SHORT NON-REFEREED PAPER

THE EFFECT OF SOIL WATER DEFICIT ON PRIMARY SHOOT EMERGENCE OF TWO SUGARCANE VARIETIES GROWN ON BARE AND MULCHED SOIL

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Introduction

Sugarcane in South Africa frequently experiences drought that may affect ratooning negatively. It has been shown that sugarcane varieties differ in their response to drought and to soil mulch cover, especially with regard to ratoon crop establishment (Smit, 2010; Olivier and Singels, 2015). Knowledge of how ratooning is affected by severe drought in the preceding crop can help growers plan plough-out and replanting. The objective of the study was to determine the effect of severe soil water deficit in the preceding crop on shoot emergence in the subsequent ratoon crop for bare soil and mulch covered soil, for two contrasting varieties.

Materials and Methods

This experiment was conducted at the South African Sugarcane Research Institute (SASRI) rainshelter at Mount Edgecombe (29°42’40”S; 31°02’35”E). Varieties NCo376 and N19 were planted in October 2017, subjected to two different water regimes (wet and dry) and harvested green on 27 June 2018, at an age of nine months. The wet water regime experienced no water stress throughout the plant crop’s life, while the dry regime had two periods during which water stress was allowed to develop in the plant crop (21 February to 22 March; 12 April to 27 June). In the subsequent first ratoon crop each of these four blocks were split into two plots. On one of these the soil was left bare, while the other was covered with a 14 cm layer of dead sugarcane leaves and tops, immediately after harvest. Each plot had six rows that were 2.5 m in length, with 1.25 m spacing between cane rows. The experiment plan is shown in Figure 1.

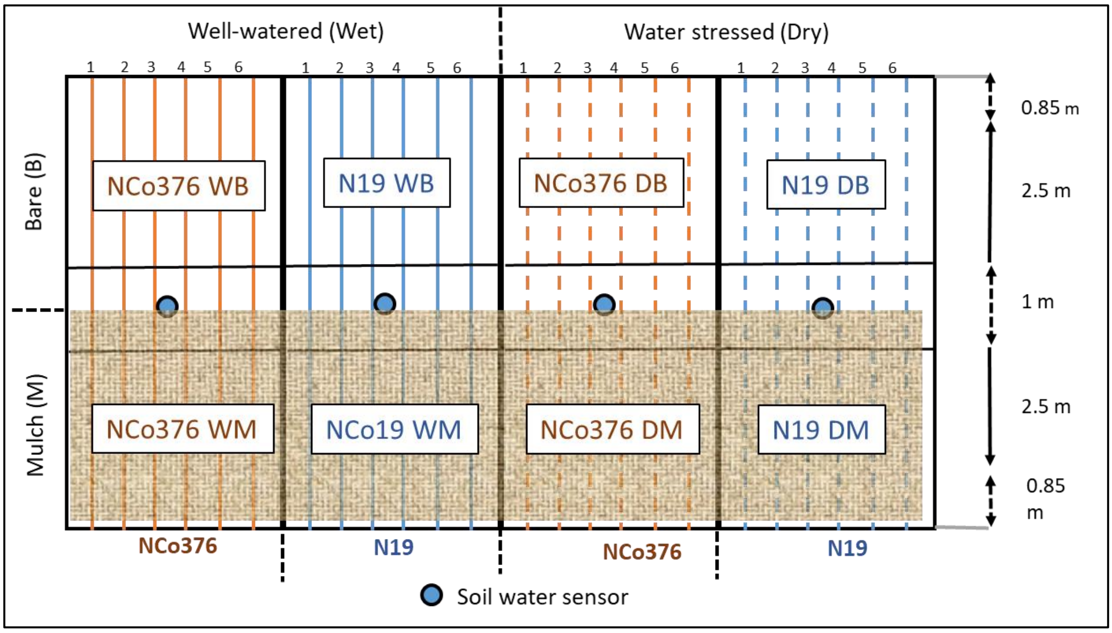

Figure 1. Experiment plan showing cultivar, water and soil cover treatments and the positioning of soil water sensors.

The ratoon crop received no water for 51 days after harvest (DAH), after which all the plots were irrigated to field capacity. Soil water content was monitored with four 80 cm capacitance probes (Figure 1). Shoot population (SP) were measured twice a week in the same four 2.5 m sections in different rows within each plot. Thermal time (TT10) was calculated as the accumulation over time from DAH=1 of daily average temperature minus a base temperature of 10°C.

Results and Discussion

Root zone average volumetric soil water content was at permeant wilting point (5%) for the dry plots throughout the dry period. For the wet plots it varied from close to field capacity (14%) on DAH=1 to about 11% at DAH=51 (data not shown).

Shoot population (SP) results are shown in Figure 1. At DAH=30 and TT10=216°Cd (TT10 requirement for primary shoot emergence used in the Canegro model, (Singels *et al*., 2008), the bare wet plots for NCo376 and N19 had SPs of 14 and 4 shoots/m^2 respectively, while the bare dry plots had only 1 and 0 shoot/m^2 respectively. Information from Jones *et al*. (2019) and Singels *et al*. (2005) indicate that primary SP below 10 shoots/m^2 can be considered sub-optimal for establishing a viable and productive crop.

