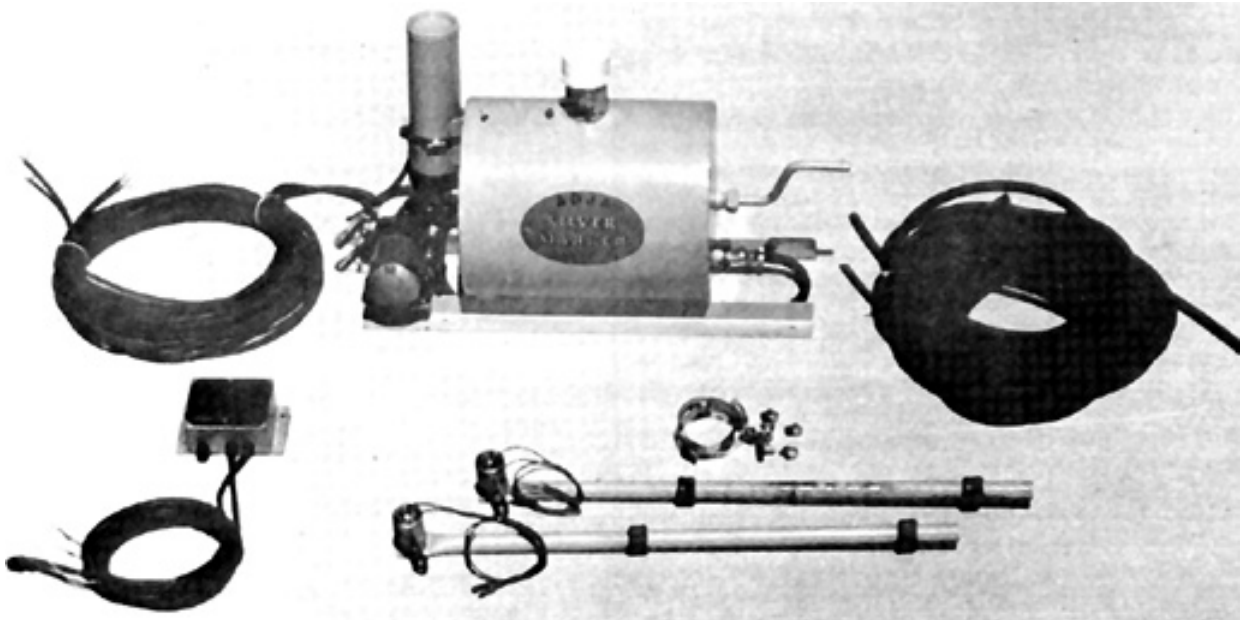


Evaluation Report 170



Adja Silver Marker

A Co-operative Program Between



ALBERTA
FARM
MACHINERY
RESEARCH
CENTRE



PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

ADJA SILVER MARKER

MANUFACTURER:

Adja Industries Limited
8814F Sixth Street S.E.
Calgary, Alberta
T2H 2K4

DISTRIBUTOR:

Alberta Wheat Pool
P.O. Box 2700
505 Second Street S.W.
Calgary, Alberta
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RETAIL PRICE: \$825.00 (June, 1980, f.o.b. Lethbridge)

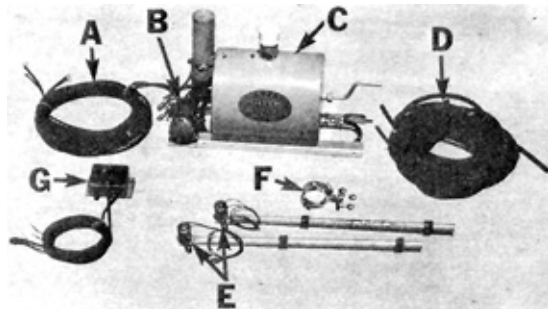


FIGURE 1. Adja Silver Marker: (A) Wiring Harness, (B) Pump, (C) Supply Tank, (D) Hoses (E) Boom End Nozzles and Solenoid Valves, (F) Mounting Hardware, (G) Control Unit.

