



The effect of Biological Treatments on Cauliflower Head Characteristics

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Summary

Four biological treatments, applied as root and foliar drench combinations, were trialed as a complement to existing management practices for Cauliflower head characteristics at Rugby Farms, Gatton. A treatment of Rhizomax™ root drench, applied at a rate of 2L/Ha at seedling transplant, with subsequent weekly applications of Lolipepta™ foliar drench (1%, variable application volume per hectare as plants grew) was demonstrated to improve head diameter, head shape and head colour rating immediately prior to harvest.

Introduction

Queensland and Victorian growers, who supply a largely domestic market for fresh and frozen varieties, dominate the Cauliflower Industry in Australia. The ability to control Cauliflower head consistency and appearance are two parameters known to improve cost margins in the Australian industry.

White Cauliflowers with tight curds are the most desirable product on the domestic market, although other colours and varieties exist (Zhao et al., 2013). The “quality” of Cauliflower curds is determined by cultivar, and also by irrigation regime, fertiliser use efficiency and disease burden (Bozkurt et al., 2011; Wurr et al., 1990).

Once-over harvesting, which is desirable to reduce labour costs, can only be practiced if head sizes are consistent and reach maturity simultaneously (Matthews, 2014). Like curd quality parameters, head size consistency and maturity have a genetic basis, but are also controlled more readily when fertiliser and irrigation regime are carefully managed, and disease burdens are low (Sarma and Chakravarty, 2011).

Advances in the development and use of biological agents have occurred in the last five years. Research indicates that biological (viz. bacterial) agents can be used to facilitate greater nutrient uptake and protection against disease, which, when applied as a soil treatment combined with a foliar drench, might enhance plant vigour and reduce disease burden (Choudhary and Johri, 2009; Jan et al., 2011; Ongena and Jacques, 2008).

In this study, the effects of soil and foliar biological treatments on Cauliflower head shape, diameter and colour were evaluated, when used as a compliment to existing management practices at Rugby Farms, Gatton.

Trial Particulars

A trial was conducted at Rugby Farms LTD, Gatton, QLD, between April and August 2014. The location of the trial was approximately 30m into the paddock, off Hoods road (on the south side), 250m west of the Head Office and approximately 1m off the lay-flat in the paddock.

The aim was to evaluate the effectiveness of biological root and foliar preparations on Cauliflower head shape, diameter and colour, alongside the standard Rugby farm management practices.

Treatments

The treatments evaluated are outlined in Table One. Root drenches were applied at transplant, whilst foliar applications occurred weekly and volume of application increased over time, commensurate with foliar expansion. These treatments were applied *in addition* to the existing standard farm practice.

Table One. Names of root and foliar treatment combinations used in a trial of Cauliflower Head parameters at Rugby Farms, Gatton, in 2014.

Treatment Name	Treatment Details	Application Details
Treatment 1 - Rhizomax root drench + Lolipepta Foliar	2% solution containing <i>Bacillus</i> sp. (Rhizomax). 1% Liquid solution containing <i>Bacillus</i> <i>amyloliquefaciens</i> (Lolipepta).	Drench applied directly to root at transplant, and directly to root zone at seven days later. Weekly application of Lolipepta applied via backpack sprayer as foliar spray to point of run-off.
Treatment 2 - NEM16 root drench + Lolipepta Foliar	Anhydrous biological preparation (NEM16) 1% Liquid solution containing <i>Bacillus</i> <i>amyloliquefaciens</i> (Lolipepta).	Vials diluted into 20L water and were applied via backpack sprayer (NEM16) as soil drench. Weekly application of Lolipepta applied via backpack sprayer as foliar spray to point of run-off.
Treatment 3 - NEM111 root drench + low conc exp. Foliar	Anhydrous biological preparations.	Vials diluted into 20L water and were applied via backpack sprayer (NEM111). as soil drench. Weekly application of “low conc. exp. Foliar” applied via backpack sprayer as foliar spray to point of run-off.
Treatment 4 - PF5 root drench + high conc exp. Foliar	Anhydrous biological preparations.	Vials diluted into 20L water and were applied via backpack sprayer (PF5) as soil drench. Weekly application of “high conc. exp. Foliar” applied via backpack sprayer as foliar spray to point of run-off.
Treatment 5 – Existing practice	Rugby farm management practices	Rugby farm management practices

Trial Layout

The total trial space occupied 150m², with three replicates of each treatment randomly assigned and established within the trial area (Figure One). Each treatment replication was approximately 10m² (1m x 10m), containing 2 rows per bed, spaced 50cm apart, and crops planted 45cm apart along each row. In each replication, ten of the possible 50 plants were measured. Therefore, for each parameter evaluated, there were 30 plants in each treatment (three replicates X ten plants per replicate).

