A TECHNIQUE FOR COMPARING THE SUSCEPTIBILITY OF TWO WEED POPULATIONS TO A HERBICIDE

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Differences in susceptibility to MCPA have been observed between nodding thistle (*Carduus nutans* L.) populations at different Hawkes Bay sites (Harrington and Popay 1987). To investigate this, a technique was required to quantify the differences in susceptibility between two populations.

This can be done by producing dose-response curves for each population and comparing the horizontal distance between the curves (Fryer and Makepeace 1977). Each population is treated with several different doses of a herbicide. The log dose plotted against percentage kill of individuals gives a sigmoid curve relationship. Probit regression analysis can be used to produce the best fitting curves for the data and to test whether they differ significantly from each other (Finney 1978).

To produce dose-response curves from populations growing in the field, it was decided to mark individual plants then spray each one with a specific dose of herbicide. This was done in preference to treating several plots with each dose rate and determining the fate of plants in each plot. Less area is required for the former method which can be important when trying to compare populations from two microenvironments where plant density is not high.

A sprayer was designed to apply herbicide accurately to individual plants. It comprised a tin box 40 cm by 40 cm with a height of 60 cm. One side had a sliding clear perspex panel so the interior of the box could be seen. The box had no base so it could be placed over a thistle plant in the field. Herbicide could then be sprayed on to the plant from a solid cone nozzle on the ceiling of the box. The totally enclosed spraying environment ensured all the herbicide reached the plant and was not blown away. It minimized spray drift to other nearby plants which may have been sprayed at another rate.

In initial experiments, the nozzle was pressurised using air from an empty hand-pumped sprayer, but a carbon dioxide cylinder is now used. A pressure regulator ensured an even pressure of 200 kPa was applied. For each plant sprayed, 5 cm³ of herbicide solution was injected into a chamber immediately above the nozzle. Pressure was applied to the chamber and a valve between the chamber and the nozzle opened to allow the herbicide to be propelled through the nozzle to the plant. Dose rates were varied by changing the concentration of the herbicide solution.

A drench-gun fitted with a nozzle (Porter 1979) could also be used for this technique. However the box sprayer is more likely to produce spray droplets similar to those produced by conventional spraying equipment. This could be important if leaf waxes and cuticles differ between populations.

To obtain a dose-response curve for a population in the field, plants apparently similar in age were selected and marked. Because pegs can be knocked over by livestock, large plastic ear-tags fixed to the ground with 150 mm galvanised nails were used for marking thistles in our experiments. Different dose rates were randomly allocated to marked plants.

Results from two trials in which this technique was used are presented (Fig. 1). In one trial, nodding thistle plants on a farm at Colyton (Manawatu) were compared with those on a Maraekakaho (Hawkes Bay) farm. MCPA (potassium salt) (IWD MCPA) was applied at seven dose rates at each site in November 1985. Ten plants per rate were treated at Colyton and 30 plants per rate were used at Maraekakaho. Plants were assessed 8 weeks later as being alive or dead.

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Fig. 1: Dose response curves for nodding thistle populations treated with MCPA (a) in the field at Maraekakaho and Colyton, and (b) in the glasshouse for populations originally from Matapiro and Argyll. Bars show 95% confidence limits for the LD50. Dots or crosses distinguish between the observations for each pair of populations. Points are not shown in (a) for the 100% mortality of both populations at 32 and 64 mg/plant.

The curves presented in Fig. 1(a) were fitted to the data using probit regression analysis. The Colyton population appeared to be 2.1 times more tolerant of MCPA than the Maraekakaho population. Differences in the LD50 (lethal dose for 50% of the population) were significant.

In another trial, seed was collected from two nodding thistle populations, at Argyll and Matapiro (both in Hawkes Bay), which had been shown to differ markedly in their tolerance of MCPA and 2,4-D (Harrington and Popay 1987). Plants were grown from this seed in pots in the same glasshouse. At 6 weeks old, they were treated in December 1986 with four rates of MCPA using the box sprayer. Ten plants per rate were treated for each population and their fate was assessed 14 weeks later.

Fig. 1(b) shows the Argyll population was 4.8 times more tolerant of MCPA than

the Matapiro population. Because the populations were grown and treated in the same environment, the populations must differ genetically in their ability to tolerate MCPA.

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