SPRAYER MARKERS

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Introduction

Sprayer markers are presently used as an aid to help apply chemicals more accurately. The use of expensive sprayer monitoring control systems is futile if over-lapping occurs or strips are left unsprayed. Excellent judgment is required to properly overlap with todays marking systems. Although the marker systems are not ideal, they are better than using no marking system.

Types

Four types of sprayer markers are commonly available: (1) One that leaves a dye mark on the crop or ground, (2) one that leaves a foamy soap on top of the crop or ground, (3) one that leaves a strip of paper on the ground and (4) one that disturbs the soil. Two dye markers, one paper marker and seven foam markers have been evaluated by AFMRC.

Operation

The marks left allow successive passes of the sprayer to be properly aligned. Marks are left at the outer edge of the previous round, so on the next round an operator can eliminate most sprayer misses or overlaps by aligning the outer end of the spray boom with the marks. This still requires considerable operator skill and judgment, since with most sprayers the outer end of the booms are over 10m from the tractor and the sprayer cannot be aligned by sighting down the row of marks. The operator has 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 is properly aligned. This is effective as long as the marks are readily visible.

Performance

Dye Markers

AFMRC tested two silver paint markers in the early 80s; the Adja silver marker and the Marshall automatic spot marker. Dye markers consist of a supply tank that stores the marking solution, solenoid valves that control the flow of the marking solution on the crop, hoses that supply the marking solution to the boom ends, a control console that allows the operator to remotely (manually or automatically) control the size of the mark and interval between marks and a pump (air or fluid) that force the marking solution from the supply tank to the boom ends.

The marking solution added to the supply tank consisted of one container of aluminum concentrate mixed with 23 L of diesel fuel. The aluminum concentrate was very difficult to mix. The mixture should be thoroughly mixed before it is added to the supply tank to prevent plugging. Agitators in the supply tank help mix the solution after standing for a period of time.

The control consoles tested had a sufficient range of mark length and space adjustment. Mark length and spacing could be varied so that a 23 L supply tank had sufficient fluid to mark from 10 to 320 ac. In normal conditions, however, the supply tank had to be filled every 20 to 40 ha when using an 18 m sprayer. Operating cost for the marking solution varied from 5 to 10 cents/ac.

Sprayer markers using air pressure tanks were inconvenient to use because: (1) There usually was no room to install a portable pressure tank on the sprayer, (2) the pressure tank had to be filled frequently, and (3) it was unsafe.

Mark visibility depended on crop height, mark length and spacing, sunlight conditions and operator sight and experience. For best visibility, marks had to be spaced every 30 m. Mark visibility was best when spraying young green crops. Marks were much less visible on standing stubble fields.

Best visibility means that a mark is spaced and sized such that the operator does not have to search for the next mark, while at the same time using the minimum amount of markings. Large sized marks spaced closely together were very visible. However, this required frequent filling, thus increasing costs and reducing work rate. More experienced operators could reduce the amount of marking fluid used by placing a mark where necessary and then following the crop rows.

Depending on field, light conditions and height of tractor seat, marks could be seen up to 500 m. Marks were more visible on cloudy days or when spraying away from the sun. Marks were harder to see when facing into the sun. Thoroughly mixing the aluminum concentrate with the diesel fuel was important for bright, highly visible marks. The marking fluid remained visible for several days. The marking fluid quickly soaked into loose, porous soils and rain quickly washed the marking fluid off plant leaves.

Foam Markers

Two types of foam marking systems exist:

(1) Standard foam markers that require the foam concentrate and water to be mixed. These foam systems usually are optional equipment on high speed sprayers like the Terra-gator, Computorspray and Spraymaster. Smaller units are available for other sprayers.

(2) Pre-mixed foam markers that come with pressurized refillable or disposable foam containers.

Both foam systems operated on the same principle, however field performance was significantly different.

Standard Foam Markers

Four standard foam markers were tested. Three of the four standard foam markers tested came as optional equipment on the sprayer. These included the Terra-gator, Computorspray and Spraymaster foam markers. The fourth was the Marshall foam marker that had to be installed on a sprayer. All systems used air to agitate the foam solution, pressurize the foam tank and regulate the foam to the boom ends.

The Terra-gator and Spraymaster sprayer foam markers had large (115 and 200 L) foam tanks. The foam discharged in spurts or continuously, practically forming a straight line down the field. The frequency of foam was varied by changing the foam tank pressure. With continuous marking, the size of mark had very little bearing on visibility since the foam mark produced could always be seen at the 1 to 2 m spacing intervals.

The Marshall foam marker had a smaller 20 L foam tank and foam delivery was controlled by an orifice. This limited the operators control over mark spacing. Mark spacing averaged about 15 m for both the Marshall and Computorspray foam markers. Since the foam marks were small, 100 to 250 mm, foam mark visibility was affected by the crop height, field surface conditions and mark spacing. Mark visibility was adequate in young cereal crop conditions but inadequate in chemfallow conditions.

