EARLY SEASON INSECT DAMAGE IN DOUBLE SKIP COTTON CROPS

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Abstract

We tested the suggestion that early season damage may limit the crops subsequent exploitation of moisture in the skip row, which may in turn limit the crops ability to recover. Over two seasons the recovery response of dryland double skip cotton was investigated, where artificial damage was used to simulate damage caused by thrips or *Helicoverpa*. Treatments included defoliation and/or tip damage. None of the treatments significantly affected yield, however there was a consistent trend towards lower yield in heavier damage treatments. Moisture extraction from the plant row and skip did not appear to be correlated with plant damage, although seasonal weather conditions may have affected this result. Earliness was not specifically assessed but heavy damage treatments appeared slightly delayed. These experiments suggest that factors other than early season damage may be affecting the plants ability to extract moisture from the skip row. Further work in this area needs to be conducted to assess the impact of damage on skip row cotton and factors affecting extraction.

Introduction

The effect of early season defoliation and tipping out in irrigated crops has been well documented, and although these results may have some relevance to double skip dryland crops, trial work in this area has been somewhat limited. Amongst growers and consultants there are several theories about the likely impact. One theory is that early plant damage restricts the plant at a crucial development stage, which then limits root growth and the capacity of the crop to extract moisture later in the season, and subsequently delay crop maturity. Following discussions with James Clark, a dryland cotton grower at Croppa Creek, and Michael Castor, Michael Castor and Associates, a trial was established at Croppa Creek during the 1998/99 cotton season to investigate in-field responses of cotton to simulated early season pest damage and subsequent impacts on moisture extraction.

Materials and Methods

The plot size for the trial was four metres of row, which centred on 2 plant rows and the area in skip. It was acknowledged that the control plants may receive some damage from insects during the season under normal growing conditions. The trial used Gaucho treated seed which reduced the likelihood of thrips damage to the trial, and it received the same spray regime as the remainder of the field. This ensured that the major differences between treatments were due to the damage inflicted and not other pests.

1998/99 season

The damage treatments were applied to each plant in the plot, and included 80% defoliation at 3 true leaves, 80% defoliation at 3 and 6 true leaves, and 80% defoliation plus tipping out at 3, 6 and 8 true leaves, and an undamaged control. Approximately 80% of each fully expanded leaf was removed using scissors, to simulate the damage caused by thrips and *Helicoverpa*, whilst simulating tip damage caused by these insects entailed removal of the main growing terminal using tweezers. A Neutron probe was used to monitor soil moisture extraction in 4 positions within each plot during the season, with access tubes positioned between the plant rows, near the plant rows, half way into the skip and the centre of the skip.

1999/2000 season

The trial design was modified for the 1999/2000 season to reflect more realistic insect damage, and plants were damaged at the 3 true leaf stage with 80% defoliation, 80% defoliation and light tip damage, and 80% defoliation and heavy tip damage. Light tip damage entailed removal of the main growing terminal using tweezers, whilst heavy tip damage involved removing the main growing terminal and 1 true leaf to simulate mirids and tipworm. Soil moisture extraction was monitored between the plant rows and the centre of the skip.

Results

1998/99

Probe readings showed no significant differences between treatments, although until mid January extraction by the severely damaged plants was less than the control. This may reflect a smaller rooting structure under the severely damaged plants, and the corresponding smaller above-ground biomass available to drive roots deeper. Favourable weather conditions during the season, meant there may have been little need to extract moisture from depth or the skip. Figure 1 shows a typical moisture profile comparison between the control and severe damage treatments, in this case on the 20th of November 1998.

