standards set by the current windscreen.

GENERAL DESCRIPTION

The Flexi-coil Model 65 is a trailing, boom-type field sprayer. The trailer is mounted on a single axle with fioatation turf tires. Two castor wheels with a suspension system support each boom. The booms automatically fold back for transport and unfold for field position. The 830 gal (3770 L) plastic tank has four jet agitators, a fluid level indicator, a filler opening with a strainer, a bottom reloading line and an Easy-Fill chemical tank.

The Flexi-coil sprayer has 54 split-eyelet Combo-Jet nozzle assemblies with diaphragm check valves spaced at 20 in (508 mm) intervals, giving a spraying width of 90 ft (27.4 m). Nozzle height is hydraulically controlled. Nozzle angle is adjustable and remains constant throughout the height range.

The Flexi-coil sprayer has a clean water container, spray tank access platform, remote control and optional automatic rate controller. The Hypro 9303C-HM4 centrifugal pump is hydraulically driven. The controller/monitor console mounts on the tractor and operates the pressure regulator and boom shut-off valves. The control console LCD displays application rate, speed, nozzle flow rate, volume and sprayed area.

Figure 1 shows the location of the sprayer's majo components while detailed specifications are given in **Appendix I**.

SCOPE OF TEST

The Flexi-coil Model 65 field sprayer was used for two spraying seasons in the conditions shown in **Tables 1 and 2**. The sprayer was used for 143 hours to spray a total of 6875 ac (2780 ha). A second spraying season was used to test the new automatic rate controller, end marker system and optional Ace BAC-75 Hyd-206 pump. The AFMRC evaluated the sprayer for rate of work, quality of work, ease of operation and adjustment, marker and pump performance, operator safety and suitability of the operator's manual.

Combo-Jet's ER80-015 and ER80-03 stainless steel nozzle tips were used during the test. Both nozzle tips were tested in the laboratory at various spraying pressures and heights.

The sprayer evaluated by the Alberta Farm Machinery Research Centre (AFMRC) was configured as described in the General Description, **Figure 1**, and the Specifications section of this report. The manufacturer may have built different forms of this sprayer before or after AFMRC tests. When using this report, be sure to first check the sprayer being purchased is the same as the one shown here. The manufacturer or AFMRC will help decide how your sprayer will perform compared with the one tested.

RESULTS AND DISCUSSION

RATE OF WORK

Table 1 shows the Flexi-coil sprayer was operated between 4 and 9 mph (6 and 15 km/h) resulting in instantaneous work rates between 44 and 98 ac/h (18 and 40 ha/h). Actual work rates were less and depended on operator skill and reloading time. The quick-folding booms, dual nozzle tips and automatic rate controller reduced time. The quick folding of the boom made tank reloading from a central location convenient. When applying 5 and 10 gal/ac (55 and 110 L/ha), a full spray tank sprayed 166 and 83 ac (67 and 33 ha), respectively.

Table 1. Operating conditions

CHEMICAL APPLIED	FIELD	HRS	SPEED		FIELD AREA	
			mph	km/h	ac	ha
Roundup	Chemfallow	27.0	5.0-9.0	8-15	1230	498
Buctril M Puma	Spring Wheat	4.0	7.5	12	160	65
Champion Plus	Barley	3.0	7.5	12	160	65
Express Pack	Barley Wheat Durum	16.0	7.5	12	800	324
Ally 2,4-D ester	Barley	1.0	7.5	12	40	16
Achieve Extra	Barley	6,0	7.5	12	245	99
Triumph Plus	Soft Wheat	3.0	7.5	12	80	32
Buctril M MCPA	Spring Wheat	6.0	7.5	12	320	130
Rustler	Chemfallow	20.0	7.5	12	1120	453
Rustler MCPA	Chemfallow	8.0	7.5	12	320	130
Roundup MCPA	Chemfallow	4.0	7.5	12	160	65
Water	Chemfallow	9.0	4.0-9.0	6-15	400	162
Transport	-	4.0	20.0	32	-	-
SUB-TOTAL (1994)		111.0	-	-	5035	2038
1995 TEST						
Triumph Plus	Spring Wheat	13.0	4.0-9.0	6-15	640	259
Horizon Target	Chemfallow	19.0	7.5	12	1200	486
SUB-TOTAL (1995)		32.0	-	-	1840	745
TOTALS		143.0	-	-	6875	2783

Table 2. Topography

TOPOGRAPHY	HOURS	FIELD AREA	
		ac	ha
Level	75	3555	1439
Undulating	38	1800	729
Rolling	9	410	166
Hilly	21	1110	449
TOTAL	143	6875	2783

QUALITY OF WORK

Application Rate Accuracy: Application rate accuracy was very good using the optional automatic rate controller. Application rate accuracy depended on the controller's flow sensor and speed sensor calibration numbers. The controller came programmed with flow and speed sensor calibration numbers of 1000 and 150, respectively. **Figure 2** shows application rates with the controller programmed to apply 5 gal/ac (55 L/ha) with the default sensor numbers and after calibrating the sensors. An application rate remained constant and was within five percent over a wide range of forward speeds. For example, at 7.5 mph (12 km/h), the actual application rate was 4.7 gal/ac (52.9 L/ha), compared to 5.0 gal/ac (55 L/ha) displayed on the monitor. Calibrating the flow and speed sensors improved accuracy to within one percent of the desired rate, **Figure 2**. For example, at 7.5 mph (12 km/h), the actual application rate was 5 gal/ac (55 L/ha), changing the flow and speed calibration numbers to 1017 and 160, respectively.

Calibrating the flow sensor was easily done by placing the monitor in calibration mode. The monitor automatically set the boom pressure to 40 psi (275 kPa) so delivery rates from at least six nozzles could be measured. A 63 oz (1.8 L) graduated cylinder and stop watch were used to measure nozzle delivery. The average delivery of the nozzle measured, multiplied by the number of nozzles on the sprayer, was entered. The monitor automatically computed the new calibration number based on total nozzle flow. The flow sensor calibration numbers for the ER80-015 and ER80-03 nozzle tips were 1017 and 1014, respectively.

The speed sensor calibration number depended on sprayer tire circumference. Tire circumference varied depending on tire pressure, spray tank fluid volume and field conditions. For greater accuracy, the speed senor was calibrated in actual field conditions, with the spray tank half full of fluid and sprayer tires properly inflated. The procedure required the operator to drive the sprayer in a straight line for a distance of at least 50 ft (15 m). In calibration mode, the new speed sensor number was entered automatically after entering the distance travelled. In the field conditions encountered, the speed calibration number varied from 160 to 163. With floatation tires, small variations in tire pressure and tank volume had negligible effects on the accuracy of the speed sensor.