The foam marks were difficult to see in crops over 25 cm tall. Adding water softener to the tank solution produced lighter, foamier marks which were more easily seen on tall crops.

The amount of foam needed depended on desired mark spacing which varied with weather and field conditions. More foam was usually used in the morning than in the afternoon. Cooler water temperatures in the morning resulted in lower quality foam (watery). More area was marked when water softener, which improved foam quality, was added to the foam tank. Operating costs for the foam marking solution averaged about 4 to 10 cents/ac.

The marks remained visible for about an hour in cool and cloudy days and for less than 30 minutes in hot, dry and breezy conditions. Therefore, marking was only adequate when making successive passes. The foam marks were not visible following a brief stop or after reloading.

Pre-mixed Foam Markers

The Peacock and Adja Model FM85-FG tested were pre-mixed foam markers. Basic components included a pressurized foam tank, foam discharge tubes with solenoid valves and control console, to regulate mark spacing and length. All components were quickly and easily installed on field sprayers. The 22 L Peacock marker foam tank was refillable. The 15 L Adja marker foam tank was disposable.

Mark visibility was good when mark spacing and length were adjusted to suit forward speed and field conditions. Both mark spacing and length were adjustable by adjusting the timer for the solenoid valves.

Marks were easily visible on young cereal crops at a mark spacing of 40 to 60 m and a mark length of 1 to 1.5 m, respectively. For accurate sprayer alignment in chemfallow conditions mark spacing was set at less than 30 m and mark length at 2 to 4 m. This was difficult to maintain when the amount spent on foam started adding up. The Adja pre-mixed foam container marked about 500 ac at a cost of 25 cents/at in young cereal crops. The Peacock pre-mixed foam container marked about 800 ac in young cereal crops at a cost of 9 cents/ac. In chemfallow conditions the Peacock foam marker marked only 300 ac at a cost of 25 cents/ac.

Pre-mixed foam marks lasted up 2 hours in normal spraying weather conditions. In hot breezy conditions, the foam marks lasted less than an hour. In cool mornings or cloudy conditions, the foam marks lasted up to 6 hours. Marks remained till next morning when used late the night before.

Paper Markers

The Marshall paper field marker was tested in 1986. A 12 VDC electric motor delivered a strip of paper, at a precise length and spacing, from a paper cassette through a pair of rubber rollers.

The motor, rubber rollers and paper cutting knife were housed in a cradle that mounted on the end of sprayer booms.

For best visibility the paper marks had to be spaced 30 m and had to be about 1 m long. A roll of paper on a 18 m sprayer lasted about 75 ac. Paper marking cost about 7 cents/ac. The paper remained visible for several days and decomposed within one season. The paper marks landed at various lateral distances from the spray swath edge because air turbulence behind the sprayer and light winds caused the paper to drift. Even in calm conditions the paper would sometimes float a metre from the sprayer before landing. In 8 km/h winds the paper drifted about 2 m from the desired mark target. In breezy weather conditions the operator constantly had to watch and determine the distance the paper was landing from the desired mark target to compensate on the successive pass. Watching the paper landing made it difficult to properly align the sprayer boom end with

the coming marks.

Static electricity caused the paper to stick to the windguard tube, eventually plugging the tube. One constantly had to watch the paper feeding through the windguard tube to avoid plugging. Spraying water on the paper rollers and windguard tubes, as recommended by the manufacturer, temporarily stopped the paper sticking. In Southern Alberta, the hot and dry conditions usually encountered during spraying caused the windguard tubes to plug several times per hour. The manufacturer installed a copper anti-static tinsel below the cutting knife which supposedly eliminated or neutralized static electricity.

Disc Markers

AFMRC has not tested any disc markers, but recommend them when using shrouded sprayers in windy conditions. The dye, foam and paper marks drifted to much in windy conditions.

Conclusions

Sprayer markers are a useful aid in reducing overlap or misses with field sprayers and applicators. Operators can use the marks produced on a previous round to judge where they should drive for proper alignment. Some operators claim that reducing overlap and misses can decrease chemical costs more effectively than minimizing over and under application rates by using sprayer monitors.

The foam marks were more visible than the dye and paper marks under most field conditions. When Using dye and paper markers the operator had to search for the next mark unless marks were frequent and conditions were ideal. The large foam marker systems could place marks more frequently on the crop with very little increase in cost or frequency of refilling. The foam marks were always visible during spraying, but disappeared following a brief stop or after reloading. Visibility was best when mark spacing and length were about 30 and 1 m, respectively, for the markers with precision control. Soap and water were convenient and less messy to handle than aluminum dye and diesel fuel.

The pre-mix foam markers were the most convenient to install and use and produced the longest lasting foam. However, the cost per area marked was the highest of all the marker systems tested. The Marshall paper marker required constant maintenance.

As mentioned, great judgment is required to properly align the sprayer end over the marks, let alone get the proper spray overlap. In the future, proper overlaps will probably depend on electronic and computer guidance systems.