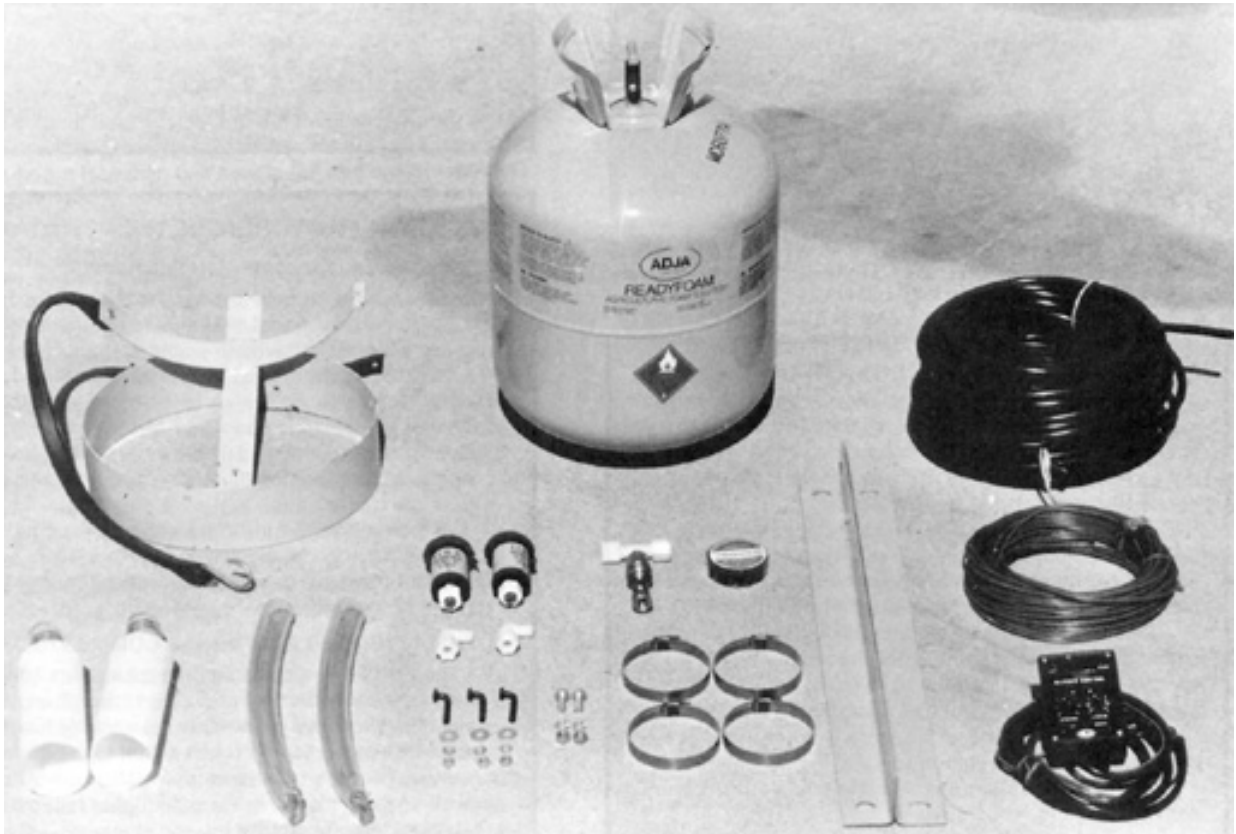


Evaluation Report

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Adja Model FM85-FG Foam Marker

A Co-operative Program Between



ALBERTA
FARM
MACHINERY
RESEARCH
CENTRE



PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

ADJA MODEL FM85-FG FOAM MARKER

MANUFACTURER AND DISTRIBUTOR:

Adja Industries Ltd.
Bay 40, 5225 - 6 St. N.E.
Calgary, Alberta
T2K 5Y4

RETAIL PRICE: (June, 1987, f.o.b. Lethbridge, Alberta).

