WEED CONTROL PRACTICES AND RESEARCH APPROACHES IN TOMATOES IN THE DRY TROPICS OF QUEENSLAND

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Summary. Current weed control programmes and commerical weed control techniques employed in tomatoes in the Bowen district of Queensland's dry tropics are discussed. Widespread use of trickle irrigation has increased weed pressure, necessitating increased use of herbicides. Benefin, napropamide and metribuzin, combined with strategic cultivations, have given satisfactory results although persistent weeds remain a problem. Excellent weed control has been achieved using plastic mulch and increased yields have resulted. Potential exists in the future for breeding commerical tomato cultivars highly tolerant of metribuzin in order to control persistent weeds such as blackberry nightshade with high rates of this chemical.

INTRODUCTION

The dry tropics area of Queensland comprises the region between Bowen and Townsville and is an important area for winter and spring production of vegetables. Tomatoes are by far the most important vegetable crop, with some 35,000 tonnes produced annually for the Brisbane, Sydney and Melbourne markets. Tomato production is centred on the Bowen district and generates around $25-30m annually for the region. Total value of horticultural production for the dry tropics region is estimated at around $85m annually.

Tomatoes are characteristically grown as a ground crop, transplanted into beds 1.5-1.8 m apart, at plant populations ranging from 5,500-11,000 plants/ha. Irrigation had been by the furrow method until recently, when a move to trickle irrigation has occurred in response to diminishing water resources in the Bowen area. Field plantings of tomatoes are carried out over the period from March to August, followed by harvesting from June to November.

The region enjoys a warm, mild climate with a relatively dry harvest peiod. A consequence of the warm climate and total reliance on irrigation is the prolific growth of weeds. Major weed species encountered in tomato fields are giant pigweed, *Trianthema portulacastrum*, blackberry nightshade, *Solanum nigrum*, fat-hen, *Chenopodium album*, nutgrass, *Cyperus rotundus*, green amaranth, *Amaranthus viridis*, summer grass, *Digitaria ciliaris*, green summer grass, *Brachiaria miliiformis*, and awnless barnyard grass, *Echinochloa colona*.

WEED CONTROL PRACTICES

Herbicide usage in tomato production has been sporadic over the years. The only herbicides registered for use in the area are fluazifop and sethoxydim for grass control, pebulate and metribuzin, the latter being for the inter-row area only. Various unregistered herbicides used at times include trifluralin, benefin, napropamide and metribuzin within the plant row. Efficient methods of cultivation have also been devised to suit the growing system and are widely used.

A renewed interest in the use of herbicides for tomatoes in the region has been prompted by the widespread adoption of trickle irrigation.

The placement of water in the centre of the plant row with this form of irrigation ensures a continuously moist environment for the germination of

weeds. Mechanical weed control at later stages of crop growth is made more difficult by the distribution of weeds within the crop row. Under flood irrigation, weed growth tends to be heavier along the side of the bed and in the inter-row area and is more successfully controlled by mechanical means.

RESEARCH APPROACHES

The current weed control research programme at Bowen has concentrated on:

1. evaluating as yet unregistered herbicides for use in tomatoes, and
2. examining other weed control strategies, particularly for the control of persistent weeds.

The narrow weed control spectrum of pebulate which is useful only for nut-grass control, and the restricted use of metribuzin, requires that broader spectrum weed control measures be available. The post-emergence grass herbicides have given satisfactory results when applied at the correct stage. Of the candidate herbicides previously mentioned, trifluralin has been found too phytotoxic and herbicide evaluations have concentrated on benefin, napropamide and metribuzin. Napropamide is often used in tomatoes (1, 9, 12) and is registered for tomatoes in other parts of Australia. Tolerance of tomatoes to metribuzin has been found to be influenced by weather conditions at the time of treatment (10), age of plant (11), the C:N ratios of the treated plants (5), and differences in cultivar tolerance (8, 13). Benefin is not reported as a herbicide for use in tomatoes.

