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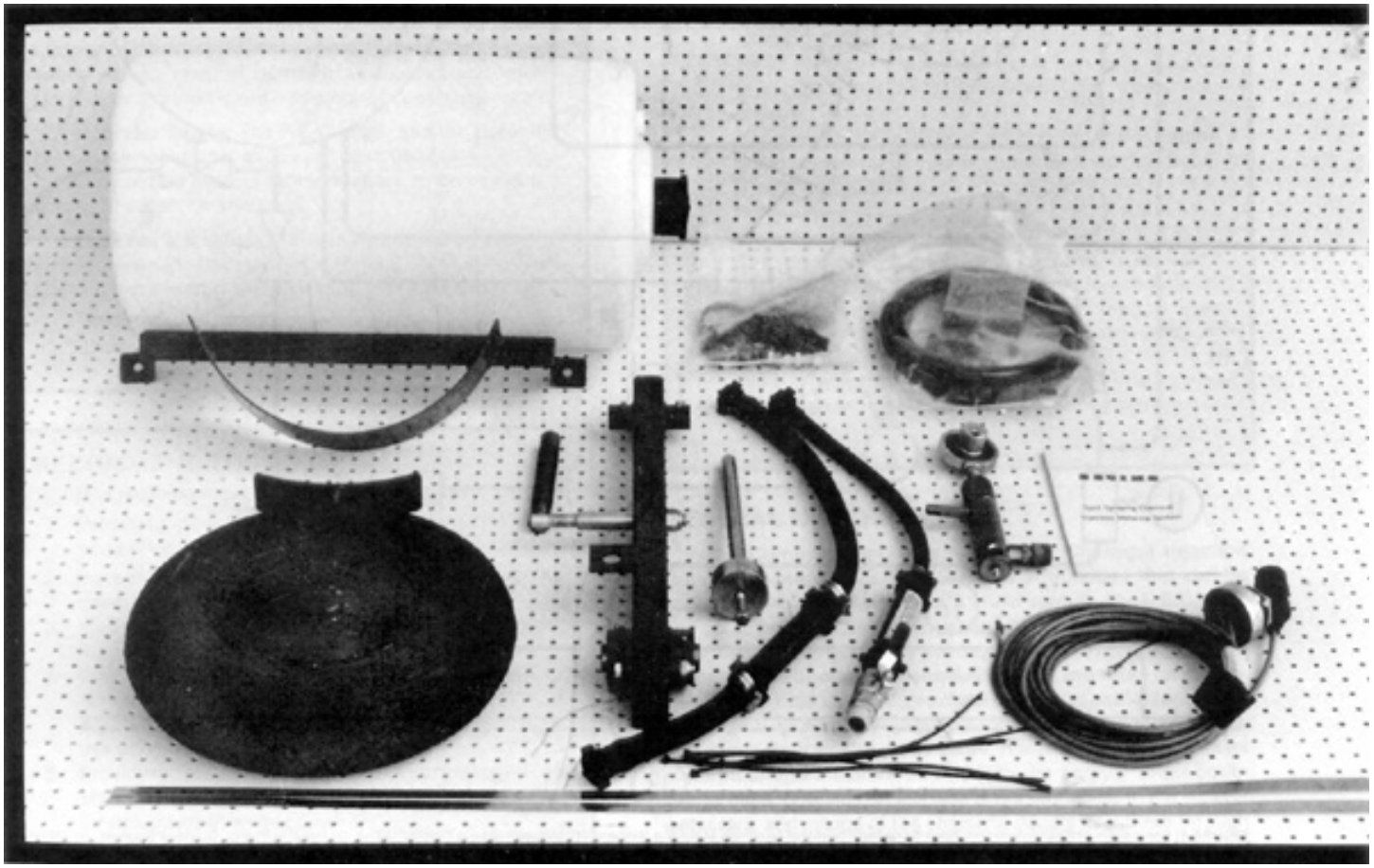

Computorspray Spot Spraying Chemical Injection Metering System (S.S.C.I.M.S.)

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

COMPUTORSPRAY SPOT SPRAYING CHEMICAL INJECTION METERING SYSTEM

MANUFACTURER AND DISTRIBUTOR:

Australian Canadian Agricultural Machinery Corp.
1306 - 15 Ave.
Coaldale, Alberta
T0K 0L0

RETAIL PRICE:

$1,358.00 (October, 1987 f.o.b. Lethbridge, Alberta).