- a) 1986 model FM85-FG \$295.00
- b) Replacement Foam Tank \$125.00

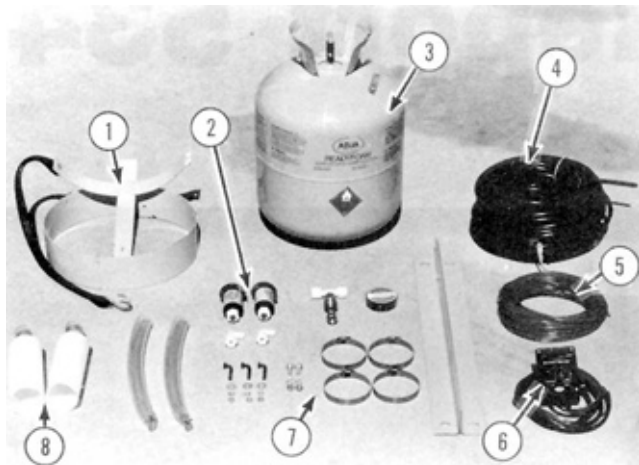


FIGURE 1. Adja Model FM85-FG Foam Marker: 1) Foam Tank Stand, 2) Solenoid Valves, 3) Foam Tank, 4) Foam Tubes, 5) Wiring Harness, 6) Control Box, 7) Mounting Hardware, 8) Boom End Funnels.

SUMMARY AND CONCLUSIONS

Quality of Work: Mark visibility was good as long as mark spacing and length were adjusted to suit forward speed and field conditions. For best visibility, the foam marks had to be about 40 in (1016 mm) long and spaced about 100 to 150 ft (30 to 46 m).

Mark durability was good using the ball foam mark and fair using the strip foam mark. At best, the strips of foam lasted about 1 hour, whereas the balls of foam could last about 6 hours in certain weather conditions.

One tank of foam lasted about 500 ac (202 ha) using a 60 ft (18 m) sprayer with marks spaced about 100 ft (30 m) and mark lengths about 40 in (1016 mm). Operating costs for foam were about 25 cents/ac (62 cents/ha).

Marker component performance was very good in the dust and moisture common to spraying operations.

Ease of Operation and Adjustment: Controls were easy to use and responsive.

Ease of agitating the foam was good. Initially the foam tank had to be laid on its side and rocked back and forth for a couple of minutes. Foam delivery was very good. The pressurized foam tank delivered quality foam consistently to the boom end funnels. Once empty, the foam tank was not reusable.

Good operator skill and judgement was required to align the sprayer boom end with the foam mark. This was more difficult with wider sprayers.

Ease of cleaning the nozzle tips and solenoid valve assemblies was fair. About 35 oz (1000 mi) of foam fluid escaped from the foam tubes when the nozzle tips were removed for cleaning.

Ease of adjusting the foam mark spacing and length was very good using the narrow boom end funnels and good using the wide funnels. The marks were spaced at desired intervals using the narrow funnels.

Ease of Installation: The Adja foam marker components were small and easy to install on most field sprayers. Installation time was about 2 hours for one man.

OPERATOR'S MANUAL

The operator's manual was useful.

MECHANICAL HISTORY

Debris from the solenoid valve assemblies plugged the nozzle tips. Several times the solenoid valve seals deformed causing foam to leak.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying the marker to prevent foam escaping from the foam tubes when cleaning the nozzle tips and solenoid valve assemblies.
2. Modifying the marker to prevent the solenoid nozzles from plugging.
3. Modifying the marker to prevent foam leaking from the solenoid valve assemblies.

Station Manager: R. P. Atkins

Project Engineer: L. B. Storzynsky

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. In an effort to improve the marker system for 1987, a completely new model #FM38-7 was introduced retailing at \$530.00. The system employs small check valve assemblies at both the tank outlet fittings and at the solenoid valves. This eliminates foam loss from the hose when servicing any part of the marker.
2. Special precautions and a tank inner coating has been applied to help eliminate welding slag, rust, etc. which was the major cause to nozzle plugging.
3. The model #FM38-7 utilizes a valve on which the nozzle tip can be removed without foam from within, without the valve being lost or without internal valve parts falling out.