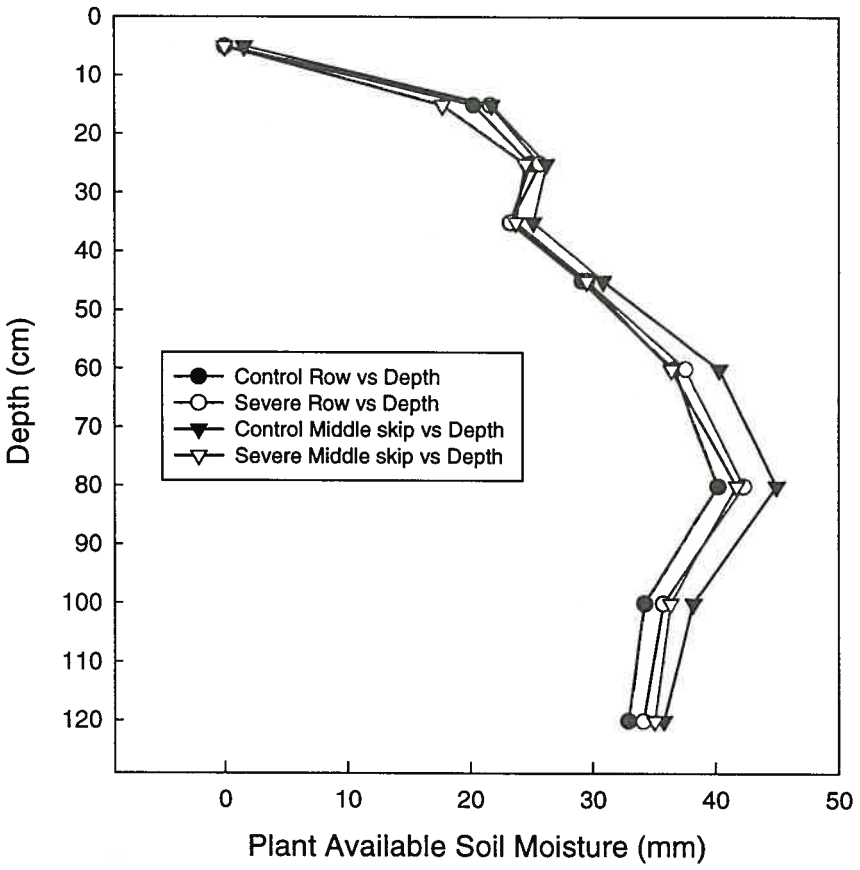

Figure 1. Plant available soil moisture on 20 November 1998

Yield results are presented in Figure 2 and show a substantial yield penalty under the severe damage treatment (80% defoliation and tipping out at 3,6 and 8 leaves). The heavy damage did cause delayed maturity, with a significant number of unopened green bolls at harvest. However, the light damage treatments probably represent more realistically the degree of early season damage caused by thrips and *Helicoverpa*, and these were not significantly different from the controls. There was a trend to lower yield in the heavy defoliation treatment (80% of leaves removed at 3 and 6 true leaves). Gin turnouts and fibre quality were unaffected by any of the damage treatments.

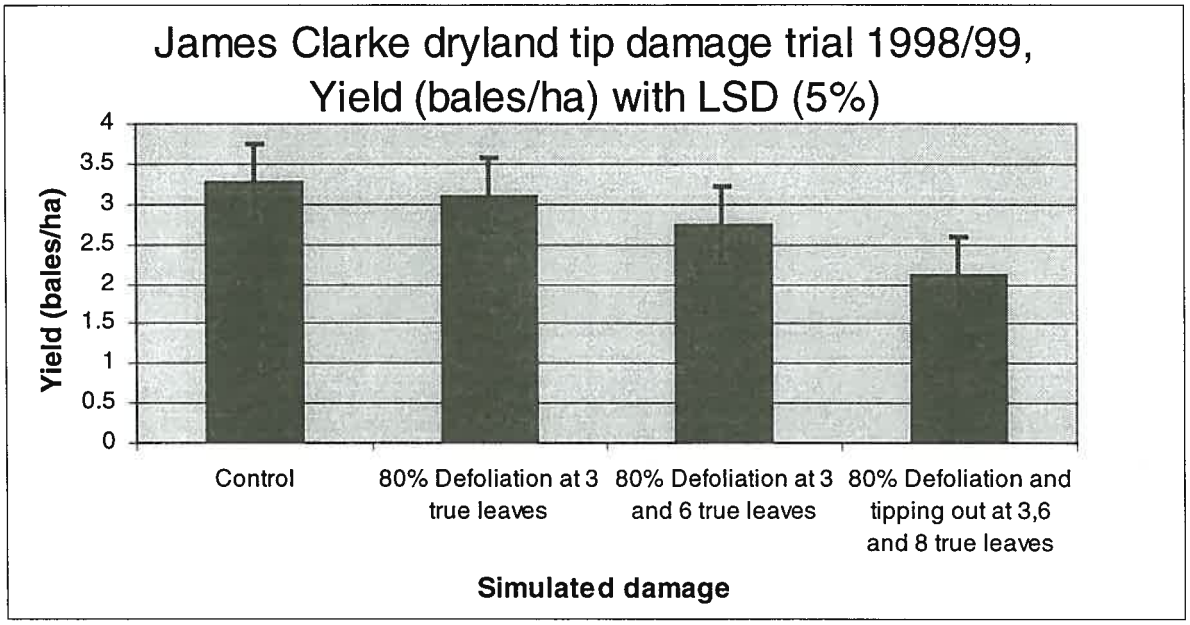

Figure 2. Yield comparisons in 1998/1999 trial (note: handpick yields).