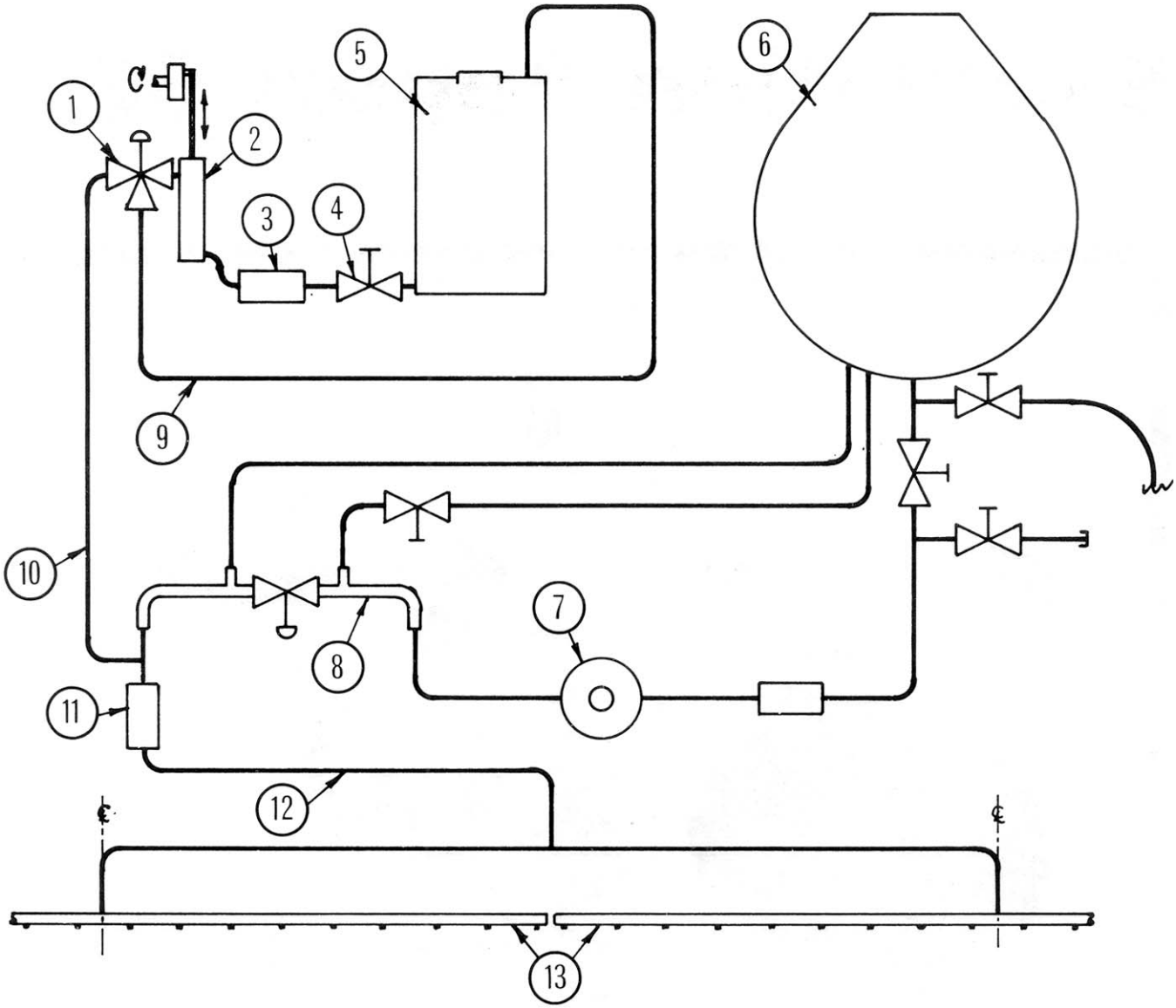

FIGURE 1. Schematic of Computorspray Spot Spraying Chemical Injection Metering System: (1) 3-Way Solenoid Control Valve, (2) Injector Pump, (3) Inline Strainer, (4) Chemical Shut-off and Drain Valve, (5) Chemical Tank, (6) Spray Water Tank, (7) Sprayer Pump, (8) Spray Water Control Manifold, (9) Chemical Return Line, (10) Chemical Injection Line, (11) Inline Strainer, (12) Boom Supply Line, (13) Spray Boom.

SUMMARY AND CONCLUSIONS

Rate of Work: Chemical injection provides no significant improvement in field work rates.

Quality of Work: The calibration of the injection system was accurate throughout the test providing it was properly maintained. The chemical injector had a wide range of application rates but the size of the chemical tank could limit the system at high application rates. Location of the S.S.C.I.M.S. was inconvenient to the operator and made it difficult to monitor its operation. The accuracy of the injector increases as the application rate increases.

Chemical mixing with sprayer water is effective and the weed kill obtained was comparable to that obtained with a standard tank mixed chemical application.

The S.S.C.I.M.S. operates effectively for spot spraylng providing 10 gal/ac (100 L/ha) spray nozzles were used. Smaller nozzles increased the response time.

Ease of Installation: The Computorspray S.S.C.I.M.S. could be installed on a field sprayer in about I hour. Installation on makes of sprayers other than Computorspray may require mounting hardware not supplied with the S.S.C.I.M.S.

Ease of Operation and Adjustment: The concept of injecting chemical has many advantages over a conventional spraying system. The injection system was easy to set. Monitoring of actual field application rates was difficult. The controls provided were subject to shorting out, were not labelled and gave no indication of whether

the system was working or not.

Chemical application rates that can be applied using the S.S.C.I.M.S. are adequate for all standard agricultural chemicals. Chemicals with very low recommended rates should be diluted with water so that higher injector rate settings can be used in order to improve metering accuracy.

Chemical and water volumes must be calculated so that manual checking of the actual applied rate can be confirmed. Mechanical problems limit the usefulness of the system for general field spraying. System failure will not be apparent to the operator and the result can be large field areas with incorrect or no chemical applied.

Filling the chemical tank required the use of a funnel while draining the tank required removing the supply lines.

Power Requirements: A 12 volt D.C. battery power supply is required to operate the S.S.C.I.M.S. controller. The injector pump is powered through a ground driven drive system. The S.S.C.I.M.S. produced good results when spot spraying a second chemical on specific target areas. A high level of operator awareness and understanding is required in order to produce consistent results.