SUMMARY AND CONCLUSIONS

The Adja Silver Marker was a useful aid in reducing overlap or misses with field sprayers. Operators could use the marks produced on the previous round to judge where they should drive for proper alignment.

The Adja was convenient to use. The tank was easy to fill while the manual agitator was effective in mixing the aluminum marking concentrate with diesel fuel. The tractor-mounted control unit was convenient and provided a sufficient range of adjustment. Mark length and spacing could be varied so that the 23 L (5 gal) supply tank had sufficient fluid to mark from 11 to 240 ha (25 to 600 ac). In normal conditions, the supply tank had to be filled every 50 to 100 ha (125 to 250 ac) when using an 18 m (60 ft) sprayer at 8 km/h (5 mph). Operating cost for marking solution varied from 12 to 25 cents/ha (5 to 10 cents/ac).

For best visibility, marks had to be spaced at 30 m (100 ft). Marks were more visible on cloudy days or when spraying away from the sun. Marks were hard to see when facing into the sun and some colour-blind operators had difficulty in seeing marks. Proper mixing of diesel fuel and aluminum concentrate, as well as proper nozzle adjustment, were both important for optimum mark visibility. Marks were more easily seen on young, green crops than on stubble or summerfallow fields. Marks usually lasted several days unless deposited on loose porous soils. Rain quickly washed the marking solution off plant leaves. Crop damage was minimal.

No safety hazards were apparent. However, normal care had to be observed with fire as diesel fuel is a carrying solution. The operator's manual included useful information on installation and operation.

Installation time was about two hours using common tools.

Durability problems encountered during the test included a malfunctioning start-override switch, broken solenoid valve wires and failure of several electronic components.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to improve performance of the start-override switch.

Chief Engineer: E. O. Nyborg

Senior Engineer: E. H. Wiens

Project Engineer: K. W. Drever

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. The control unit has been redesigned to eliminate the problems associated with the start, override switch. In addition, a heavier transistor is being incorporated which will withstand temporary short circuits in the external wiring.

NOTE: This report has been prepared using SI units of measurement. A conversion table is given in APPENDIX II.

GENERAL DESCRIPTION

The Adja Silver Marker is mounted on field sprayers to aid in aligning successive passes in the field. A 12 V diaphragm pump delivers an aluminum concentrate-diesel fuel mixture from a 23 L (5 gal) supply tank to solenoid valve controlled nozzles mounted at either end of the sprayer boom. Both length and spacing of the aluminum colored marks are adjustable from the control unit mounted on the tractor. Manual operation is also possible.

FIGURE 1 shows the major components of the marker while detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Adja Silver Marker was mounted on an 18 m (60 ft) trailing field sprayer and used for 73 hours of typical spraying. Laboratory tests were also conducted to aid evaluation.

The Adja was evaluated for ease of installation, ease of operation and adjustment, quality of work, operator safety and suitability of the operator's manual.

RESULTS AND DISCUSSION

EASE OF INSTALLATION

Installation Time: The Adja was easy to install on a sprayer, taking one man about two hours using common tools found in most farm shops. Sufficient brackets and mounting hardware were provided to install all components.

Supply Tank and Pump Assembly: The supply tank and pump assembly had to be mounted on the sprayer frame at a location which provided convenient access for filling and servicing. A suitable location on most sprayers was on the drawpole assembly.

Electric Valves, Nozzles and Hoses: The solenoid valves, nozzles, hoses and valve wires were easily attached to the sprayer boom with the clamps and ties provided.

Control Unit and Wiring Harness: The control unit mounted on the tractor with four screws. A quick connector was provided to disconnect the control unit when unhitching. No clamps were supplied to connect the control unit to the tractor battery.

EASE OF OPERATION AND ADJUSTMENT

Filling: The supply tank was easy to fill. A 1.1 L (0.25 gal) can of aluminum concentrate was added to the tank, and the remainder of the 23 L (5 gal) tank was filled with diesel fuel. A funnel was needed as the tank opening was only 50 mm (2 in). A hand operated agitator was provided on the supply tank for mixing the aluminum concentrate with the diesel fuel. The agitator had to be used when filling or if the sprayer was allowed to stand with solution in the supply tank.