The first observation after the end of the dry period (DAH=54 at TT=391°Cd) showed that bare dry plots had significantly lower SP than bare wet plots, while NCo376 produced significantly more shoots than N19 (4 and 19 shoots/m^2 for NCo376; 0 and 12 shoots/m^2 for N19). The mulch layer reduced SP in dry and wet plots for both varieties (0 and 11 shoot/m^2 for NCo376; 0 and 2 shoots/m^2 for N19, respectively). After receiving water, the bare dry plots all produced additional shoots reaching SP of 39 and 17 shoots/m^2 for NCo376 and N19, respectively, at DAH=93 (TT=740°Cd). The mulched dry plots also produced additional shoots but much fewer than the bare dry plots (SP of 17 and 10 shoots/m^2 for NCo376 and N19 respectively). The mulch layer resulted in a reduction in SP for the wet plots of 50 and 65% for NCo376 and N19 respectively, and 67 and 42% for the dry plots. The reduction in SP due to the mulch layer for wet plots was 50 and 65% for NCo376 and N19, respectively, while the corresponding reduction for dry plots was 67 and 42%, respectively.

These results indicate that the two varieties responded differently to soil water status and soil mulch cover. NCo376 produced more shoots than N19 and was more tolerant of low soil water status. Mulch cover affected shoot emergence of NCo376 less than that of N19 for favourable soil water conditions. Variety choice is therefore a key consideration for drought survival, and plough-out and replanting decisions need to take this into account.

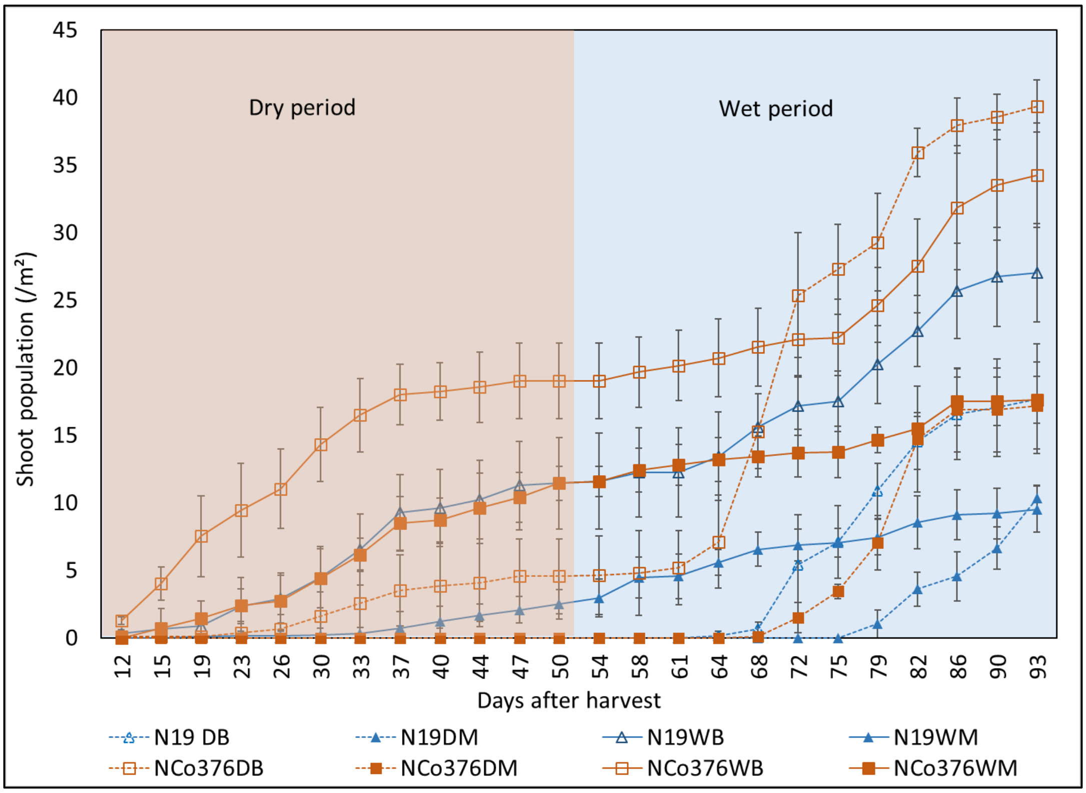

Figure 2. Shoot population over time for the different treatments. Error bars indicate standard error of the treatment mean. (See Figure 1 for explanation of treatment codes).

Conclusion

The study showed that severe soil water deficit leading up to harvest hampers ratooning of sensitive varieties, while robust varieties can fully recover when water is applied even after a lengthy dry period. Mulch layers tend to reduce primary shoot emergence under wet and dry conditions. The impact on yield was not tested. Variety choice is therefore a key consideration to survive during times of drought, and plough-out and replanting decisions need to take this into account.

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