Operator Safety: The S.S.C.I.M.S. has the potential to reduce operator exposure to chemicals. A few mechanical and system problems have to be overcome before this can be achieved.

Operator's Manual: The manual contained clear instructions on the installation of the S.S.C.I.M.S. but very brief information on the operation and maintenance.

Mechanical Problems: Mechanical problems limited the functional performance of the S.S.C.I.M.S.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Providing positive attachment between the drive wheel hub and the pump drive shaft.
2. Increasing the number of graduation markings on the chemical tank.
3. Modifying the system to produce faster spot spraying response times.
4. Enclosing the wiring on the control panel, providing labels to indicate switch operation and providing a positive means of monitoring injector operation from the operator's station.
5. Providing graduated labels that correspond to standard units of chemical application rates (i.e. litres/acre or litres/hectare).
6. Providing drain valves so that disassembly of the injector plumbing is not required in order to drain the chemical tank. Operator convenience and safety would be improved with this feature.
7. Increasing operating instructions and recommendations in the operators manual, and correcting deficiencies.

Station Manager: R. P. Atkins
Project Engineer: J. Russell

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Model's produced after 1986, have been fitted with two set screws in lieu of the original one. Models produced in the 1988 season and future will use a key-way style.
2. The 10 L markings are indicative. The shrinkage of the rotational molding process alone means, we can only be indicative of the volume to the markings.
3. Since we currently feed-in, as close to the last point as possible, in the prime supply line, we could only reduce response time by using muliple feed-ins. As this could heavily increase cost, it must be looked at in total. Current users appear to find the present system satisfactory and from all indications, they would not like to absorb the extra cost involved for response reduction.
4. We are currently looking into a enclosed control panel, but again cost to the enduser, enters into this situation. We have found, after speaking to farmers at many agricultural shows etc. that they usually will permanently mount the switches into the dash of the tractor or vehicle. In this case the panel is disgarded and is of no use, therefore the added cost could be eliminated. It would be our intent to make this panel available as a option only for those who request.
5. Because of the various width booms, this would be difficult. A litres/hectare chart is given for 18.3m booms and 12.2m booms on page 5 of the S.S.C.I.M.S. manual and is also shown again on page 55 of the owners manual.
6. The lower tank drain valve is provided, to facilitate the shut-off of the chemical tank for change of chemicals, in addition to cleaning the suction filter. It also allows the draining of all lines and pump re disassembly if required.
7. We will be redrafting the manual to take in all points as Pami test indicate. This will be a comprehensive update for future production units.

GENERAL DESCRIPTION

The Computorspray "Spot Spraying Chemical Injection Metering System" (S.S.C.I.M.S.) is an attachment that can be added to the basic Computorspray field sprayer. The S.S.C.I.M.S. unit could also be attached to other makes of field sprayers with only minor modifications to the mounting hardware. This report describes the operation of the S.S.C.I.M.S. mounted on a Computorspray field sprayer provided by the manufacturer. The S.S.C.I.M.S. is a system that holds agricultural chemicals in a tank separate from the spray water. It injects the chemicals as required and at a calibrated rate into the sprayer water boom supply lines. Chemical in the tank is not circulated in the sprayer water tank and mixing of the chemical occurs as it flows through a fine strainer and the boom supply piping. The system is mounted on the sprayer frame and uses a pneumatic drive wheel (powered by contact with a sprayer cart wheel) to power the injector pump. An electric solenoid controlled from a remote panel mounted by the operator switches the injector on and off. Major system components are illustrated in FIGURE 1, and detailed specifications are listed in APPENDIX I.

SCOPE OF TEST

The Computorspray S.S.C.I.M.S. was obtained from the manufacturer mounted on a Computorspray Model 647/2 ground driven sprayer, and was operated in the field conditions shown in TABLE 1 for 45.5 hours while spraying about 1834 acres (731 hectares). The S.S.C.I.M.S. was evaluated for ease of operation and adjustment, quality of work, safety and suitability of the operator's manual. Field testing was performed using No. 4 Spray Jets exclusively, providing a sprayer water rate of 10 gal/ac (nominal 100 L/ha). Laboratory tests included checking the calibration table in the operator's manual using water as the in-

jected fluid. Water was injected while the sprayer was operated over a range of simulated field speeds to determine if pressure in the boom lines affected the injector calibration. Chemicals were not used for the laboratory calibrations due to technical and safety considerations. Mixing effectiveness and delay times for spot spraying were evaluated using four spray jet sizes corresponding to four different spray water application rates.

TABLE 1. Operating Conditions.

CHEMICAL APPLIED	CROP	HOURS	GROUND SPEED mph (km/h)		FIELD ac	AREA (ha)
Decis	Spring Wheat	2	6	(10)	55	(22)
MCPA and Sodium TCA	Barley	5	6	(10)	218	(87)
Lontrel	Canola	1	6	(10)	46	(18)
Hoegrass II	Spring Wheat	6	6	(10)	260	(104)
Stampede	Summerfallow	3	6	(10)	135	(54)
Spot Spray Lontrel	Canola	12	6	(10)	480	(190)
Furadan	Barley	2	7	(11)	55	(22)
Target	Spring Wheat	2	7	(11)	55	(22)
2-4D	Summerfallow	2.5	6	(10)	55	(22)
Water Calibration	Crop and Summerfallow	10	6-12	(10-20)	475	(190)
TOTAL		45.5			1834	(731)

RESULTS AND DISCUSSION

RATE OF WORK

Chemical injection provides no significant improvement in field sprayer rate of work and reduces rate of work when manual monitoring of the application rate is required. Induction of chemical while filling the spray water tank for standard tank mix application is more convenient than filling a separate chemical tank.