Field Operation: The marks left by the marking solution allowed successive passes of the sprayer to be properly aligned (FIGURE 2). Marks were left at the outer edge of the previous round, so on the next round an operator could eliminate most sprayer misses or overlaps by aligning the outer end of the spray boom with the marks. This still required considerable operator skill and judgement, since, as with most sprayers, the outer end of the booms were over 9 m (30 ft) from the tractor and the sprayer could not be aligned by sighting down the row of marks. The operator had to judge the distance from the mark to where he should be driving and then use the mark as a check to see if the sprayer was properly aligned. This was effective as long as the marks were readily visible.

Controls: FIGURE 3 shows the control unit on the Adja. All controls were convenient to operate. The start-override button was useful in providing extra marks on corners or on the tops of hills.

Fluid Level: A fluid level indicator was not provided on the supply tank. Fluid level had to be judged by trial and error.

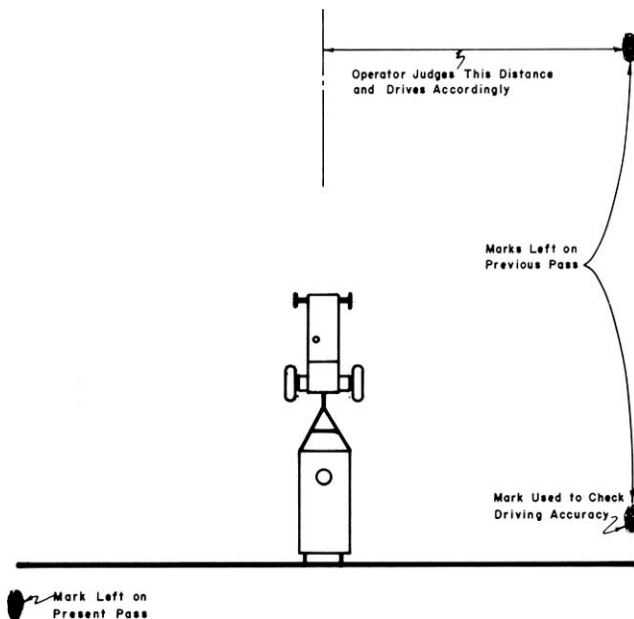


FIGURE 2. Schematic Illustrating Adja Silver Marker Operation.

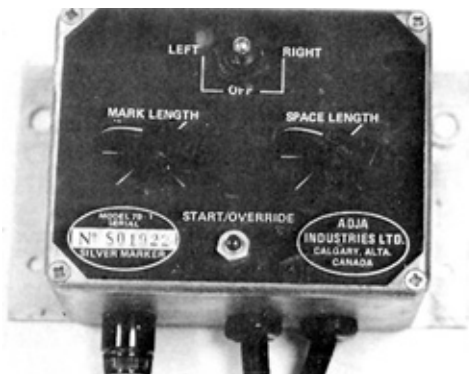


FIGURE 3. Control Unit.

QUALITY OF WORK

Mark Visibility: Mark visibility depended on crop, mark length, mark spacing, sunlight conditions, and operator sight. For best visibility, marks had to be spaced every 30 m (100 ft). Depending on field and light conditions, marks could be seen up to 500 m (1650 ft). Marks were more visible on cloudy days or when spraying away from the sun. Marks were hard to see when facing into the sun. Some colour-blind operators had difficulty seeing the marks. Thorough mixing of the aluminum concentrate with the diesel fuel was important for bright, highly visible marks. Marks were more visible if the spray nozzle was tipped forward when spraying around a field or tipped backward when spraying back and forth across a field.

Mark visibility was best when spraying young, green crops. Marks were much less visible on standing stubble fields. Most of the marking fluid was sprayed on the ground and was not readily visible through the stubble. Where stubble and trash had been tilled, the marks were easier to see.