MANUFACTURER'S ADDITIONAL COMMENTS

The FM38-7 Foam Marker has generally undergone many improvements in brass fitting rather than plastic, in high quality braided hose rather than plastic tubing and in stainless steel solenoid valves rather than plastic bodied valves. The more deluxe model "SM" control timer is used on all foam markers providing higher reliability and greater marking flexibility.

GENERAL DESCRIPTION

The Adja Model FM85-FG Foam Marker is mounted on field sprayers to aid in aligning successive passes in the field. A disposable 3.3 gal (14.8 L) portable pressurized tank delivers foam to solenoid valve controlled nozzles mounted at each end of the sprayer booms. The foam is dropped down one of two available types of end boom funnels. A 1.25 in (32 mm) diameter vinyl hose is used to leave strips of foam while a 2.5 in (64 mm) diameter tube is used to leave balls of foam. Both the length and spacing of the foam marks are adjustable from the control box mounted on the tractor. Manual operation is also possible.

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

SCOPE OF TEST

The Adja Foam Marker was mounted on 60 and 53 ft (18 and 16 m) trailing field sprayers and used for 113 hours of typi-

cal spraying. Laboratory tests were also conducted to aid evaluation.

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

RESULTS AND DISCUSSION

QUALITY OF WORK

Mark Visibility: Foam mark visibility depended on field surface, foam mark spacing and length and the operator. Foam mark visibility was good in most field conditions encountered as long as mark spacing and length were adjusted to suit forward speed and field conditions. The foam marks were best visible on level fields with young green crops where mark spacings of about 100 to 150 ft (30 to 46 m) could be used. Foam marks spaced too far apart caused the operator to search for the next mark which resulted in a zig zag spraying pattern. In addition, more foam was used at large mark spacings because the mark length usually had to be increased for good visibility.

For best visibility using the narrow foam funnel, the foam marks had to be about 40 in (1016 mm) long. The foam strips and balls were equally as visible.

Mark Durability: The strips of foam marks lasted about an hour normally, but less than half an hour in hot and breezy weather conditions. Increasing the foam strip length increased mark durability. The balls of foam marks could last several hours, normally, but less than one hour in hot and breezy weather conditions.

Quantity of Foam Used: The amount of foam needed depended on field surface, field topography, sprayer size, operator skill and weather conditions. The solenoid valve could be set to open from 0.2 to 0.7 seconds and to close from 2 to 60 seconds. This meant that the 3.3 gal (14.8 L) tank held sufficient foam fluid to cover about 40 to 6437 ac (16 to 2606 ha) using Lurmark 015-F80 nozzles on a 60 ft (18 m) sprayer at 5 mph (8 km/h). However, a typical area covered by one foam tank was about 500 ac (202 ha) using a 60 ft (18 m) sprayer with a mark spacing of 100 ft (30 m) and a mark length of 40 in (1016 mm).

Operating cost for the Adja foam was about 25 cents/ac (62 cents/ha).

Environmental Effects: The performance of the Adja control box, solenoid valves and wiring harness was not affected by the dust or moisture common to spraying operations. The foam had no adverse effect on the crop.

EASE OF OPERATION AND ADJUSTMENT

Foam Tank: The foam tank had to be removed from the stand and agitated for a couple of minutes each day before using. Removing the foam tank from the stand and the foam tubes from the foam tank was quick and easy. It was important to remember to close the foam tank valve before removing the foam tube quick coupler to prevent foam escaping. To agitate the tank the manufacturer recommended laying the foam tank on its side over a sprayer wheel and rocking the foam tank back and forth. Once agitated, the foam stayed agitated due to the motion and vibration of the sprayer.

The pressurized foam tank delivered good quality foam evenly and consistently to the boom end funnels in all conditions encountered during the field test. Not using the foam marker over a period of time, due to weather conditions for example, caused the foam inside the foam tubes to deteriorate to a liquid state. The deteriorated foam was quickly and easily emptied by adjusting the mark spacing at the minimum setting until good quality foam appeared from the boom end funnels.

The amount of foam remaining had to be judged by the weight of the foam tank. The foam could be nearly completely emptied from the tank. Once empty, the foam tank was not re-useable and had to be disposed. The manufacturer warned against attempts to refill the foam tank.