1999/2000

Plants appeared to recover well from the damage treatments, and an assessment in early January showed a decrease in plant height with increasing damage intensity, but no significant differences in node number or fruiting structures. Measurements of soil moisture in the plant row and the centre of the skip periodically during the season showed no significant differences between treatments, and by defoliation all treatments had similar moisture profiles.

Maturity picks confirmed that the 80% defoliation and heavy tip damage had lower numbers of bolls per metre with a final yield of 4.25 bales/ha, 83% of the control treatment (Figure 3). Amongst the damage treatments however there were no significant differences.

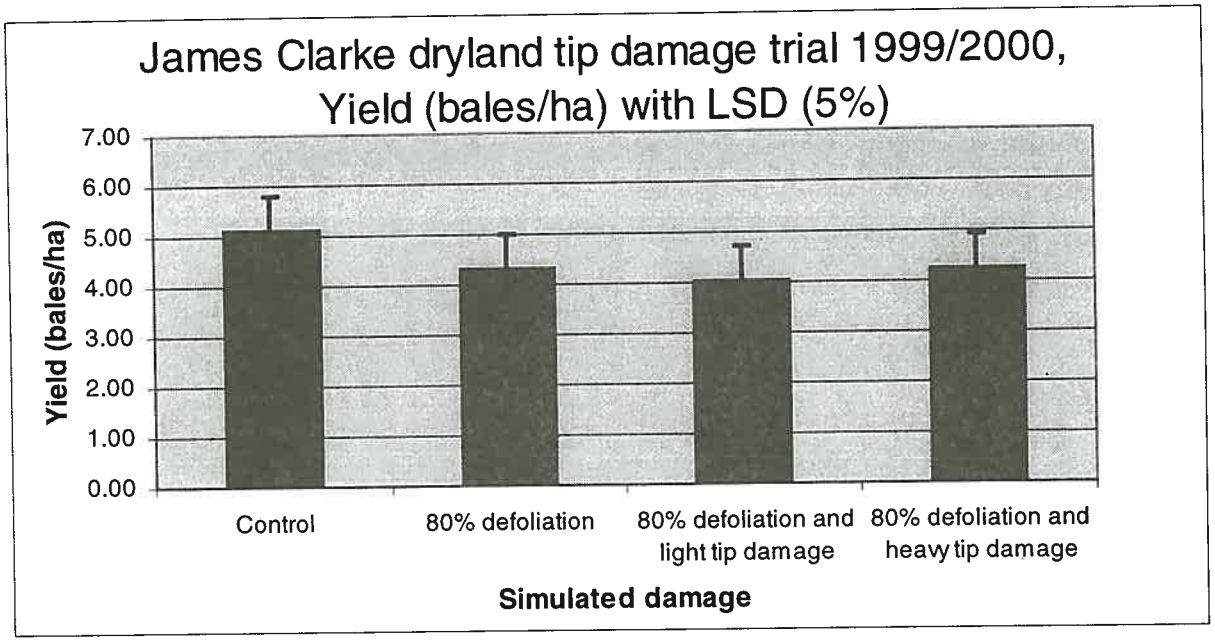

Figure 3. 1999/2000 yield results (note: handpick yields).

Comparisons of boll number during maturity picks revealed no statistically significant differences, however the control treatment had consistently higher numbers of mature bolls, and from this some degree of earliness could be expected. An assessment of gin turnout and boll weight again revealed no significant differences between treatments.

Conclusion

Soil moisture extraction under dryland conditions is highly variable and exploitation of the skip row can be affected by many factors. Investigation of the impact of plant damage on this extraction capacity suggests that damage by thrips and *Helicoverpa* during early season plant growth may not limit the plant ability to exploit soil moisture at depth and in skip. Rather, that weather conditions experienced during crop growth will have a greater impact on the range of soil moisture extraction. There is some scope to use seasonal forecasts to allow planting to a solid configuration during seasons which have been forecast to receive above average rainfall, during which the crop will not be limited by soil moisture.

The cool conditions in both years may have reduced the rate of compensation before the season came to a finish, but do show that double skip cotton could tolerate increasing levels of

early season damage without subsequent yield loss. The deciding factor is cost of control vs risk of not achieving a profitable yield, and will be unique to each growers situation.

The factors affecting soil moisture extraction under dryland double skip crops need to be investigated over a wider range of seasons to refine our knowledge of this process and assess possible management strategies to achieve maximum resource utilisation.

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