

The GxExM interaction and effect on nitrogen uptake in Australian cotton.

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Abstract

The interaction of genetics, environment and management and the effect on nitrogen uptake (kg N/ha) was investigated using Bollgard® 3 variety - Sicot 746 B3F. Cotton plants were sampled from first flower to maturity and divided into thirds based on total nodes, each third was then partitioned into stem, leaf and seed. Two cotton growing regions in Australia (northern and southern New South Wales) were sampled during the 2017/18 cotton season. Both regions achieved 15.6 bales/ha, however, the plants nitrogen uptake pattern differed from first flower to maturity. Understanding why nitrogen uptake patterns differed may assist in how we can further exploit the GxExM interaction to improve efficiencies and yield.

Keywords: GxExM, uptake, cotton

1. Introduction

The interactions of genetic, environment and management in cotton is one opportunity to be exploited to improve nitrogen use efficiency and yield in cotton systems in Australia. Recently a study by Liu et al 2013 showed that improvements in yield were attributed to the interaction of both improved genetics and management combined (76%) over a 15-year period. These achievements have resulted from serendipitous implementation of research outcomes. Through better understanding of the reasons for these interactions there maybe opportunities to enhance yield and fibre quality. This study highlights efforts to understand opportunities associated with cotton nutrition (especially N).

2. Materials and Methods

Two regions were selected, northern NSW (Gwydir Valley) and Southern NSW (Riverina). The same cultivar was selected, a new release Bollgard® 3 variety (Sicot 746 B3F).

Plant biomass was sampled from four replicates, divided evenly into thirds (bottom, middle and top: based on total nodes), each third partitioned into stem, leaf and seed. Samples were taken every two weeks starting from first flower (4 samples). The samples were then dehydrated, ground and

analysed for Total N. The biomass was recorded and used to calculate whole plant and partitioned (stem, leaf and seed) nitrogen uptake (kg N/ha). The results are presented using a relative relationship (R_o) to assist with the ease of comparing between the regions where:

$$R_o = \frac{\text{N Uptake (kg N/ha Riverina)}}{\text{N Uptake (kg N/ha Gwydir)}} - 1$$

3. Results

3.1 Whole Plant Uptake

The environmental and management impact on whole plant N uptake (kg N/ha) is shown in Fig. 1. Cotton in the Riverina region assimilated more N at first flower when compared to the Gwydir valley. The opposite was then evident as the crop reached maturity (Fig. 1).

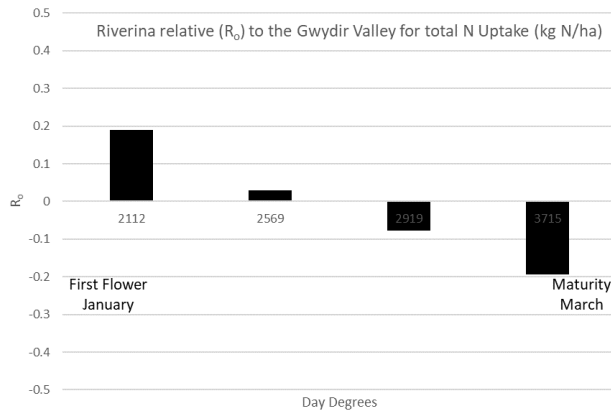


Fig. 1: Relative relationship (R_o) of total nitrogen uptake for whole plant. The numbers on the x-axis are the day degrees on which samples were taken.

3.2 Stem, Leaf and Seed Uptake

Stem and seed N uptake in the top of the plant was higher in southern NSW (Fig. 2) during January following first flower. Leaf N uptake fluctuated in southern NSW compared to northern NSW (Fig. 3). Significant N uptake in the seed was shown at the top of the plant in southern NSW from January (Fig. 4), however assimilated similar N rates as the northern NSW site by March.

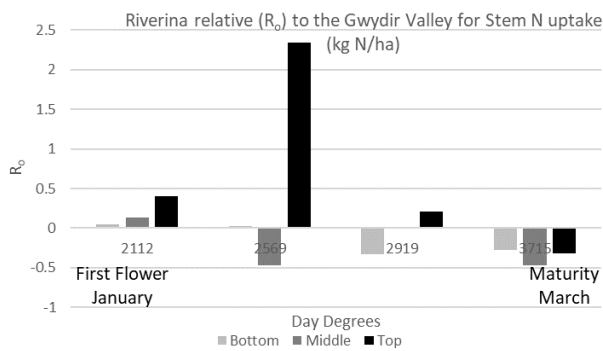


Fig. 2: Relative relationship (R_o) of total nitrogen uptake in cotton stem.

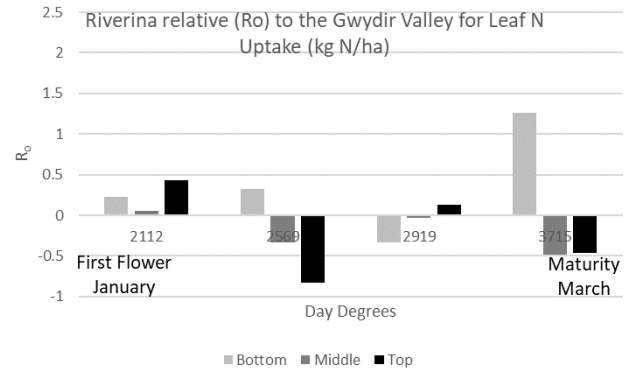


Fig. 3: Relative relationship (R_o) of total nitrogen uptake in cotton leaf.

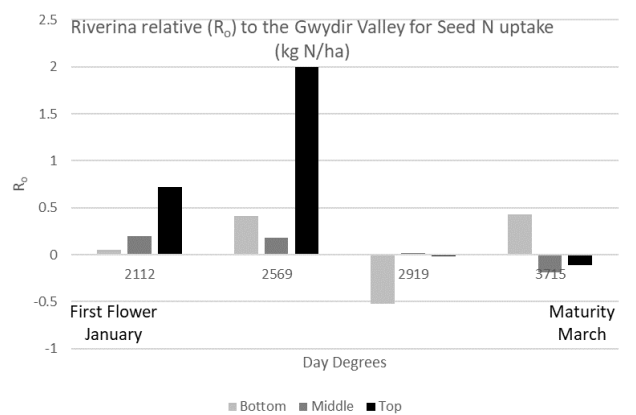


Fig. 4: Relative relationship (R_o) of total nitrogen uptake in cotton seed.

4. Conclusions

Under differing environments and management, the same cultivar was shown to assimilate nitrogen in stem, leaf and seed differently within the plant from first flower to maturity yet produced a similar yield. Further investigation is required to understand the N uptake dynamics in cotton in different regions to improve timing of application to meet demand.

Acknowledgements

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References

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