FURTHER DEVELOPMENTS IN AGRICULTURAL SPRAY NOZZLES

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SUMMARY

THIS paper is written to draw attention to the fact that manufacturers of spray equipment are playing their part in experimenting with nozzle development and are making available products which will make for easier and more efficient application of agricultural chemicals.

It is my intention in this paper to bring before you developments which are a forward step in the application of agricultural chemicals. There is no doubt that applicators are becoming more and more conscious of the fact that better results can be obtained with the use of the more specialised spraying equipment that has been developed over the past few years. Manufacturers have been paying particular attention to all aspects of spray machinery and in this paper my remarks will be confined mainly to new methods of application and control of wind drift.

The introduction of a series of spray nozzle tips known as Agricultural Flooding nozzles will, I feel sure, prove suitable for many New Zealand applications. The wide angle spray permits close to ground mounting of the spray nozzle and this low spraying level, plus the low line pressures that can be used, practically eliminates driftage. The unusually wide spray angle gives extremely wide ground coverage per nozzle, reducing the number of nozzles needed per boom. The tip is designed in the conventional tip style at present being used in New Zealand, which means that a change of output can easily be made from the range of sizes available. Uses of this nozzle include the spraying of pre-emergence chemicals, anti-bloat materials, and liquid fertilisers.

A further new development is the double outlet fan type spray tip. This tip is designed with two orifices to give both a forward and backward projection from a spray boom. Over the years, it has been considered that the cone type nozzle, particularly the full or solid cone type, has been more suitable to use than fan types tip for hard-to-wet weeds, owing to the fact that both forward projection and rear projection were given. However, the overall coverage on a boom is not even with the cone tip. The double fan nozzle is designed in such a way that forward and rear projection is given, while at the same time the overall coverage is evenly distributed along the entire length of the boom.

There is reason to believe that the spraying of thistles, rushes, etc., can be more efficiently carried out with this nozzle.

SPRAY DRIFT

The reduction of pressure with an aim to reducing atomisation has had very good results in field trials. Pressures are in the 10 to 15 p.s.i. range, through nozzles of wide angle allowing lower boom heights. Nozzles can also be inclined backward from the boom in order to enable the boom to be further lowered.

The use of a deflector shield at each nozzle has proved an advantage in driving remaining drift down on to the crop. This can affect selectivity of materials, but generally the damage is so slight as to be negligible.

With this method, it has been found that the spraying of pea crops has been efficiently carried out on days formerly regarded as unsuitable for spraying, owing to the strength of the wind.

Experimental work has been carried out in U.S.A. (1) with the spraying of convolvulus (*Convolvulus arvensis*) in vineyards with 2,4-D. Considerable experimental work was carried out to obtain a nozzle capable of being operated at exceedingly low pressures to give minimum atomisation. It

should be recognised that minimum atomisation may reduce control of the pest by poorer distribution, coverage, or penetration. However, where driftage is of paramount importance a percentage control is possible in places where previously spraying was considered impossible. The selected nozzles were of the flooding type with a flow rate output of 1.7 U.S. gallons per minute at 40 lb p.s.i., but operated at 0.88 lb p.s.i., giving an output of .22 U.S. gallons per minute. Nozzle spacing was at 8 in., while boom height was also 8 in. to give even coverage The exceedingly low pressure of .88 lb p.s.i. was obtained by entering the liquid, controlled by a conventional relief valve, into the boom at 60 lb p.s.i., then through a restricting orifice before the liquid entered the nozzle. A semi-circular boom shield with a neoprene curtain along the lower edge was fitted over the entire boom. This lifted overhanging grape canes and forced tall weeds over for better spray coverage. The results obtained were very promising and damage symptoms were few and minor.

The above details are given to illustrate what can be done to obtain driftage control. In normal field work, where coverage is of most importance, a good control of wind driftage can be obtained by the use of wide angle fan tips at pressures ranging from 10 to 14 p.s.i. and spraying at boom heights of approximately 18 in. The low pressure flat spray patterns are less subject to driftage since they contain less fine particles and have higher spray velocities. Overlapping flat spray patterns produce uniform distribution across the entire boom width.

It has been widely advertised in overseas journals that good results from low pressure spraying can be obtained with hollow cone nozzles. The following points are given as to why the flat spray is superior for this application:

1. The flat spray would generally produce larger particles than its equivalent hollow cone spray at any particular pressure. The hollow cone produces more fines around the periphery of the spray, the flat spray will have approximately a 10 per cent higher medium average number particle size than the equivalent hollow cone spray.
2. The flat spray has a higher spray velocity than the comparable hollow cone nozzle; this means a better chance for the spray to carry directly to the ground. The issuing spray velocity of the flat spray is approximately double that of the hollow cone nozzle.
3. The flat spray pattern lends itself to boom application better than the hollow cone, from the standpoint of overlap and distribution. The distribution from the flat spray pattern tapers off toward the edges to allow for overlap. The distribution from the hollow cone spray will increase as you approach the overlap section. The flat spray can also be rotated such that there is no interference or butting of adjacent sprays on a boom.
4. The hollow cone flow rate is sensitive to the fluid characteristics such as viscosity of the liquid being sprayed. Increase in viscosity of a liquid will increase the flow rate of a hollow cone nozzle; viscosity will have little or no effect on the flow rate of a flat spray nozzle.

NOZZLE MATERIALS

Brass for the manufacture of nozzles continues to prove an efficient material for the majority of agricultural needs, while stainless steel and tungsten carbide are able to cope with the abrasive compounds. Nylon has been given wide overseas advertising, but the only real advantage that has been noticed in this country is its use in the manufacture of aerial spray nozzles, the saving in weight being a big advantage to aerial operators using large numbers of brass units.

BROADCAST SPRAYING

Considerable attention has been given to this type of application over the last few seasons and these have proved very satisfactory for specific application. The spraying is carried out from a single or cluster of nozzles

to deliver a spray pattern from 38 to 66 ft wide, deepening on pressure and capacity.

The nozzle assembly produces a uniform, flat spray pattern. Atomisation is as fine as possible in relation to the distance the spray must travel to complete the pattern. Normal operation height is 36 in. but angle mounting at 45 degrees reduces the height of spray and decreases the effect of wind driftage. The reduced height results in a slight decrease in coverage, which in turn results in a slight increase in volume over ground area sprayed.

The set up is designed for spraying of grains, grasses, etc., where wheel damage proves a problem, and also for spraying in areas containing trees or stones which prevent the operation of boom sprayers.

It must be recognised that this method is very susceptible to wind driftage, but in some cases, by using the appliance to one side only and spraying down wind, the wind can be used to advantage.

A further type of broadcast spraying that has simplified the spraying of fencelines has been the fitting of the off-centre spray tip to the ends of spray booms.

Acknowledgments

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Reference

1. Wesley E. Yates. Down to Earth. 16 (2) 15-19.