QUALITY OF WORK

Range: The S.S.C.I.M.S. can apply chemicals over a range of rates from 0 to 67 oz/ac (0 to 4.7 L/ha). The range was sufficient to apply all of the chemicals used in the field testing at recommended rates. Chemical tank volume may limit capacity of the system for chemicals that are applied at relatively high rates (e.g. Hoegrass II at 3.5 L/ha).

Chemical Metering: The S.S.C.I.M.S. was supplied with a normally closed solenoid valve and two inline check valves to control the on/off operation of the injector. This arrangement could not operate effectively against the pressure in the boom lines and eventually was replaced with a three-way solenoid that operated successfully.

The injector pump is a positive displacement single piston unit and provides accurate and consistent metering of fluids that are in the normal range of viscosity for agricultural chemicals. The calibration table in ' the manual was checked using water in the laboratory before field testing and at the end of field testing. Results shown in FIGURE 2 indicate consistent operation over the test period with no indication of pump wear.

Field Operation: The S.S.C.I.M.S. is ground driven to provide the calibrated application rate regardless of variation in field speed. Problems that caused errors in the applied rate were generally due to mechanical problems with the S.S.C.I.M.S. Chemical application was erratic in the first field trials. Manual operation of the injector drive wheel produced positive results but, operation at field speeds and pressures caused the drive wheel hub to turn on the pump drive shaft resulting in a reduced and uneven application rate. The hub used a set screw to lock it to the shaft and the screw had turned on the shaft. PAMI cut a key way in the pump drive shaft and welded a keyed hub to the drive wheel hub to provide positive attachment. The modified drive functioned without problems for the remainder of the test. It is recommended that the manufacturer consider providing a positive attachment between the drive hub and the pump drive shaft.

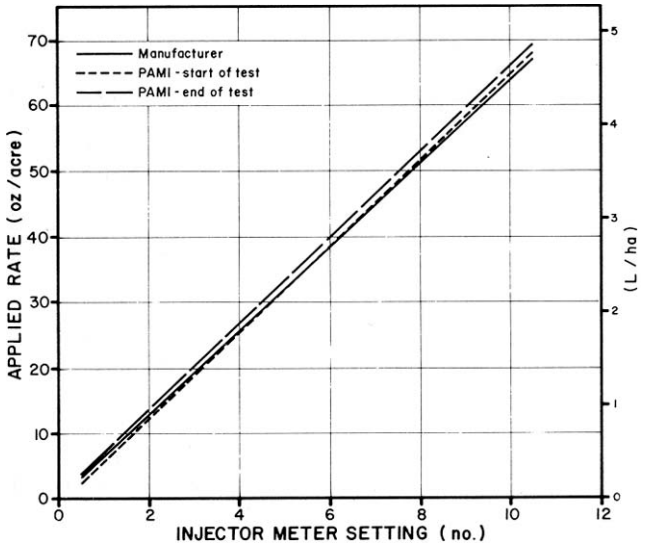

FIGURE 2. Application Rate Calibration Curve Comparisons.

Moist field conditions created a soil build up on the sprayer cart wheel and the injector drive wheel that effectively increased their circumferences. The change in circumference could result in significant variations in applied rates under some field conditions.

Applied rates below the set rate continued to plague the S.S.C.I.M.S. during field operation. Small pieces of plastic that originated in the chemical tank were found lodged in the valves of the injector pump. The valves could net seal effectively due to the plastic pieces and chemical injected was less than required. Careful cleaning of the chemical tank combined with the installation of an inline strainer in the pump suction line reduced the frequency of valve sealing problems. The injector pump valves are very sensitive to foreign material that can prevent complete sealing.

The mounting location of the S.S.C.I.M.S. made monitoring its operation difficult for the operator. Problems with the S.S.C.I.M.S. were usually only discovered by the operator during spray water tank refilling when the volume of chemical in the chemical tank could be checked. The chemical tank has graduated markings molded into the side at 10 litre intervals that can be used as a guide to determine application rate accuracy. More precise graduation markings would allow more accurate spot checking of the application rate in the field. A graduated cylinder was used by PAMI in the field to make accurate appliation rate measurements. It is recommended that the manufacturer consider increasing the number of graduation markings on the chemical tank.

The wide base of the chemical tank and the small sump requires a minimum level of chemical to provide a constant supply of fluid to the pump. Field operation splashes the chemical in the tank and could result in a dry sump when the level in the tank is allowed to get very low. Pesticide (with a low recommended application rate) applied with the S.S.C.I.M.S. was diluted with water in the chemical tank so that adequate volume could be maintained in the tank. Dilution also allowed for an increased application rate setting on the injector pump. Higher settings produced better application accuracy. Setting the injector pump rate can result in significant errors at the lower range of the pump. A setting error of 1/4 scale division results in a 25% error in applied rate at the lowest setting of 0.5 while the same setting error at the highest application rate results in only 1.2% error in applied rate.