Controls: FIGURE 2 shows the control box on the Adja Foam Marker. All controls were convenient to operate and responsive. A start-override button was useful in providing ex-

tra marks on corners and during turns.

Operation of the control box required the operator to turn on the power switch and set the control switch to operate either the left or right end foam solenoid valve.



FIGURE 2. Control Box.

Cleaning: The solenoid valves contained Lurmark 015-F80 nozzle tips that regulated the foam to the boom end funnels. Occasionally the nozzle tips and solenoid valve assemblies required cleaning. Care had to be exercised during cleaning to prevent foam from spraying on the operator. The pressurized foam inside the solenoid valve assembly and foam tubes rapidly escaped when the nozzle cap was being removed. About 35 oz (1000 mi) or 30 ac (12 ha) of foam fluid escaped from the foam tubes. It is recommended that the manufacturer consider modifying the marker to prevent foam escaping from the foam tubes when cleaning the nozzle tips and solenoid valve assemblies.

Field Operation: The foam marks allowed successive passes of the sprayer to be properly aligned (FIGURE 3). 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 with most sprayers, the outer ends of the booms were over 30 ft (9 m) 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 on whether the sprayer was properly aligned.

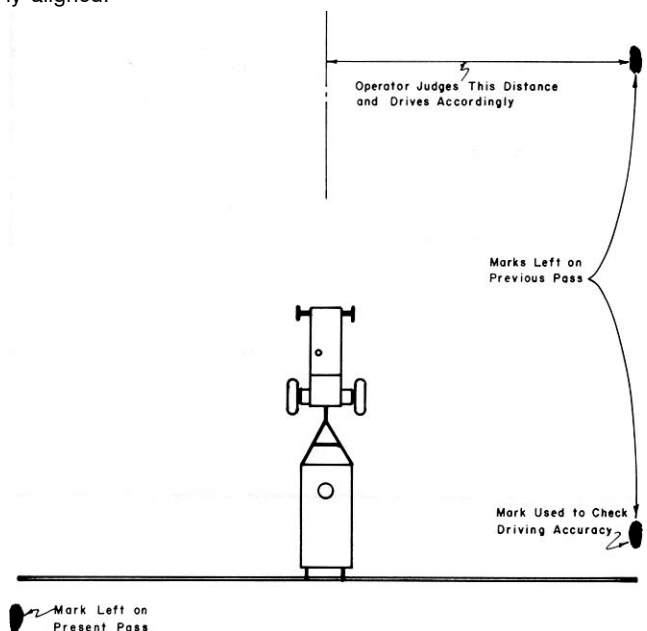


FIGURE 3. Schematic Illustrating Adja Marker Operation.

From the tractor seat the sprayer boom end may seem properly aligned with the foam mark, when in fact the mark could be several feet from the sprayer boom end. It is recommended the operator frequently get off the tractor and check the mark with respect to the sprayer boom end, and make adjustments accordingly.

Mark Adjustments: Foam mark shape depended on the funnel used at the solenoid valves. The manufacturer supplied two types of boom end funnels as shown in FIGURE 1. The narrow funnel left strips of foam and the wide funnel left balls of foam (FIGURE 4). The manufacturer didn't indicate conditions each funnel was best suited for.