Figure 2 also shows resulting nozzle pressures at various forward speeds. Nozzle pressure increased as forward speed increased, and vice versa. Speeds from 4 to 10 mph (6 to 16 km/h) resulted in nozzle pressures from 12 to 63 psi (80 to 435 kPa). Forward speed depended on field conditions, work rate required and needed nozzle pressure to ensure adequate spray coverage and minimum amount of spray drift. Speeds below 5 mph (8 km/h) produced pressures below 20 psi (150 kPa), which resulted in poor spray patterns, **Figure 6**. In essence, nozzle spray deposition at low pressures dictated the slowest speed the sprayer could be run.

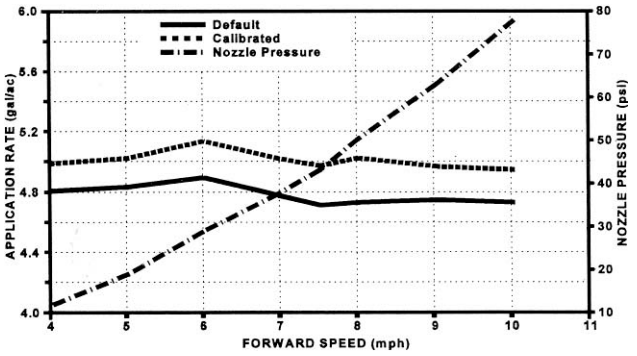

Figure 2. Application rate and nozzle pressure at various speeds with the controller programmed to apply 5 gal/ac (55L/ha).

Controller Response Times: Controller response to a change in speed was good. Figure 3 shows the automatic rate controller responding to a speed change using the fine-tune default setting of 25 and fine-tune setting of 40. Speed was changed from 7.5 to 6 mph (12 to 9.7 km/h) and back to 7.5 mph (12 km/h) with the controller set to apply 5 gal/ac (55 L/ha). At a fine-tune setting of 25, the controller responded within four seconds, stabilizing the application rate at 5.4 gal/ac (61 L/ha). It took an additional 20 seconds before the application rate was within two percent of 5 gal/ac (55 L/ha). Response time included the time to change tractor speed and the time application rate stabilized.

Response times were within three seconds at the fine-tune setting of 40. In addition, higher fine-tune settings brought application rates within two percent of the desired rate much faster. A fast response time ensured a constant application rate. Nozzle pressure oscillated when the fine-tune number was set higher than 40. Nozzle pressure oscillation also occurred when the motorized control valve operated near the maximum flow position. The

motorized control valve operated near the maximum flow position using the ER80-03 nozzles at speeds above 8 mph (13 km/h).

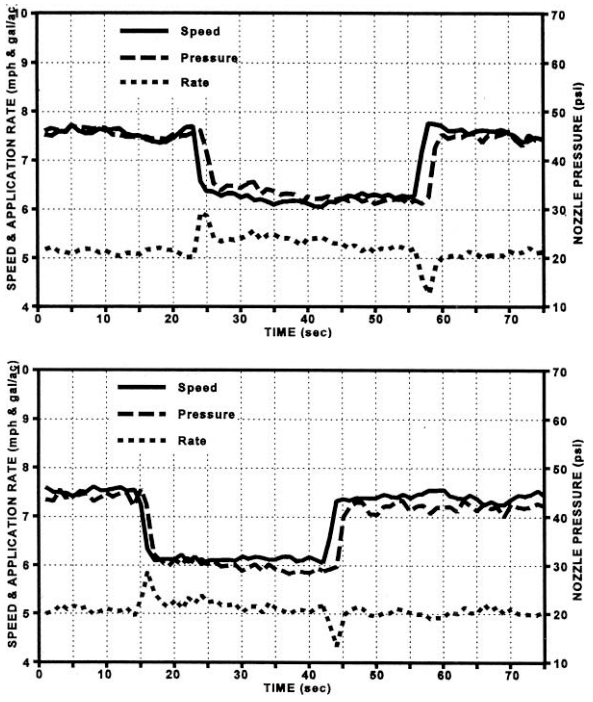

Figure 3. Automatic rate controller's response time to 1.5 mph (2.5 km/h) speed change. Top: Fine tune number at 25, Bottom: Fine tune number at 40.

Nozzle Calibration: Measured nozzle delivery was very good. Average delivery of Combo-Jet's ER80-015 and ER80-03 stainless steel nozzle tips was within three percent of Combo-Jet's rated output when new or used. The ER80-015 and ER80-03 nozzle tips were used in the field for 104 and 36 hours, respectively. Nozzle wear was typical of stainless steel tips and rated as good. A set of nozzles should be replaced when delivery of any nozzle tip exceeds the manufacturer's rating by more than ten percent.

Variability among individual nozzle deliveries for the Combo-Jet ER80-015 and ER80-03 nozzles was very good. Coefficient of Variation (CV[1]) was 2.3% for the ER80-015 tips and 1.5% for the ER80-03 tips.

Distribution Patterns: Spray distribution patterns from the Combo-Jet extended range (ER) 80° nozzle tips were good. **Figure 4** shows a typical, spray distribution pattern along the boom for Combo-Jet extended range 80° nozzles. The nozzles were operated at a pressure of 40 psi (275 kPa), a height of 15 in (380 mm) and a forward angle of 20°. Application rates along the boom varied from 3.2 to 7.5 gal/ac (36 to 84 L/ha) at 7.5 mph (12 km/h) with the ER80-015 tips. The spray distribution pattern coefficient of variation (CV)[2] at 40 psi (275 kPa) was 15.2%.

Figures 5 and 6 show how nozzle height and pressure affected spray pattern uniformity for Combo-Jet extended range (ER) 80° nozzles. The CV results were compared to previously tested Lurmark standard 80° and Tee Jet extended range 80° nozzle tips. As nozzle height and pressure increased, spray patterns improved. The Combo-Jet nozzle tips produced acceptable spray patterns at nozzle heights above 15 in (380 mm) and pressures above 35 psi (250 kPa). The Combo-Jet extended range 80° nozzles had similar spray pattern characteristics as standard 80° nozzles. Tee Jet extended range 80° nozzles produced better spray patterns than the Combo-Jet extended range nozzles.

To reduce spray drift in windy conditions, nozzles should be operated at pressures and heights as low as possible without sacrificing coverage. In field conditions, the Combo-Jet extended range nozzles were operated at pressures between 30 and 50 psi (205 and 345 kPa) and at heights between 15 and 18 in (380 and 460 mm). In windy conditions, nozzle height was reduced to 15 in (380 mm) to close the opening between the crop canopy and windscreen panels.

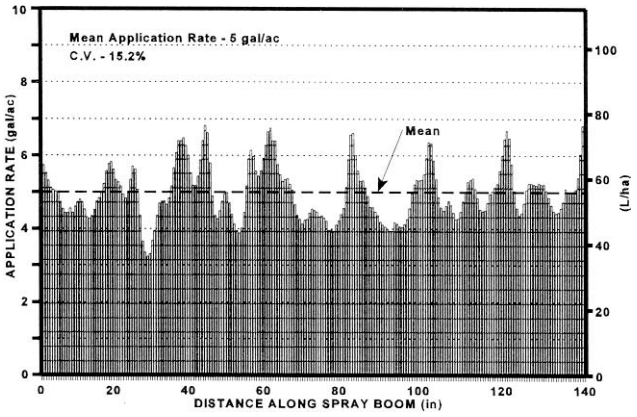

Figure 4. Spray distribution pattern along the boom at 40 psi (275 kPa) with Combo-Jet's extended range ER80-015 stainless steel nozzle tips, operated at a 15 in (380mm) height, 20° forward angle and 7.5 mph (12 km/h).