1. Herbicide evaluations.

Several experiments have been conducted at Bowen to examine the efficacy and phytotoxic effects of napropamide, benefin and metribuzin. Napropamide and benefin have been applied pre-plant, mechanically incorporated, while metribuzin has been applied post-planting. These experiments have included both hand-weeded and weedy plots for each of the herbicide and control treatments. In none of these experiments have yields been significantly affected by the herbicide treatments. Growth of the major weed species present, gaint pigweed, has been well controlled by benefin, napropamide and metribuzin. Removal of this weed has resulted in higher populations of blackberry nightshade in herbicide treated plots compared to untreated plots. This work has indicated the necessity for strategic cultivations to be employed in addition to herbicide treatments.

2. Other strategies.

Herbicide/cultivation combinations. The cultural techniques involved with the use of trickle irrigation necessitate at least a single hilling-up cultivation (sometimes two) to be carried out early in the life of the crop. This practice ensures a greater depth of soil covering the irrigation tube resulting in less water reaching the soil surface in the plant row. Avoidance of moist surface soil in the plant row reduces yield losses due to fruit rots. This system is complementary to the use of napropamide and benefin in assisting removal of persistent weeds appearing within the first two weeks after transplanting. Metribuzin can also be utilised in this system where application can be made over the crop following these early cultivations. Crop tolerance to metribuzin is known to improve as plants age (2) and I have observed this in the field.

Use of mulches. A second strategy is the use of plastic mulches for weed control and this technique has produced excellent results. In two field

experiments at Bowen, plastic mulch treatments significantly out-yielded all herbicide treatments and produced yields 51 and 62% higher than the hand-weeded control treatments.

The use of plastic mulch, apart from providing excellent weed control, has the additional benefit of increasing yield due to other agronomic factors such as increasing soil temperature and maintaining even moisture conditions within the plant bed. The plastic mulch treatments in these experiments involved the removal of weeds at the base of the plant on one occassion. In a recent experiment, the addition of a narrow band of metribuzin sprayed along the centre of the bed prior to plastic mulch being laid removed the necessity to hand-weed at the base of the plant.

Control of persistent weeds. The removal of blackberry nightshade and related species from within tomato crops has received considerable attention in recent years. Several researchers have evaluated the use of repeated applications of increasing dosages of acifluorfen for control of blackberry nightshade in tomato crops (3, 4, 6). Variable results are reported, with phytotoxicity to tomatoes being a common factor. Initial attempts at using this technique at Bowen resulted in severe phytotoxicity to tomatoes, with satisfactory control where severe blackberry nightshade problems occur, but further development would appear to be necessary.

A second herbicide with potential for removing blackberry nightshade from tomato crops is metribuzin. The mechanism here involves the differential response of tomato cultivars to metribuzin applications. Several researchers have reported large differences in cultivar susceptibility to metribuzin (8, 10, 13). A suggestion that potential existed for improving metribuzin tolerance in tomatoes through breeding (8) has been followed by the same author, with the release of metribuzin-tolerant tomato germplasm (7). This latter study indicates excellent tolerance to metribuzin applications up to 16 times recommended rates of 1.12 kg a.i./ha.

The opportunity to remove blackberry nightshade from tomatoes using higher rates of metribuzin therefore exists and attempts to incorporate this into the fresh-market tomato breeding programme at Bowen will be made in the near future.

FUTURE WEED CONTROL STRATEGIES

Recommended strategies for weed control in tomatoes in the Bowen district are likely to include the use of the herbicides napropamide, benefin or metribuzin, in conjunction with strategic cultivation. A further option using plastic mulch in conjunction with metribuzin may be an economic alternative. Prospects for future tomato cultivars with improved tolerance to metribuzin appear possible and would assist in allowing the use of higher rates of metribuzin to control difficult to control weeds such as blackberry nightshade.

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