The boom supply inline strainer provided effective mixing of the injected chemical with the spray water. Turbulent flow through boom supply lines and plumbing fittings enchanced the mixing action.

Spot Spraying: The primary purpose for the S.S.C.I.M.S. is spot spraying of specific field areas with one chemical while applying a general chemical to the entire field. Significant savings can be realized by reducing chemical used. Labour and machinery operating time can also be reduced by using spot spraying. A limiting factor that effects spot spraying effectiveness is the time required for the injected chemical to reach the sprayer nozzles after the operator has determined the need for application of the injected chemical. The response time determines the ability of the operator to actually apply chemical to the desired field area after visually identifying a weed or insect infestation (the target area). FIGURES 3, 4, 5 and 6 indicate the chemical application pattern that would appear as the sprayer travels down a field after the injector is switched on. The lower volume spray jets require operator recognition and action a long distance before the target area. Effective spot spraying would be very difficult when using the low volume spray jets No. 1, 2 and 3 under normal field conditions. Spot spraying could be effectively controlled when using the No. 4 jets.

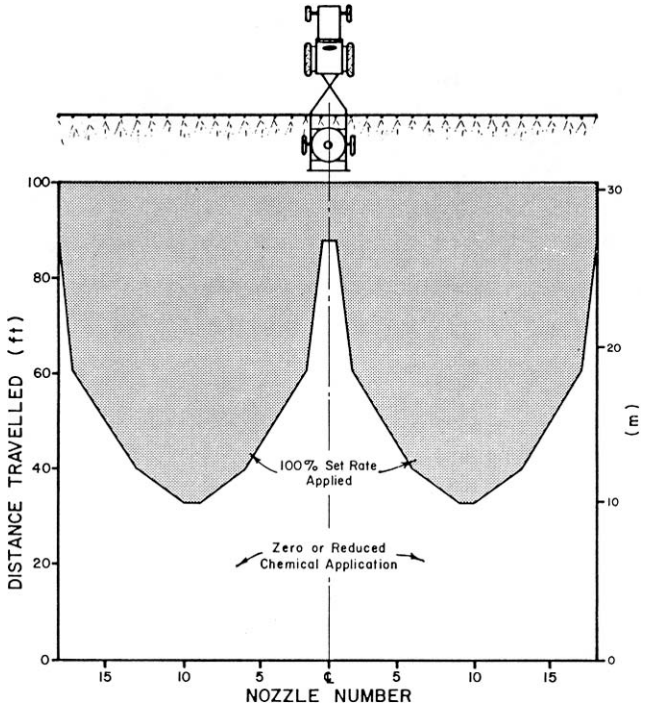

FIGURE 3. System Response Profile with 100 L/ha Spray Jets (Computorspray Jets #4).

The distance the sprayer travels before chemical is applied from each nozzle after switching on the injector equals the distance travelled while still applying chemical after the injector is switched off. The on/off cycle for the low volume spray jets is very long. It is recommended that the manufacturer consider modifying the system to produce faster spot spraying response times.

EASE OF INSTALLATION

Installation Time: The S.S.C.I.M.S. unit was obtained from the manufacturer already mounted on the sprayer, however; it was removed and replaced several times during the evaluation testing. One hour would be required to mount the complete S.S.C.I.M.S. unit to a Computorsprayer. Mounting the S.S.C.I.M.S. on different makes of field sprayers may require materials not provided with the unit. No instructions are provided that describe mounting to other makes of field sprayers.

Mounting: Initial installation requires welding two brackets and the injector pivot shaft to the sprayer cart frame. The brackets support the chemical tank adjacent to the injector pump. The injector pump and drive wheel are mounted on a pivot arm that allows the drive wheel to contact one of the sprayer cart wheels. A coil spring maintains tension on the pivot assembly so that the drive wheel and the sprayer cart wheel are held in contact with enough force to drive the injector pump.

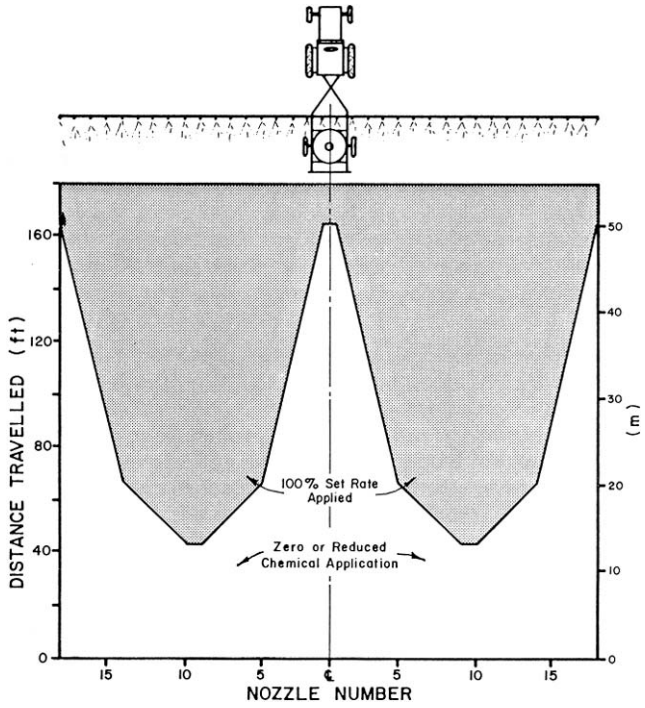

FIGURE 4. System Response Profile with 50 L/ha Spray Jets (Computorspray Jets #3).