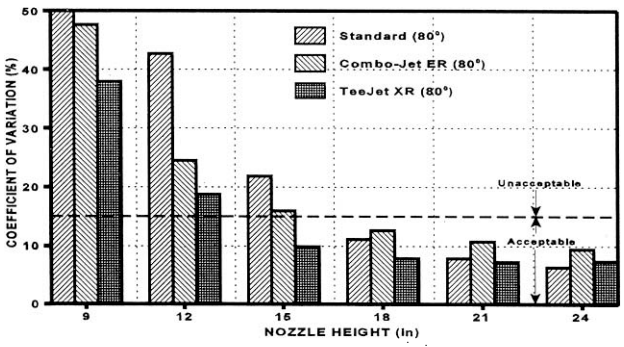

Figure 5. Spray pattern uniformity for Combo-Jet extended range Lurmark standard and Tee Jet extended range 80° nozzles operating at 40 psi (275 kPa).

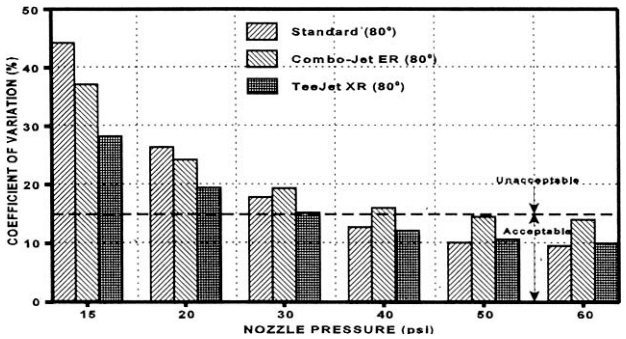

Figure 6. Spray pattern uniformity for Combo-Jet extended range, Lurmark standard and Tee Jet extended range 80° nozzles operating 15 in (380 mm) above target.

Spray Drift: Airborne spray drift was less than two percent using the windscreens. American Society of Agriculture Engineers (ASAE) Standard S387 "Test Procedure used for Measuring Deposits and Airborne Spray from Ground Swath Sprayers" was used to measure airborne spray drift. Spray drift methodology developed by Agriculture and Agri-Foods Canada at the Regina Research Station was also incorporated.

[1]The coefficient of variation (CV) is the standard deviation of delivery rates from ten nozzles expressed as a percent of the mean delivery rate. A CV below 3% indicates similar delivery rates for all nozzles.

[2]The coefficient of variation (CV) is the standard deviation of application rates for successive 0.6 in (16 mm) sections along the boom expressed as a percent of the mean application rate. The lower the CV, the more uniform 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.

The sprayer was tested in field conditions with the wind perpendicular (crosswind) to the sprayed swath. ER80-015 nozzle tips were used with and without the windscreen. The nozzles were operated at 40 psi (275 kPa) and a height of 18 in (460 mm) above the target. Tractor speed was 7.5 mph (12 km/h) giving an application rate of 5 gal/ac (55L/ha). Weeds in the chemfallow field were 6 in (150 mm) tall and standing stubble was 10 in (250 mm) high.

Figure 7 shows airborne spray drift as a percent of the chemical emitted in various wind speeds. In a 20 mph (32 km/h) crosswind, airborne spray drift was 11.3% with the windscreen off the sprayer, and two percent with the windscreen on. The windscreen reduced airborne spray drift by more than 80% in 20 mph (30 km/h) crosswind.

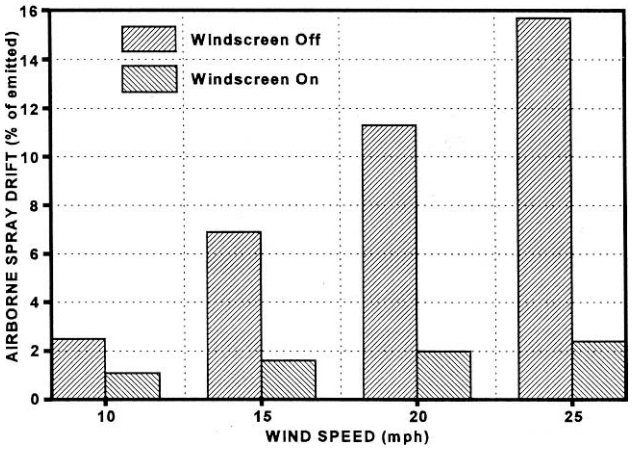

Figure 7. Airborne spray drift from Combo-Jet ER80-015 nozzles operated at 40 psi (275 kPa) nozzle pressure and 18 in (460 mm) nozzle height.

Appendix III shows actual spray drift trial results. Results include off-swath ground drift, swath deposits, airborne drift and swath deposit variability (CV). Swath deposit variability was determined by calculating the coefficient of variation (CV) of the spray deposits measured in the sprayed swath. The CV's averaged 25% with and without the windscreen. This showed the windscreen did not adversely affect spray deposition. Off-swath ground drift was low and usually occurred within the first two meters.

Spray Drip: Flexi-coil windscreens, **Figure 1**, enclosed the spray, causing some spray droplets to swirl between the front and rear windscreen panels. The swirling droplets accumulated on the windscreen panels, forming large droplets that dripped off the front and rear windscreen panels. The number of drip droplets averaged 7 and 17 droplets/yd^2 (8 and 20 droplets/m^2) with the ER80-015 and ER80-03 nozzles, respectively. Spraying direction in relation to wind direction did not increase or decrease spray dripping.

Average spray drip volume ranged from 0.6 to 2.8% of the application rate, **Figure 8**, in trials conducted in chemfallow conditions (see spray drift field conditions). In areas of the swath where the stubble was short and little wiping occurred, spray drip volumes were higher. Spray drip volumes above six percent occurred in areas where the panels washed off suddenly from boom vibration. Visual assessment of crops and weeds sprayed showed no adverse effects from spray dripping using chemicals listed in **Table 1**.

Weed Control: Scientific experiments were not conducted to determine the windscreen's effectiveness to improve weed control. General observations showed weed control was typical on the crops sprayed with chemicals applied at label rates, **Table 1**. Weed control was reduced in areas of the field where the end markers passed. After a period of three weeks, a row of weeds and voluntary crops were established in the marked soil **Figure 15**.