	RUGBY 2 (T5)	RUGBY 3 (T5)	
Lay-Flat			
T1R3	T4R2	T2R3	T4R1
T1R1	T3R3	T4R3	T1R2
T3R1	T2R2	T1R3	T3R2
RUGBY 1 (T5)			
Standard Rugby			
Hoods Road			

Figure One. Location of root and foliar treatment combinations (in bold) used in a trial of Cauliflower head quality parameters at Rugby Farms, Gatton, in 2014.

Data analysis

The effect of treatment on Cauliflower head diameter, head shape, and head colour was determined using one-way ANOVA in R version 3.1.1. Statistically significant differences were reported at the alpha = 0.05 level.

Results

Head Diameter

Head diameter variability was small between replicates of each treatment (n = 10 per replicate per treatment), and hence data were pooled for analysis (n = 30 per treatment, pooled across all replicates of the same treatment). Head diameter immediately prior to harvest was significantly wider in plants treated with RhizomaxTM root drench and LolipectaTM foliar drench (Treatment One) than any other treatment. Other treatments were not significantly different to the existing management practices (Figure Two). On average, this represented a 6% increase in head diameter relative to the existing practices on the farm.

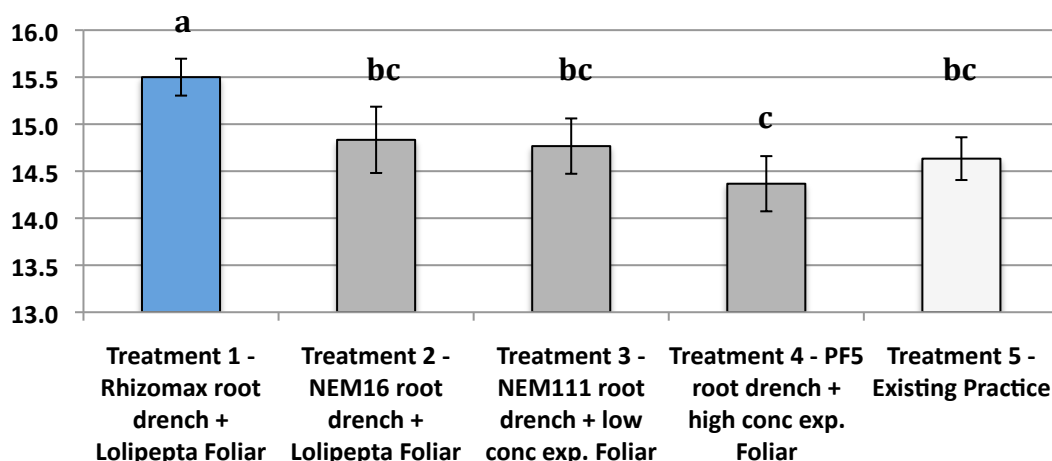


Figure Two. Average head diameter (\pm standard error) of Cauliflower plants following root and foliar treatment combinations used in a trial of Cauliflower head parameters at Rugby Farms, Gatton, in 2014.

Head Shape

Head shape was determined via visual inspection of heads prior to harvest. Although an improved dome-shaped product with tighter curds was produced as a result of application of Rhizomax™ root drench and Lolipecta™ foliar drench (Treatment One), this effect was not statistically significantly different from the existing practice (Figure Three). Nonetheless, Treatment One was the only compliment to existing practices that enhanced head shape, whilst other treatments resulted in head shapes that were significantly more irregular than existing practice.