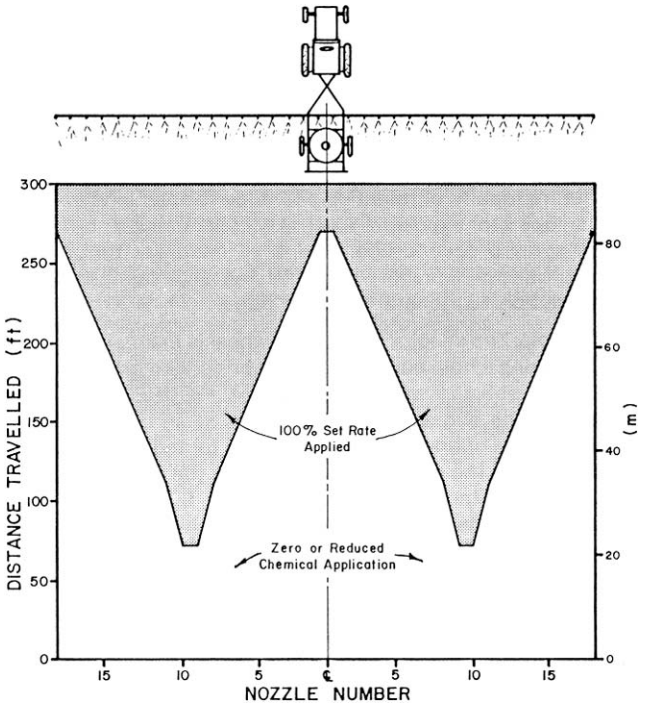

FIGURE 5. System Response Profile with 30 L/ha Spray Jets (Computorspray Jets #2).

Plumbing: The high pressure nylon chemical injection tubing is routed from the injector pump three-way solenoid control valve to a tee in the boom supply line at the sprayer control manifold. A supply tube complete with inline strainer is attached from the chemical tank outlet to the injection pump inlet fitting, a nylon return tube is also installed from the three-way solenoid valve to the top of the tank.

Electrical System: The injector pump three-way solenoid control valve is powered by a paired wire providing twelve volts

through a lighted switch panel that is mounted at the operator's station.

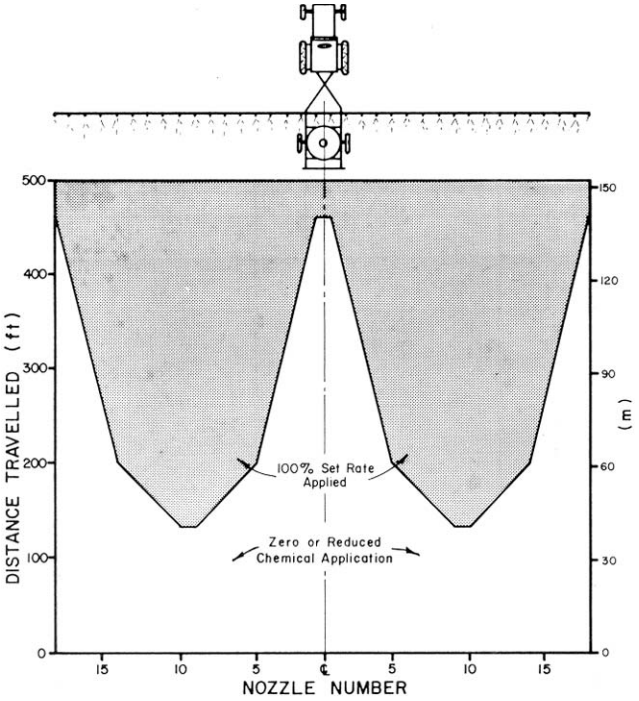

FIGURE 6. System Response Profile with 15 L/ha Spray Jets (Computorspray Jets #1).

EASE OF OPERATION AND ADJUSTMENT

Advantages of S.S.C.I.M.S.: The concept of injecting chemical directly into the sprayer boom supply lines has significant advantages. Calculation of water volume and chemical required is simplified. The chemical is metered according to the rate that is set on the injector pump and chemical that is unused can be returned to its original container when spraying is completed. Water in the sprayer tank can be kept free from chemical contamination and can then be used to flush the boom lines before repairs or maintenance is performed in the field, reducing operator exposure. The S.S.C.I.M.S. can also be used to spot spray a second chemical or to increase the rate of chemical while the sprayer operates using a conventional tank mixed solution for general field coverage.