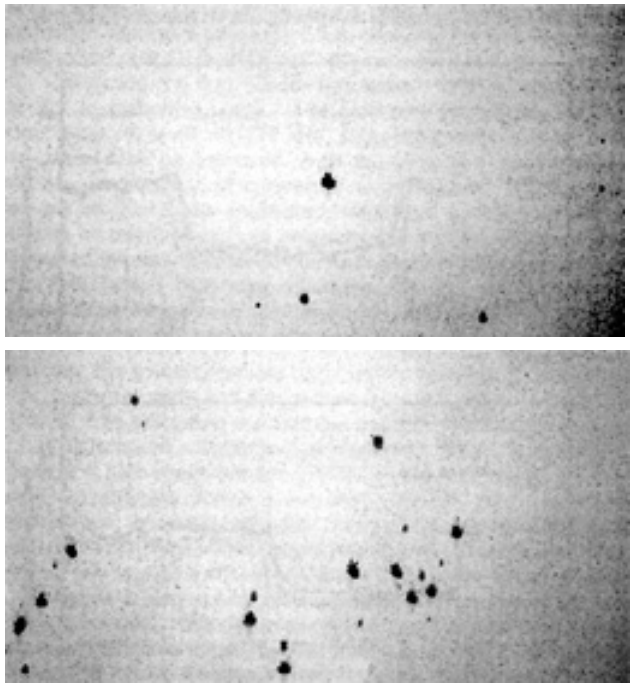

Figure 8. Samples of spray drip droplets collected on 0.6 yd^2 (0.5 m^2) area. Top: Average. Bottom: Maximum.

Pressure Losses: Sprayer plumbing pressure losses were low and rated as very good. Pressure in the plumbing system were measured at the pump, controls, spray booms and nozzles. Pressure loss across the 90 ft (27.4 m) boom was less than 1 psi (7 kPa).

The pressure sensor showed 4 psi (25 kPa) low and rated as fair. The mechanical pressure gauge was accurate. The pressure sensor and mechanical pressure gauge were near the boom shut off valves and therefore did not measure actual nozzle pressure When using small sized nozzles (ER80-015), the difference between the mechanical gauge pressure and nozzle pressure was less than 2 psi (14 kPa). However, when using larger tips like the ER80-03 nozzles, the pressure difference was 4 psi (25 kPa). The pressure difference and sensor inaccuracy did not affect applicatior rates since application rates depended on controller flow and speed sensor accuracy. However, confusion resulted when referencing nozzle application rate charts and catalogues.

Use of Optional Nozzles: The Combo-Jet nozzle body assembly, **Figure 9**, accepted only Combo-Jet nozzle caps.

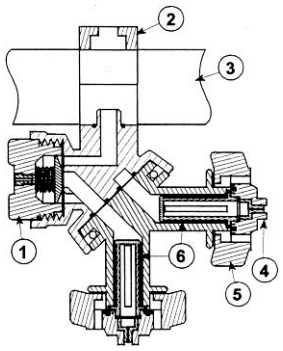

Figure 9. Combo-Jet Nozzle Body Assembly: (1) Diaphragm Check Valve, (2) Split-Eyelet Clamp, (3) Spray Boom, (4) Nozzle Tip, (5) Quick-Disconnect and Self-Aligning Nozzle Cap, and (6) Strainer.

Combo-Jet caps are available to attach conventional nozzles to Combo-Jet body assemblies. Adapters are also available to fit Combo-Jet nozzle caps to conventional nozzle body assemblies.

System Strainers: Flexi-coil sprayer strainers were good. The tank filler opening and pump inlet hose were equipped with 16 and 80 mesh strainers, respectively. Both strainers effectively removed large foreign material. The long 50 and 100 mesh nozzle strainers effectively prevented the Combo-Jet ER80-015 and ER80-03 nozzles from plugging.

Boom Stability: Flexi-coil boom stability was very good. The booms remained stable in the field conditions encountered, Table 2. The tubular booms, boom truss system and suspension system on the boom castor wheels reduced boom bounce in rough fields. In addition, the tubular truss reduced horizontal boom movement. Boom pivot joints allowed the nozzles to remain level with the contour of the land ensuring consistent nozzle tip to target height.

Crop Damage: Crop damage was considered insignificant. The trailer and boom wheels travelled 2.5 and 2% of the total field area sprayed, respectively. Less crop damage was observed in the sprayer wheel tracks when spraying in crops less than 7 in (180 mm) tall. The AFMRC's studies show sprayer wheels should be run in tractor tracks. The combined percentages of crop damage due to sprayer wheels and tractor wheels is greater than the damage when sprayer wheels are run in tractor tracks.

Previous studies conducted by the AFMRC showed crop damage when shrouds were not washed before spraying a crop susceptible to the previous chemical. To avoid potential crop damage the windscreens were washed before changing chemicals. After washing the windscreen panels, a chemical residue was evident from the milky rinsate on the ground.

The end marker discs caused some crop damage.

EASE OF OPERATION AND ADJUSTMENT

Application Rate: Ease of adjusting application rates was very good. The Combo-Jet nozzle body assemblies housed two nozzle tips allowing two application rates. The nozzle body assemblies were equipped with ER80-015 and ER80-03 nozzles. At 7.5 mph (12 km/h) and 40 psi (275 kPa), nominal application rates were 5 and 10 gal/ac (55 and 110 L/ha).

The controller could be programmed to apply three different rates using the same nozzles. Adjusting application rates during spraying was useful in fields with varying weed infestations. The rates entered were usually within 15 percent of the desired nominal rate. Adjusting application rates more than 20 percent from the nominal rate required a speed change or different sized nozzle.

When switching nozzles, the booms were raised and pointed against the wind. The windscreen's front panels flipped up making it easier to reach the nozzle bodies. Contact with chemical residues on the screens was also reduced. The nozzle bodies were also accessible through the windscreens' top opening.

Controls: Ease of operating Flexi-coil's Model SP655 monitor/controller was very good, Figure 10. The monitor, controller, keys and display were contained in one console. The console's adjustable pedestal was easy to mount on small tractor dashes. The console included two LCD digital displays. The left display showed speed, application rate and nozzle flow. The right display showed nozzle pressure. Area, accumulated area, volume and accumulated volume sprayed were also displayed.

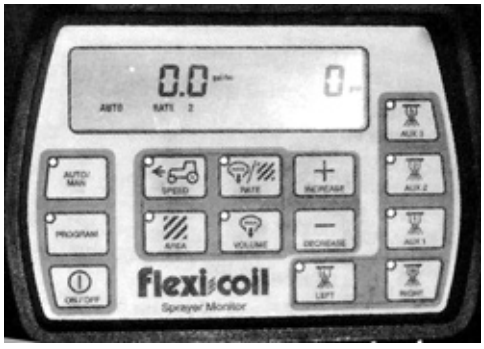

Figure 10. Flexi-coil's monitor and controller console.

The console had 14 large touch keys used to program, adjust and control various spraying operations. Some keys had several functions and some had to be used together, which made the monitor difficult to use at the start of each spraying season. The code names were also difficult to understand after not using the monitor for an extended period.