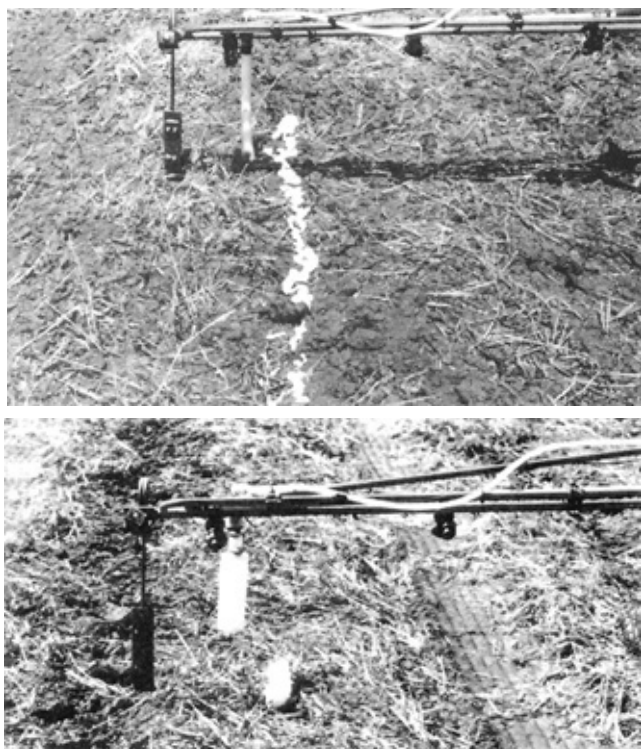


FIGURE 4. Foam Shape: (Upper) Strip of Foam, (Lower) Ball of Foam.

Mark length and spacing were easier to adjust using the narrow funnel. The narrow funnel left a mark each time the solenoid valve opened. This was convenient and ensured a mark at regular intervals. Mark length could be adjusted from about 10 in (254 mm) long to a continuous strip. The foam strips were about 5 in (127 mm) wide.

Foam did not dispense from the wide funnel each time the solenoid valve opened and as a result mark spacing varied considerably. This was inconvenient, making it difficult to adjust to a desired mark spacing.

The foam marks were about 5 in (127 mm) long and changed very little at most mark length settings using the wide funnel. Increased mark length settings increased the frequency of foam dispensed and as a result, mark spacings were decreased. Foam mark visibility enhanced because mark spacing was decreased and not because the foam mark length increased. In essence, both mark spacing and length controls could be used to adjust foam mark spacing when using the wide funnel.

EASE OF INSTALLATION

Installation Time: The Adja Foam Marker components were small, light and easy to install, taking one man about two hours. Some brackets were built to install the solenoid valves and foam tank stand.

Installation instructions provided were useful.

Foam Tank: The foam tank was mounted on the stand provided. The stand was secured on the sprayer frame at a location that provided convenient access for removing the foam tank for agitation. A suitable location on most sprayers was on the trailer hitch.

Solenoid Valves: The solenoid valves were mounted on the bracket arms provided. The bracket arms were long enough to install the solenoid valves 10 in (254 mm) from the end spray nozzle. The bracket arms provided were not easily adaptable to some sprayer booms, therefore mounting hardware had to be built to secure the solenoid valves. The boom end funnels easily attached to the solenoid valve nozzle caps by gear clamps.

Wiring Harness and Foam Tubes: The wiring harness and black foam tubes were attached together along the sprayer trailer frame and booms with electrical tape provided. The white foam tubes provided later during the test were rigid and more difficult to install.

The foam tubes were easily connected and tightened to the solenoid valves and foam tank with compression fittings.

Control Box: The control box was mounted at a suitable location on the tractor. The control box was attached with two screws and was wired directly into the tractor electrical system. A quick electrical pull-apart connector was provided to disconnect the control box when unhitching the tractor.

OPERATOR SAFETY

No safety hazards were observed if normal safety precautions outlined in the operator's manual were adhered to.

OPERATOR'S MANUAL

The operator's manual included useful information on installation and operation. When to use the narrow or wide foam funnels was not clearly stated. A parts list was also provided.

MECHANICAL HISTORY

TABLE 1 outlines the mechanical history of the Adja Foam Marker during 113 hours of field operation, while spraying about 2805 ac (1136 ha). The intent of the test was evaluation of the functional performance and an extended durability evaluation was not conducted.

TABLE 1. Mechanical History

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA	
		ac	(ha)
- solenoid nozzles plugged		throughout the test	
- solenoid valve leaked and was replaced at	10, 23	320, 620	(130, 251)
- black foam tubes failed and were replaced with white tubes at	23, 28	620, 770	(130, 311)

DISCUSSION OF MECHANICAL PROBLEMS

Plugged Solenoid Nozzles: The solenoid nozzle tips plugged several times during both the lab and field tests. Debris from the solenoid valve assemblies were found plugging the nozzle tips. It is recommended that the manufacturer consider modifying the marker to prevent the solenoid valve nozzles from plugging.