Controls: The injector pump drive wheel is manually engaged by releasing a hold back chain, the spring then engages the drive wheel with the sprayer cart wheel, FIGURE 7. Flow of chemical to the boom lines is controlled by an on/off switch mounted by the operator. With the switch turned off chemical is pumped from the chemical tank through the solenoid valve and back to the tank through a return line. Switched on, the solenoid directs the chemical flow through the injector line to the tee in the spray boom supply line. The sprayer used for testing also had an electric boom spray control that was wired so that when the sprayer water to the booms was switched off the chemical flow to the booms was also switched off. The control panel consisted of two, two-way rocker switches and one three-way toggle switch mounted on a metal plate that left all of the wiring open and exposed to the elements (FIGURE 8). The open wiring on the control panel represents a fire hazard. No labels were provided with the control panel. PAMI attached self-adhesive labels to the panel to indicate switch operation. One rocker switch controlled the injector valve, the second controlled the sprayer boom water supply, and the toggle switch controlled a foam marker system. The rocker switches were lighted when in the on position, however; the lights only indicate that the switch has power and an open circuit in the wiring to the injector would not be indicated. If power to the injector solenoid is interrupted during spraying the operator would not be aware of the problem, and chemical injection would stop.

FIGURE 7. Injector Pump with Drive Engaged.

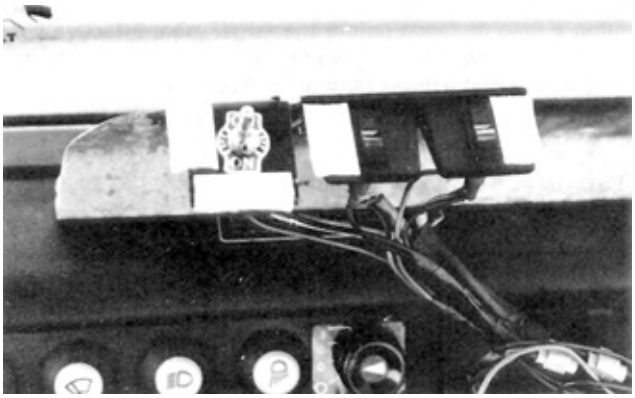

FIGURE 8. Injector and Sprayer Control Panel (Note: Labels Added by PAMI).

Chemical flow cannot be monitored by the operator durlng application. The S.S.C.I.M.S. is mounted on the rear frame of the Computorspray field sprayer and is completely hidden by the sprayer water tank, FIGURE 9. It is recommended that the manufacturer consider enclosing the wiring on the control panel, providing labels to indicate switch operation and providing a positive means of monitoring injector operation from the operator's station.

Setting the Chemical Flow Rate: An eccentric cam that controls the stroke of the single piston injector pump determines the chemical application rate. A label with graduated division markings from 0 to 10.5, FIGURE 10, is attached to one half of the cam and it is alligned with an incised mark on the opposite half to set the application rate. Numbers on the label correspond to millilitres of liquid pumped for each revolution of the drive shaft and they are related to a litre per hectare application rate by a table in the operator's manual. The application rate is easily adjusted by loosening a single bolt that holds the two halves of the eccentric cam together. Turning one half of the cam until the desired graduation aligns with the incised mark sets the rate and the bolt is tightened. Numbers on the cam label do not correspond to standard rates of appliation and it is necessary to interpolate between the graduated markings to achieve recommended rates for most of the chemicals used in the field tests. It is recommended that the manufacturer consider providing graduated labels that correspond to standard units of chemical application rates.

Chemical Tank Filling and Draining: The chemical tank opening is 50 in (1270 mm) above ground level when mounted on the Computorspray frame and has a 1.875 in (50 mm) opening. A Funnel is recommended for safe and convenient filling of the tank. The original tank supplied had a concave neck around the filter cap that collected dust and debri during field operation; a new model of tank with a raised neck solved this problem. The tank is drained by removing the supply line at the pump inlet and opening the ball valve at the tank outlet, care

must be taken to close the ball valve before disconnecting the supply line to prevent spillage. The chemical left in the injector line can be removed manually by disconnecting the injector line at the boom line tee and placing the end in a collecting container. Turning the pump drive wheel by hand with water in the chemical tank will force the chemical out of the injector line. Very little dilution of the chemical will occur if an assistant warches for when the chemical exiting the line becomes clear water. The same procedure reversed should be used to prepare the injector for spot spraying so that chemical will immediately enter the spray boom lines when the injector is switched on, otherwise a delay will occur as chemical fills the injector line. Flushing the system results in a mixture of chemical and water that must be disposed of in a safe manner.

FIGURE 9. Operator's View of S.S.C.I.M.S. Completely Obscured by Sprayer Water Tank. Arrow Indicates Location of Injector Pump.

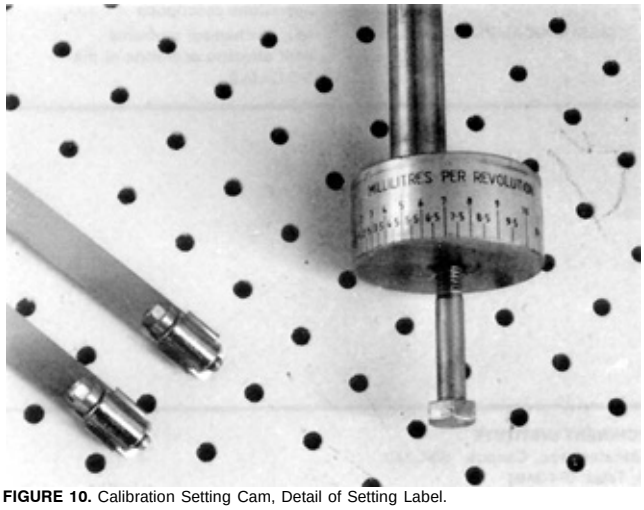

FIGURE 10. Calibration Setting Cam, Detail of Setting Label.