Mark Durability: The marking fluid usually remained visible for several days on green crops. Fluid quickly soaked into loose, porous soils and rain quickly washed the marking solution off plant leaves.

Crop Damage Crop injury was minimal. The marking fluid contacted less than 0.1% of the total crop area and usually caused no injury. In a few cases the leaf tips were slightly burned.

Quantity of Fluid Used: The amount of marking fluid needed depended on crop conditions, field topography, sprayer size, forward speed and operator skill. The solenoid nozzle valve could be set to open from 0.1 to 0.4 s and to close from 4 to 30 s. This meant that the 23 L (5 gal) supply tank held sufficient fluid to cover from 1 to 240 ha (25 to 600 ac) when using TeeJet 4015 marking nozzles on a 18 m (60 ft) sprayer at 8 km/h (5 mph). Typical area covered by one supply tank full of marking fluid ranged from 50 to 100 ha (125 to 250 ac).

Operating costs for marking solution varied from 12 to 25 cents/ha (5 to 10 cents/ac).

OPERATOR SAFETY

No safety hazards were observed if normal safety precautions were observed. Normal care had to be observed with fire as diesel fuel is used as a pressurized carrying solution.

OPERATOR'S MANUAL

The operator's manual included useful information on installation and operation. A well illustrated, detailed parts list was also provided.

ELECTRICAL POWER REQUIREMENTS

The Adja drew a maximum current of 3 A and could be attached to a 12 V electrical system with either a positive or negative ground.

DURABILITY RESULTS

The Adja Silver Marker was operated for 73 hours. The intent of the test was functional evaluation and an extended durability evaluation was not conducted. The following mechanical problems occurred during functional testing.

TABLE 1. Mechanical Problems

Electrical	Item	Operating Hours
	The wire on the right solenoid valve broke and was repaired at	22
	The right solenoid valve would not function due to an internal broken wire at	52
	The start-override switch began operating intermittently at	39
	Electronic components including the timer circuit, a transistor and diode failed and were replaced at	end of test
Plumbing		
	The right outer hose became disconnected from the hose barb and was repaired at	20

DISCUSSION OF MECHANICAL PROBLEMS

Solenoid Valve Wires: The wires on the right solenoid valve broke twice due to field vibration. The first break was external to the coil and was repaired. The second break occurred inside the coil housing and was not repairable, requiring replacement of the solenoid.

Start-Override Switch: The start-override switch (FIGURE 3) began operating intermittently after 39 hours of operation due to dust entering the switch. It is recommended that the manufacturer consider modifications to improve switch performance.

APPENDIX I

SPECIFICATIONS

MAKE:	Adja Silver Marker
MODEL:	79-1
SERIAL NUMBER:	801922
ELECTRICAL POWER REQUIREMENTS:	12V
CONTROL BOX:	
- size	95 x 120 x 58 mm
- controls	mark length, space length, left or right selector switch, start-manual override switch
MARKING SYSTEM:	
- type	silver spray
- marker fuel	Adja Silver Concentrate No. 155 mixed with diesel fuel
FLUID SYSTEM	
- reservoir capacity	23 L
- pressure source	12 V diaphragm pump
- marking nozzles	Spraying Systems TeeJet 4015
- nozzle control valve	12 V electric solenoid valve, 10 W rating
- nozzle hose length	two, 12,830 mm
WIRING HARNESS	
- power supply cable	one, 18/2 AWG Type SJ, 2300 mm long
- nozzle control valve cable	two, 18/2 AWG Type SJ, 13,000 mm long
OPTIONS:	
- Spraying Systems 4030, 4020 or 6509 nozzles; flex down spout.	

APPENDIX II

CONVERSION TABLE

1 litre (L)	= 0.2 Imperial gallon (gal)
1 metre (m)	= 3.3 ft (ft)
1 millimetre (mm)	= 0.04 inches (in)
1 hectare (ha)	= 2.5 acres (ac)
1 kilometre/hour (km/h)	= 0.6 miles/hour (mph)
1 kilopascal (kPa)	= 0.15 pounds per square inch (psi)



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