The agitator and pump shut-off valves were mounted on the sprayer hitch frame. Both valves were accessible and easy to use.

Boom Positioning: Ease of boom positioning was very good. Positioning the booms from the tractor seat allowed getting in and out of fields quickly. This allowed reloading from a central location. The sprayer booms folded into transport position in less than 15 seconds by raising the wet booms and driving forward simultaneously. For long road transport the operator had to manually place the draw booms closer to the sprayer and lock the hydraulic rams and end marker arms. Positioning the draw booms closer to the sprayer reduced transport width from 14 ft to 9 ft (4.3 to 2.8m) providing safe road transport, **Figure 11**.

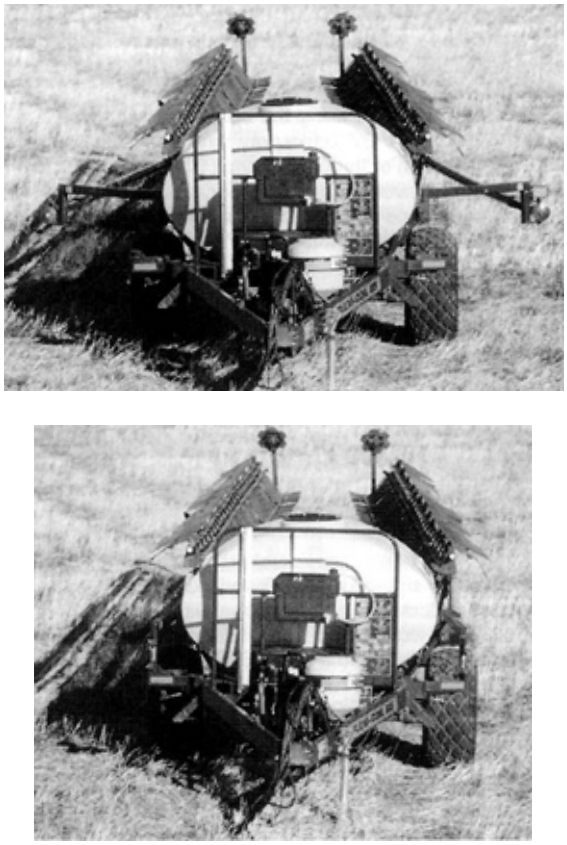

Figure 11. Flexi-coil sprayer in transport position.
Top: Field Transport, Bottom: Road Transport.

Placing the booms.in field position averaged 1.5 minutes and a distance of 92 ft (28 m). The procedure involved backing up the sprayer while unfolding the booms evenly. The booms were unfolded evenly to avoid jamming the draw booms into the trailer. The sprayer locked in field position by lowering the wet boom to spraying height.

Castor Wheel Adjustments: Ease of adjusting the boom wheels was very good. The castor wheels were adjusted at the factory. No further adjustments were made during 143 hours of spraying. The sprayer booms unfolded, folded and trailed well throughout the test.

Maneuverability: Sprayer maneuverability was very good. The sprayer towed well in both field and transport position. In hilly fields the 90 ft (27.4 m) sprayer swayed the front end of smaller tractors. Care had to be exercised when transporting the sprayer in windy conditions. The windscreens acted like sails and forced the boom ends to the edge of the road. The extra force on the

middle castor wheels caused uneven tire wear and once caused a tire to come off the rim.

The sprayer's turning radius was 46 ft (14 m) in transport position. Interference between the windscreens and wet booms behind the spray tank limited turning. Turning into tight approaches was easy because the castor wheels followed the spray tank trailer tracks closely. There was no need to swing out.

Backing up the sprayer in transport position for a short distance was possible, until the booms started unfolding. When backing up more than 30 ft (10 m), the booms were chained together. A back-up kit is available from the manufacturer.

The windscreens lifted quickly, therefore spraying over obstacles and going through gullies was not a problem.

Nozzle Adjustments: Ease of adjusting nozzle angle and height was good. The angle of the nozzles was adjusted 20° forward to prevent spray from contacting the windscreens or castor wheels. The nozzle angle remained constant at all boom heights. At 40 psi (275 kPa), the Combo-Jet extended range 80° nozzles had a spray pattern angle of 110°. The wide spray pattern did not interfere with the windscreen panels.

Nozzle height was controlled hydraulically. Hydraulic cylinder stops were used to set spray height. Nozzle height was manually measured and cylinder stops adjusted until the desired height was set. Nozzle height ranged from 15 to 45 in (380 to 1140 mm) above the ground.

Tank Filling: Ease of filling the spray tank with water was very good. The 830 gal (3770 L) spray tank was filled using the bottom reloading system or through the tank filler opening. Bottom reloading was more convenient and safer because less foaming and splashing occurred. Time required to fill the spray tank and add the chemical was less than 20 minutes using a 2 in (50 mm) diameter hose.

Chemical Inducting: Ease of adding chemical to the spray tank was good. The Flexi-coil sprayer was equipped with a 10 gal (45 L) Easy-Fill chemical tank, **Figure 1**. The Easy-Fill tank filler opening was 4 ft (1.2 m) above the ground making it easy to lift chemical containers to. Caution was required to prevent the chemical splashing in windy conditions. With the windscreens, spraying in windy conditions was prevalent. Granular formulations should be added through the spray tank filler opening as recommended on the product label. The sprayer tank filler opening was 6.8 ft (2.1 m) above the ground and toward the front of the sprayer tank. The non-skid platform allowed easy access to the spray tank filler opening.

Inducting a chemical was easy because the Easy-Fill chemical tank was near the pump shut-off valve. To reduce solution foaming, chemical was also inducted during agitation with the spray tank nearly full. Both were convenient and preference depended on operator skill, time and amount the chemical foamed.

Less than 30 seconds was required to induct a chemical from a full Easy-Fill tank. Closing the pump shut-off valve inducted the chemical faster. The pump was operated slowly, to prevent pump cavitations.

Hitching: Ease of hitching was good. The hitch jack provided was strong and safe. In transport position with the spray tank empty the trailer hitch weight was 235 lbs (95 kg). The hitch was adjustable to level the spray tank trailer. Hitching included the hook-up of six hydraulic lines for the pumps hydraulic motor, end marker and secondary booms, and an electronic coupler for the monitor/controller.

Cleaning: Ease of cleaning nozzle tips, strainers and windscreens was good. Nozzle strainers came out of Combo-Jet's nozzle assembly with the nozzle cap exposing the entire strainer for rinsing. Nozzle orifices were unplugged using a soft bristle toothbrush to prevent orifice damage.

Removing the nozzle caps from Combo-Jet nozzle assemblies for cleaning was often difficult. Pliers were used to remove some nozzle caps. The washer inside the nozzle cap was wetted to make the nozzle cap go on easier.

The pump inlet strainer was accessible from the right side of the hitch frame for removal. The strainer bowl was placed horizontally, preventing chemical solution draining on the operator's hands.