POWER REQUIREMENTS

The tractor 12 volt DC power supply was adequate to operate the solenoid control valves. The ground driven injector pump does not increase the power input required to any significant extent.

OPERATOR SAFETY

The S.S.C.I.M.S. can reduce operator exposure to chemicals when the sprayer water tank is used to hold only clear water. Chemical injected with the S.S.C.I.M.S. can be swtiched off and the sprayer booms can be flushed with water from the sprayer water tank before maintenance of sprayer jets or boom plumbIng is performed. Exposure to concentrated chemical increases when using the S.S.C.I.M.s. Filling, priming, calibration and draining of the system requires handling of chemical concentrate and the danger of spillage is increased. Problems with leaking fittings and other mechanical repairs caused exposure to chemical concentrate.

Operation of the sprayer as a standard tank mix field sprayer with injection of a second chemical results in no safety benefit from the S.S.C.I.M.S. system. It is recommended that the manufacturer consider providing drain valves so that disassembly of the injector plumbing is not required in order to drain the chemical tank.

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 clearly describes installation of the S.S.C.I.M.S. to Computorspray models of field sprayers. Description of S.S.C.I.M.S. operation is very brief. The distance values listed in the manual while injected chemical passes through the spraying system refer to chemical reaching the first nozzle on the boom and are not realistic values that could be applied to field operation (see FIGURES 3, 4, 5 and 6 for actual spot sprayIng delay distances). Cleaning and flushing the S.S.C.I.M.S. system should be a daily maintenance procedure and not performed only when changing chemicals and at the end of the spraying season as recommended in the manual. Chemicals should not be stored in the S.S.C.I.M.S. chemical tank when the sprayer is not is use. The manual incorrectly states that the S.S.C.I.M.S. metering system is not affected by sprayer cart ground wheel rolling radius. Sprayer cart tire size, type and inflation are all factors that will effect the chemical application rate. It is recommended that the manufacturer consider increasIng operating instructions and recommmendations in the operator's manual and correcting deficiencies.

MECHANICAL PROBLEM

TABLE 2 lists the mechanical problems that were encountered during testing of the S.S.C.I.M.S. The intent of the test was evaluation of functional performance and an extented durability evaluation was not conducted.

TABLE 2. Mechanical History

ITEM	OPERATING HOURS	EQUIVALENT FIELD ac	AREA (ha)
- injection line connection failure at Control valve system changed.	start of test		
- drive wheel slipping on pump shaft at Keyed shaft manufactured.	7	218	(87)
- hold back chain hook failed at Heavier hook installed.	7	218	(87)
- leaking plumbing fittings; injector suction hose fittings functioned poorly	throughout the test		
- injector pump valves not sealing completely. Disassembly and cleaning required at each occurance. Inline strainer installed in suction hose towards end of test.	throughout the test		

APPENDIX I

SPECIFICATIONS

MAKE:	Computorspray S.S.C.I.MS.
MODEL:	Not designated
MANUFACTURER:	Australian Canadian Agricultural Machinery Corp. 1305 - 15 Ave. Coaldale, Alberta T0K 0L0
TANK CAPACITY:	Single 60 litre chemical tank with 10 litre graduation markings
METERING SYSTEM:	
- pump	single piston type with ball valves
- rate controller	eccentric cam
- flow controller	on/off electric solenoid
- flow indicator	none
INJECTION SYSTEM:	
- location	tee at manifold outlet to sprayer boom lines
- mixing	inline strainer in boom lines and general boom line plumbing
POWER REQUIREMENTS:	12 volt DC (tractor or truck battery) Access to ground driven wheel required.

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)
horsepower (hp) x 0.75	=	kilowatts (kW)
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	=	millimeters (mm)
inches water gauge (in·wg) x249.1	=	pascals (Pa)
miles/hour (mph) x 1.61	=	kilometres/hour (km/h)
pounds force per square in (psi) x 6.89	=	kilopascals (kPa)
pounds mass (lb) x 0.45	=	kilograms (kg)

SUMMARY CHART
COMPUTORSPRAY S.S.C.I.M.S.

RETAIL PRICE:	$1,358.00 (October, 1987 f.o.b. Lethbridge)
RATE OF WORK:	- no significant advantage
QUALITY OF WORK:	- adequate range of chemical rate provided - chemical flow metering rate was good when mechanical problems did not occur - careful checking of application rate is required during operation and is inconvenient - chemical is effectively mixed with spray water - time lag excessive for spot spraying with low volume spray jets - time lag good for spray jets at 10 gal/ac (100 L/ha) spray water rate
INSTALLLATION:	- simple; time required - 1 hour
OPERATION AND ADJUSTMENT:	- good; simple to set application rate - measuring of water and chemicals required to confirm application rate accuracy - controls and monitoring ability unsatisfactory - tank filling and draining unsatisfactory - changing field speed automatically compensated for
POWER REQUIREMENTS:	- 12 volt DC supply and access to a ground driven sprayer cart wheel
OPERATOR SAFETY:	- fair; direct contact with concentrated chemical is increased with present system
OPERATOR'S MANUAL:	- fair; system installation description good; inadequate operations description
MECHANICAL PROBLEMS:	- fair; mechanical problems limit effective operation of the S.S.C.I.M.S.

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