Growth responses of selected bottle gourd landraces to water stress under controlled environment conditions

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Introduction

Bottle gourd (*Lagenaria siceraria* (Molina) Standl.) is a popular food crop in rural South Africa, where it is grown mostly for its leaves and fruit. Bottle gourd leaves possess huge untapped potential for food and feed industries (Chimonyo and Modi, 2013). However, not much information is available on its production, especially in the South African context where it is grown using landraces and, largely by rural subsistence farmers located in marginal areas. The objective of the study was to determine growth responses of bottle gourd landrace selections to water stress.

Fig 1 Bottle gourd seedling

Fig 2. Bottle gourd seedlings at two weeks after transplanting

Fig 3. Bottle gourd plants at 8 weeks after transplanting

Materials and methods

Four bottle gourd landrace selections (Zim 1, E4, Cal, Round) were grown under two water regimes (30% and 100% crop water requirement (ETc)) in a semi-controlled growth tunnel (~33/18°C day/night; 60 - 80% RH) at the University of KwaZulu-Natal, South Africa. The experiment was laid out as a randomized complete block design with three replications. Plant height, leaf number, branch number, chlorophyll content index, stomatal conductance and male and female flowers were monitored bi-weekly until harvest.

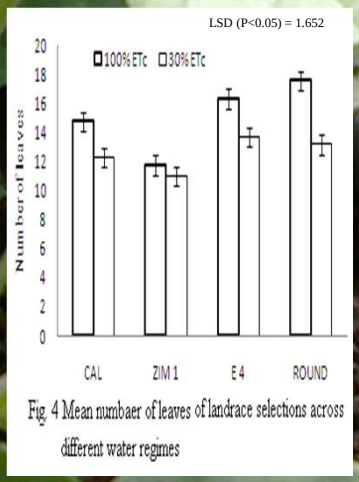

Fig. 4 Mean numbaer of leaves of landrace selections across different water regimes

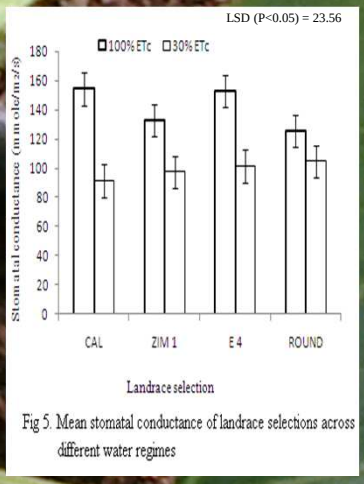

Fig 5. Mean stomatal conductance of landrace selections across different water regimes

Results and discussion

Water stress had a negative and significant effect ($P \leq 0.05$) on vine length, branch number, stomatal conductance and stem and total fresh mass and a highly significant effect ($P \leq 0.001$) on leaf number and area (Fig 4 - 8). According to Voothuluru and Sharp (2013), the reduction in leaf number is said to be associated with delay in leaf appearance and enhanced leaf senescence. Reduction in leaf area is said to be linked with reduction in cell size due to a reduction in cell turgidity. Water stress caused a significant ($P<0.001$) reduction in plant vine length of 8.2% (see Fig 5) and lateral branch number by 25% (data not shown). This is because water stress has a greater effect on lateral branch production than vine length (Reynolds and Naylor,1994).

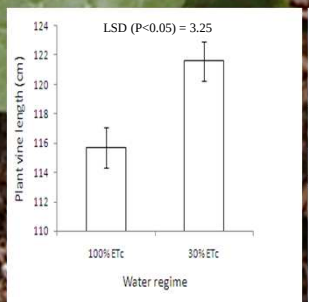

Fig 6. Vine length of bottle gourd in response to different water regimes

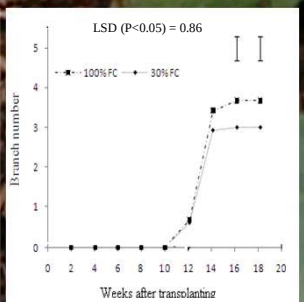

Fig 7. Branch number of bottle gourd plants in response to different water regimes

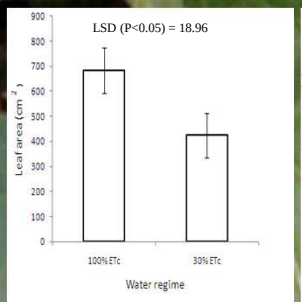

Fig 8. Leaf area of bottle gourd in response to different water regimes

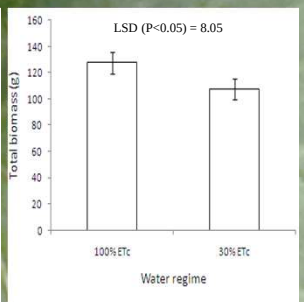

Fig 9. Total biomass of bottle gourd in response to different water regimes

Conclusion

Water stress affected growth and physiology of all bottle gourd landrace selections. This could have a negative effect on the plant's potential as a leafy vegetable when grown under water stress. Stomatal conductance was a better physiological indicator for water stress than chlorophyll content index. E4 was prolific when grown under well-watered conditions suggesting that it was more suitable for leaf harvesting. Zim 1 had physiological and morphological traits that suggests that it had better drought tolerance.

References

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