The windscreens were easy to wash. Raising the booms exposed the entire underside of the windscreen panels. A fire hose and nozzle were installed on the nurse tank to clean the windscreen panels. The windscreens were washed in the field to avoid farmyard contamination. Flexi-coil offeres a rinse kit that installs on a rinse or nurse tank to clean the windscreens.

Draining: Ease of draining the spray tank was good. Draining tank and line rinse solution was needed when switching chemicals, before storing the sprayer and to prevent freezing during late fall applications. Nearly all the spray tank rinse water was first sprayed on the field and then drained from the tank and lines. The spray tank was drained through the reloading line. The tank sump made it possible to drain the tank completely.

The pump cavity was drained by installing a drain valve at the bottom of the pump. Draining the hoses was done by loosening the ring clamps and removing the hose ends. Solution in the spray booms was drained by removing the end plugs. Combo-Jet diaphragm nozzle body assemblies were difficult to drain. The diaphragm was removed to drain the nozzle body assembly completely. Using air pressure to pressurize the booms was more convenient to drain booms and nozzle assemblies for fall spraying and winter storage.

Lubrication: Ease of lubricating the sprayer was good. The Flexi-coil sprayer had 36 grease fittings that required greasing daily or every ten hours. Twelve grease fittings required grease every 50 hours. Grease fittings were easy to get to with a grease gun. Stickers that showed grease fitting location and greasing interval were useful and still visible after two spraying seasons. Fifteen minutes was required to lubricate all grease fittings.

PUMP PERFORMANCE

Output: The sprayer was tested using Hypro Model 9303C-HM4 and Ace Model BAC-75 Hyd-206 centrifugal pumps. With 54 nozzles on 90 ft (27.4 m) of sprayer booms, the Hypro pump output was rated fair and Ace pump output rated as good. **Figure 12** shows the maximum nozzle pressures available running the pumps at a shut-off pressure of 100 psi (700 kPa). Pump shut-off pressure was the pressure at the pump discharge at zero flow. To reach shut-off pressures of 100 psi (700 kPa), the ACE pump was operated within the manufacturer's maximum hydraulic flow rating while the Hypro pump was operated above the manufacturer's maximum hydraulic flow rating.

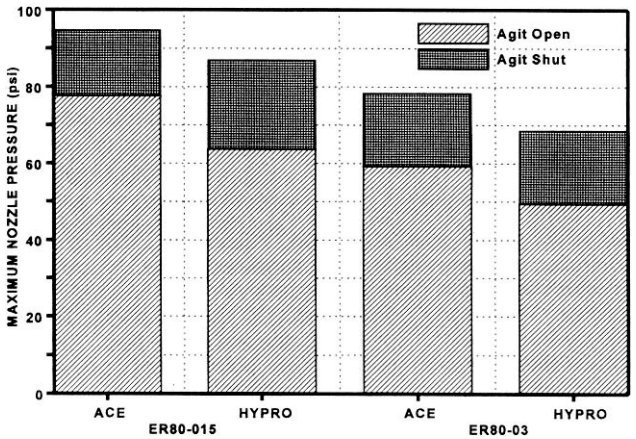

Figure 12. Maximum nozzle pressure available at pump shut-off pressure of 100 psi (700 kPa).

Figure 12 shows both pumps were adequate using ER80-015 nozzle tips. With the agitator valve open, the ACE pump delivered a maximum nozzle pressure of 80 psi (550 kPa). The Hypro pump delivered a maximum nozzle pressure of 65 psi (450 kPa). Shutting the agitator valve increased pressure to the nozzles by 20 psi (140 kPa). Maximum nozzle pressure decreased using the larger ER80-03 nozzle tips. The ACE pump delivered a maximum pressure of 60 psi (415 kPa) to the ER80-03 nozzles, which was adequate.

Spraying capacity was limited by the hydraulic drive motors. The sprayer was limited to nozzles rated at 0.25 gal/min (1.1 L/min), i.e., ER80-03, 8003 and 11003 nozzles. This was adequate to

apply 10 gal/ac (110 L/ha) at 40 psi (275 kPa) at a speed of 7.5 mph (12 km/h).

Agitation: Agitation output was very good. The Flexi-coil sprayer was equipped with two horizontally mounted hydraulic agitators. Even with a tank full of chemical solution, mixing was visible and aggressive. Table 3 shows agitator output during various operating conditions using 0.19 in (4.8 mm) diameter orifices.

Agitation rates varied depending on pump speed, nozzle size and control and agitator valve opening. Maximum agitation rates occurred with the agitator fully opened. While spraying the control valve was partially open to provide the desired spraying pressure. The control bypass line returned to the pump suction line. Flows shown in **Table 3** are with the agitator valve opened and the control valve adjusted to produce a nozzle pressure of 40 psi (275 kPa).

TABLE 3. Agitation

OPERATING CONDITION	PUMP SPEED rpm	AGITATION gal/min	AGITATION L/min
Reloading	3600	21	96
Field Spraying	4500	24	109

Average agitator output was 24 gal/min (109 L/min) during field spraying. This exceeded recommended agitation rates for emulsifiable concentrates and wettable powders. Normally recommended agitation rates for emulsifiable concentrates such as 2,4-D are 1.5 gal/min per 100 gal (1.4 L/min per 100 L) of tank capacity. For wettable powders such as Atrazine, recommended agitation rates were 3.0 gal/min per 100 gal (3.0 L/min per 100 L) of tank capacity. During reloading, agitator output was 21 gal/min (96 L/min).

MARKER PERFORMANCE

Mark Visibility: Mark visibility was good in cereal crop conditions. **Figure 13** shows a typical mark left by the end marker in a young cereal crop. The disc left a continuous mark of gouged and thrown soil. Depth and width of a mark in the soil and amount of soil thrown were controlled by adjusting the marker disc angle. For best visibility, the end marker disc angle was adjusted so the soil was thrown next to the gouged soil. This produced a wide area of moist, dark soil that was more visible. The end marker was helpful in aligning the sprayer in young cereal crops.

Figure 13. Mark made in cereal crop with end marker disc angle set at maximum.

Mark visibility in chemfallow field conditions was poor. In chemfallow fields and tall cereal crops, the end marker disc angle was set at maximum. In addition, weights were added to the end marker assembly to make the marks deeper. Later in the test, Flexi-coil's discs were removed and replaced with 19 in (50 cm) diameter discs. Marks from the large discs were visible and helpful in tall cereal crops and helped a little in chemfallow fields, **Figure 14**. More crop damage occurred with the large disc set at the maximum angle.

Figure 14. Mark made in chemfallow conditions with large 19 in (50 mm) diameter disc attached to the end marker arm.

Sprayer Alignment: Aligning the sprayer to the mark made on the previous pass was good. When the mark was visible, the end of the sprayer was aligned using the end castor wheel. The end castor wheel was used as an aid by driving over the mark. The chain was useful for some operators in aligning the sprayer boom end to the mark.

