The development and use of solid stream nozzles for aerial application of molinate for barnyard grass control in rice crops in New South Wales

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Molinate (S-ethyl N,N-hexamethylenethiocarbamate) has been widely used since 1966 for control of barnyard grass (Echinochloa spp.) in rice crops in New South Wales. This weed was initially confined to crops which were established on prepared seedbeds, for which ground application of molinate to dry bays immediately before permanent water was usually satisfactory.

However, changes in aerial sowing methods saw an increase in barnyard grass infestations in these crops for which molinate in permanent water is particularly needed. Also in wet years ground application to dry bays is not always possible.

Molinate uptake in barnyard grass seedlings occurs through the stems at the soil-water interface. Hence a method of application to allow herbicide penetration of the vegetative canopy above the water was devised in 1971.

The main considerations for a suitable technique included the following:

- Droplets which would readily penetrate a vegetative canopy.
- Low droplet density acceptable as dispersion would occur through the water.
- Ability to apply accurately to small bays under high wind conditions.
- Reduction in total volume compared to aerial application of molinate to dry bays where 100 L/ha is required.

Solid stream nozzles consisting of concave stainless steel discs with 15 holes of 450 mm diameter were compared with D8 - 45 hollow cone nozzles. Results are shown below:

Nozzle type	Mean flying height (m)	Droplet density (no/cm2)	nmd* (μ)	vmd+ (μ)	% Reaching target
D8 - 45	2.3	9.8	138	324	71.8
	3.3	9.4	126	421	82.6
Solid stream	2.3	3.7	141	613	92.0
	3.3	2.3	161	637	95.2
					LSD (5%) 11.3

*number mean diameter
+volume mean diameter

This work was carried out by P.A. Taylor of CSIRO; we have obtained similar results in respect of droplet density and size for solid-stream nozzles. It will be seen that these nozzles produce large droplets with minimum losses.

Smaller output solid-stream nozzles, which gave a total volume of approximately 40 L/ha, were unsuitable owing to blockages, so the larger ones described above were used. These put out 80 L/ha, but subsequently it was possible to reduce this to 40 L/ha by halving the number of nozzles. It was necessary to limit the boom length to avoid wing tip vortices and to align the boom at 180?; i.e., facing fully backwards into the airstream. This ensured that the droplets produced would be coarse, with a minimum of small ones. By trial and error it was found that a flying height of 5 m gave the best uniformity, particularly under high wind conditions. The development work was done with Piper Pawnee aircraft.