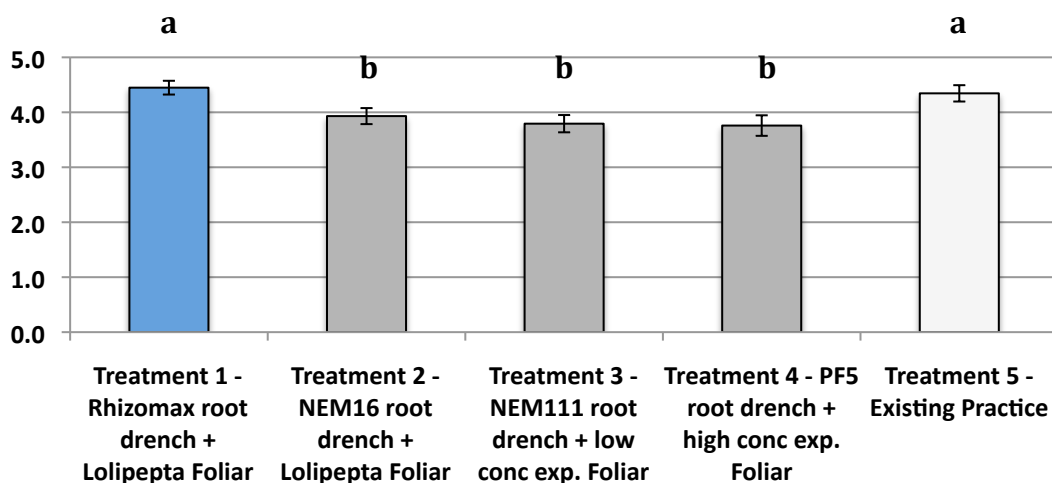


Figure Three. Average head shape score (\pm standard error) of Cauliflower plants following root and foliar treatment combinations used in a trial of Cauliflower growth and quality parameters at Rugby Farms, Gatton, in 2014.

Head Colour

Head colour was determined via visual inspection of heads prior to harvest. Although an improved product with whiter curds was produced as a result of application of Rhizomax™ root drench and Lolipecta™ foliar drench (Treatment One), this effect was not statistically significantly different from the existing practice (Figure Four). Nonetheless, Treatment One was the only compliment to existing practices that enhanced curd colour, whilst other treatments resulted in curd colours that were, on average, significantly more yellow than existing practice.

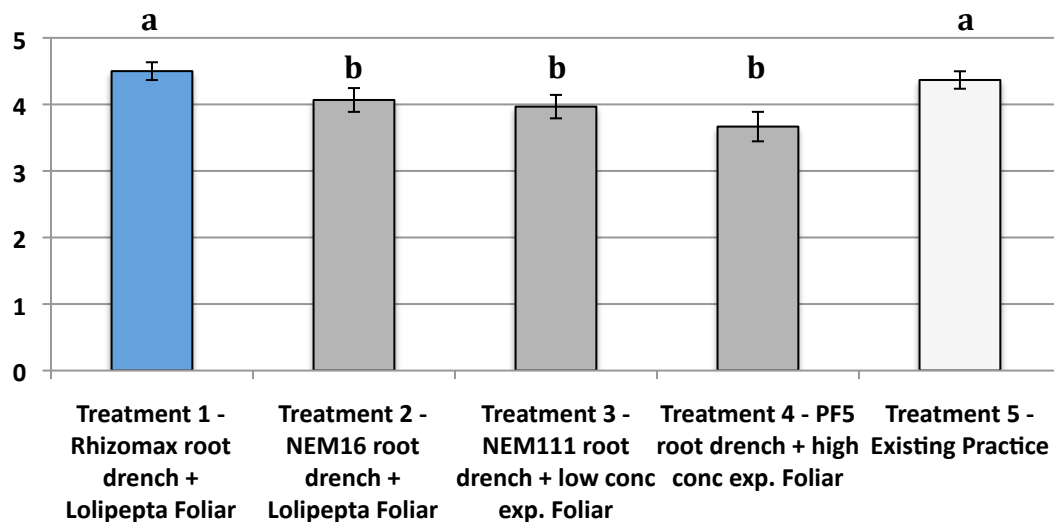


Figure Four. Average head colour score (± standard error) of Cauliflower plants following root and foliar treatment combinations used in a trial of Cauliflower growth and quality parameters at Rugby Farms, Gatton, in 2014.

Conclusions

Treatment One (Rhizomax™ root drench and Lolipecta™ foliar drench) was the only product, when, added in compliment to existing practice, was demonstrated to increase Cauliflower head shape and colour. All other treatments resulted in product that was significantly poorer in marketable quality than Treatment One or the existing practice on farm.

Treatment One, when applied in compliment to existing practice, yielded substantially wider Cauliflower heads relative to the existing practice on farm. This effect was significant, and resulted in, on average, a 6% yield increase at harvest.