Mark Durability: Mark durability was good. Marks in cereal crop conditions were visible and helpful for several days. Only heavy rains eroded the marks. Marks left in chemfallow and tall cereal crop conditions were visible and useful in subsequent and pre-harvest spray applications. In chemfallow conditions new weeds grew in and around the mark making the mark more visible, **Figure 15.** Crop damage that occurred during post-emergent spraying was visible in pre-harvest conditions.

Figure 15. New weeds and voluntary crop in mark.

Controls: Controlling the end markers was very good. The end markers were operated by one hydraulic cylinder that was at the centre of the sprayer booms. Lowering one end marker to the ground automatically lifted the other off the ground. Both end markers automatically lifted in a vertical position when the sprayer was folded for transport.

OPERATOR SAFETY

The first section in the operator's manual emphasized operator safety. The manual discussed operating, chemical, maintenance, transport, hydraulic and tire safety. One warning decal near the chemical fill tank reminded operators to wear rubber gloves, a face mask and goggles when adding chemicals. Another decal cautioned the operator around high pressure hydraulic lines. A storage tank for clean water and Easy-Fill chemical tank increased spraying safety.

The windscreen was coated with dust, straw and chemical residue after spraying. Chemical residues were more noticeable inside the shroud. Extra care was taken not to touch the windscreens when changing, cleaning or checking nozzle tips or spray patterns. The windscreens were rinsed in the field before working near the windscreens.

Caution: Operators are cautioned to wear suitable eye protection, respirators and clothing to reduce operator contact with chemicals. Although many commonly used agricultural chemicals may by harmless to humans, they are hazardous if improperly used. In addition, knowledge is limited about the long-term effects of human exposure to many commonly used chemicals. Sometimes, the effects may be cumulative, causing harm after continued exposure over several years.

OPERATOR'S MANUAL

The operator's manual was very good. The manual was clearly written, well illustrated, and followed a practical order. Information was provided on safety, sprayer operation, maintenance, adjustments, trouble shooting, specifications and optional equipment.

MECHANICAL PROBLEMS

Table 4 outlines the mechanical history of the Flexi-coil Model 65 sprayer during 143 hours of operation while spraying 6875 ac (2780 ha). The intent of the test was evaluation of functional performance. An extended durability evaluation was not conducted.

TABLE 4. Mechanical history

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA	
		ac	ha
Castor wheels were difficult to grease	throughout the test		
Inserting locknuts on the windscreen panel nylon shear bolts was difficult	throughout the test		
Three front windscreen panels (left inner boom) bent spraying through a gulley and were replaced at	29	1230	500
Controller functioned intermittently in the "auto" mode at	48 to 79	2070 to 3675	840 to 1490
Right castor wheel assist cable broke and repaired at	55, 110	2390 5035	970 2040
The right end marker pivot bolt failed and replaced at	79	3675	1490
The right middle castor tire came off the rim transporting the sprayer in 35 mph (60 km/h) wind at	60	2635	1070
Two bolts on hydraulic boom lift assembly failed and were replaced at	110	5035	2040

MECHANICAL HISTORY

Greasing Castor VWheels: Greasing the bottom grease fitting on each castor wheel required extra force on the grease gun handle. The castor wheel grease fittings were replaced, but greasing was still difficult. After spraying 3000 acres (1200 ha), grease could not be injected in two of the four castor wheel grease fittings. The AFMRC recommends modifying the castor wheel assembly to make it easier to grease the castor wheels.

Controller in Auto Mode: The controller did not function in the automatic mode several times while spraying about 1600 ac (650 ha). Several troubleshooting ideas recommended in the operator's manual were tried, but failed to resolve the problem. The monitor/controller cable connections were disconnected and then reconnected. Dust and sand were lodged in several connectors. After reconnecting the cables, the controller functioned normally in the automatic mode.

Windscreen Nylon Shear Bolts: Inserting the locknuts on the nylon shear bolts was difficult. Many of the 0.25 x 2.5 in (6 x 64 mm) nylon shear bolts broke trying to screw the locknuts on. The AFMRC recommends modifying the windscreen panel shear bolts to make it easier to secure the windscreen panels.

End Marker Bolt: The right end marker pivot bolt failed while using a 19 in (50 cm) disc on the marker assembly. The disc angle was set at maximum and used in chemfallow fields. The heavier disc could have caused the bolt to fail.

APPENDIX I

SPECIFICATIONS

MAKE:	Flexi-coil Auto-Fold Field Sprayer			
MODEL:	65			
SERIAL NUMBER:	S65.C000-P056153			
MANUFACTURER:	Flexi-coil Ltd. P.O. Box 1928 1000 71 Street East Saskatoon, SK. S7K 3S5 Phone: (306) 934-3500			
DIMENSIONS:	Transport Position		Field Position	
-height	7 ft (2.2 m)		7 ft (2.2 m)	
-length	62.5 ft (19 m)		21 ft (6.4 m)	
-width	8.8 ft (2.7 m)		96 ft (29.2 m)	
-trailer wheel tread	7.3 ft (2.2 m)			
-clearance height	22 in (550 mm)			
-turning radius	46 ft (14 m)			
TIRES:				
-trailer	2, 16.5 L x 16.1, 6 ply			
-castor	4, 6.70-15, implement			
WEIGHT:	Transport Position (empty)		Field Position (loaded)	
-left trailer wheels	1470 lb	(667 kg)	5010 lb	(2275 kg)
-right trailer wheels	1410 lb	(640 kg)	4970 lb	(2256 kg)
-inner boom wheels				
-left	740 lb	(336 kg)	740 lb	(336 kg)
-right	730 lb	(331 kg)	740 lb	(336 kg)
-outer boom wheels				
-left	470 lb	(213 kg)	490 lb	(222 kg)
-right	480 lb	(218 kg)	480 lb	(218 kg)
-hitch	240 lb	(109 kg)	1540 lb	(699 kg)
TOTAL	5540 lb	(2515 kg)	13970 lb	(6342 kg)
SPRAY. TANK:				
-material	plastic			
-capacity	830 gal (3770 L)			
-agitation	hydraulic, 4 jet agitators			
FILLER OPENING:				
-shape	round			
-size -small	5 in (121 mm) I.D.			
-large	16 in (400 mm) I.D.			
-location	top, front, centre			
-height above ground	6.8 ft (2.1 m)			
CHEMICAL INDUCTOR:				
-type	Easy-Fill tank			
-capacity	10 gal (45 L)			
-opening	8 in (200 mm) I.D.			
-height above ground	48 in (1220 mm)			
-strainer	1, 16 mesh			
STRAINERS:				
-pump inlet hose	1, 80 mesh			
-nozzle assembly	54, 50 & 100 mesh			
-spray tank	1, 16 mesh			

PUMP:

-make	Hypro
-model	9303C-HM4
-type	centrifugal
-operating speed	4350 rpm at hydraulic flow of 9 gal/rain US (34 L/min)
-type of drive	hydraulic motor

PUMP: (optional)