Leaking Solenoid Valves: The solenoid valve seals deformed and didn't seal properly against the solenoid valve plunger. As a result the foam continuously leaked from the solenoid valve assembly. Turning the seal upside down helped stop the leak sometimes but the procedure required that the nozzle cap be removed. Nearly 35 oz (1000 mL) of foam fluid was lost from the foam tubes when removing the solenoid nozzle cap each time to adjust the solenoid valve seal. It is recommended that the manufacturer consider modifying the marker to prevent foam leaking from the solenoid valve assemblies.

Foam Tubes: The black foam tubes supplied at the beginning of the test split and leaked foam. The black tubes were replaced with white tubes that were more durable.

**APPENDIX I
SPECIFICATIONS**

MAKE:	Adja Foam Marker
MODEL:	EM85-FG
ELECTRICAL POWER REQUIREMENTS:	
- volts	12VDC
- current draw	0.9 A
CONTROL BOX:	
- size	4 x 2.88 x 1.63 in (102 x 73 x 41 mm)
- controls	power on-off, mark size, distance between marks, left or right marking, manual override
MARKING SYSTEM:	
- type	foam
- marker fluid	pressurized foaming fluid
- tank capacity	3.3 gal (14.8 L)
MARK DELIVERY SYSTEM:	
- foam tubes	1/4 in (6.4 mm) I.D. x 52 ft (15.8 m) long
- boom end funnels	
- narrow	Vinyl Hose 14 in (356 mm) long x 1.25 in (32 mm) I.D.
- wide	PVC Tube 9 in (230 mm) long x 2.5 in (64 mm) I.D.
- control valve	12V electric solenoid valve
- regulating nozzle	Lurmark 015-F80 tip
WIRING HARNESS:	
- power cable	7 ft (2.1 m) long
- solenoid valve cable	70 ft (21.3 m) long
WEIGHT:	
- components	18 lbs (8.2 kg)
- foam tank	42 lbs (19.0 kg)
- Total	60 lbs (27.2 kg)

APPENDIX II

MACHINE RATINGS

The following rating scale is used in PAMI Evaluation Reports:

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

APPENDIX III

CONVERSION TABLE

acres (ac) x 0.40	= hectares (ha)
miles/hour (mph) x 1.61	= kilometres/hours (km/h)
feet (ft) x 0.305	= metres (m)
inches (in) x 25.4	= millimeters (mm)
pounds mass (lb) x 0.45	= kilograms (kg)
Imperial gallons (gal) x 4.55	= litres (L)
pounds force per square inch (psi) x 6.89	= kilopascals (kPa)
fluid ounce (oz) x 28.4	= millilitres (mL)

SUMMARY CHART

ADJA Model FM85-FG FOAM MARKER

RETAIL PRICE:	\$295.00 (June, 1987, f.o.b. Lethbridge)
QUALITY OF WORK:	
Mark Visibility	Good; at suitable mark spacings and lengths
Mark Durability	Good; about 6 hours
- foam ball	Fair; about 1 hour
- foam strip	
Quantity of Foam Used	
- area marked	about 500 ac (202 ha) per tank
- cost	25 cents/ac (62 cents/ha)
Environmental Effects	Very good; Components not affected by dust or moisture and foam had no affect on crop
EASE OF OPERATION AND ADJUSTMENT:	
Foam Tank	Good; foam tank had to be shaken initially
- agitating	Very good; evenly and consistently
- foam delivery	Very good; easy to use and responsive
Controls	Fair; lost about 35 oz (1000 ml) of foam fluid
Cleaning	Good; required good judgement
Field Operation	
Mark Adjustment	Very good; spacing at regular intervals
- narrow funnel	Good; spacing at irregular intervals
- wide funnel	
EASE OF INSTALLATION:	Very good; about 2 hours, components light and compact
OPERATOR'S MANUAL:	Very good; useful
MECHANICAL HISTORY:	Foam tubes split and solenoid valves leaked or plugged



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