-make	Ace
-model	BAC-75HYD-206
-type	centrifugal
-operating speed	4900 rpm at hydraulic flow of 7 gal/min US (26.5 L/min)
-type of drive	hydraulic motor

CONTROL CONSOLE:

-make	Flexi-coil
-pressure sensor	digital, 0 to 77 psi (0 to 480 kPa)

SOLENOID VALVES:

-make	Spraying Systems
-size	2, 1 in (25 mm) NPT, 12 VDC

SPRAY BOOM:

-material	PVC
-size	1 in (25 mm)
-height adjustment	
-type	Hydraulic
-range	15 to 45 in (380 to 1140 mm)
-angle adjustment	
-type	manual rotation
-range	20 to 30° forward
-nozzle assembly	
-make	Combo-Jet, Wilger Industries
-type	split-eyelet diaphragm double nozzle
-number	54
-spacing	20 in (508 mm)
-cap	quick-connect, colour coded, self-aligning
-effective spraying width	90 ft (27.4 m)

APPENDIX II

MACHINERY RATINGS

The following rating scale is used in Alberta Farm Machinery Research Centre's Evaluation Reports.

- Excellent
- Very Good
- Good
- Fair
- Poor
- Unsatisfactory

APPENDIX III

SPRAY DRIFT TRIALS AND RESULTS

Trial Number	Wind Speed at 2 m height (km/h)	Amount of 2,4-D Sprayed Me (g)	On-Swath Deposit Ms (g)	Off-Swath Deposit Mg (g)	Airborne Drift Mass Ma (g)	On-Swath Deposit (% Me)	Off-Swath Deposit (% Me)	Airborne Drift Da (%Me)	Total Drift Mass Mt (g)	Total Drift Dt (%Me)	Recovery R (%)	Swath CV (%)
A: Windscreen On												
AFM-1	15.0	171.4	127.3	0.6	1.2	74.3	0.4	0.7	1.8	1.1	75.3	33.2
AMF-2	27.3	167.3	151.3	0.9	5.3	90.4	0.5	3.2	6.2	3.7	94.1	33.5
AFM-3	19.4	159.6	135.7	0.4	1.2	85.0	0.2	0.7	1.6	1.0	86.0	24.8
AFM-4	27.0	171.2	132.9	0.5	3.5	77.6	0.3	2.1	4.0	2.4	80.0	30.5
AFM-5	26.0	162.6	114.4	0.7	2.0	70.3	0.5	1.2	2.8	1.7	72.0	20.5
AFM-14	10.3	160.7	147.6	0.9	2.1	91.9	0.6	1.3	3.0	1.9	93.8	27.7
AFM-15	18.2	164.0	142.5	0.7	2.0	86.9	0.4	1.2	2.7	1.6	89.0	22.4
AFM-16	13.1	160.7	155.5	0.7	1.0	96.8	0.4	0.7	1.8	1.1	98.0	26.1
AFM-20	18.1	166.1	139.3	1.4	3.0	83.9	0.8	1.8	4.5	2.7	87.0	20.2
B: Windscreen Removed												
AFM-7	31.6	172.4	122.8	4.6	20.4	71.2	2.7	11.8	25.0	14.5	85.7	26.4
AFM-8	20.2	171.2	133.9	1.3	3.3	78.2	0.7	1.9	4.6	2.7	80.9	27.3
AFM-9	16.1	165.0	132.0	1.0	1.2	80.0	0.6	0.7	2.2	1.3	81.3	22.5
AFM-10	24.8	170.2	144.0	2.7	10.5	84.7	1.6	6.2	13.2	7.8	92.4	21.7
AFM-11	20.1	167.8	129.8	4.2	9.7	77.3	2.5	5.8	13.9	8.3	85.6	22.3
AFM-12	19.9	168.6	131.4	2.3	9.7	78.0	1.3	5.7	12.0	7.1	85.0	27.1
AFM-13	12.5	165.0	131.9	2.7	4.6	80.0	1.6	2.8	7.3	4.4	84.4	18.2

SUMMARY CHART

FLEX-COIL MODEL 65 AUTO-FOLD FIELD SPRAYER

RETAIL PRICE:	$26,867.60 (April 1996 f.o.b. Lethbridge, AB)
RATE OF WORK:	82 ac/h (33 ha/h) @ 7.5 mph (12 km/h)
QUALITY OF WORK:	
-application rate accuracy	**very good;** 1% after calibrating flow and speed sensors
-nozzle calibration	
-delivery	**very good;** within 3% of Combo-Jet's rating
-CV	**very good;** 1.5 to 2.3%
-wear	good; typical of stainless steel tips
-spray distribution	
-CV	**good;** 15% above 35 psi (250 kPa) and 15 in (380 mm)
-spray drift	less than 2% with windscreens (ER80-015 nozzles)
-spray drip	0.6 to 2.8% of application rate
-pressure	
-loss	**very good;** less than 1 psi (7 kPa) across booms
-pressure sensor	**fair;** read 4 psi (25 kPa) low
-straining	**very good;** Combo-Jet nozzle strainers were long
-boom stability	**very good;** suspension system on castors
-crop damage	considered insignificant in young cereal crops

EASE OF OPERATION AND ADJUSTMENT:

-application rate	**very good;** quick with Combo-Jet dual nozzle assemblies and 3 rate option
-controls	**very good;** automatic rate controller and monitor.
-boom wheel adjustments	**very good;** no adjustments made after initial adjustment before tests.
-maneuverability	**very good;** booms followed tank trailer closely
-boom position	**very good;** 92 ft (28 m) to unfold booms
-nozzle adjustment	**good;** screw adjustment on boom hydraulic cylinders
-tank filling	**very good;** utilized pump, less than 20 minutes to fill and add chemical
-chemical inducting	**good;** chemical splashing in windy conditions
-hitching	**good;** standard hitch
-cleaning	**good;** Combo-Jet nozzle strainers, windscreen underside exposed
-draining	**good;** through reload line
-lubrication	**good**; 36 grease fittings, 4 were difficult to inject grease

PUMP PERFORMANCE:

-capacity	**good;** adequate for 0.25 gal/min nozzles (1 L/min), i.e., 8003, ER80-03 etc.
-agitation	**very good;** exceeded recommended rates

END MARKER PERFORMANCE:

-mark visibility	
-cereal crops	**good;** at a maximum disc angle
-chemfallow	**poor;** not helpful
-sprayer alignment	**good;** aided by end castor tire or chain
-mark durability	**good;** lasted several days
-controls	**very good;** hydraulic control
OPERATOR SAFETY:	Improved with clean water storage tank, Easy-Fill chemical tank, trailer platform and Combo-Jet nozzle assemblies
OPERATOR'S MANUAL:	**very good;** complete information on safety and operation.
MECHANICAL HISTORY:	bottom castor wheels were difficult to grease

ALBERTA FARM MACHINERY RESEARCH CENTRE

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html

Prairie Agricultural Machinery Institute
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:
P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080