

South African  
Barley  
Breeding  
Institute

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## **COCKTAIL PRODUCTION PRACTICES TRIALS**

## **FINAL REPORT ON NITROGEN FERTILISATION TRIALS**

## **2008-2010 SEASONS COMBINED**

During the 2008 winter season, the Agricultural Services Department in the irrigation areas, decided to investigate alternative production practices for the cultivation of the malting barley variety, Cocktail.





## **AGRICULTURAL SERVICES: IRRIGATION**

### **COCKTAIL PRODUCTION PRACTICES TRIALS**

#### **FINAL REPORT ON NITROGEN FERTILISATION TRIALS**

**2008-2010 SEASONS COMBINED**

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### **Terms of Reference:**

During the 2008 winter season, the Agricultural Services Department in the irrigation areas, decided to investigate alternative production practices for the cultivation of the malting barley variety, Cocktail.

The main objective will be to evaluate and establish optimum nitrogen fertilization guidelines for the new variety, Cocktail. The trial has run over a period of three years per locality, and included Puma as reference variety.

Trials were planted under overhead pivot sprinkler systems in the Douglas and Taung areas.

### **Procedure:**

Trials were layout using a complete factorial randomized block design with three replications, with split plots of Puma and Cocktail.

Plot sizes were 6m x 1.52m. (9.12m<sup>2</sup>) per variety.

Nitrogen treatments that were applied were:

- ☞ 120 kg N/ha
- ☞ 140 kg N/ha
- ☞ 160 kg N/ha
- ☞ 180 kg N/ha
- ☞ 200 kg N/ha

Nitrogen treatments were also applied at the following stages:

- ☞ Split 1 = 100% Of the nitrogen treatments applied at planting
- ☞ Split 2 = 66.6% of the total nitrogen treatments applied at planting, and 33.3% of nitrogen total treatment applied at six (6) weeks after emergence.
- ☞ Split 3 = 66.6% of the total nitrogen treatments applied at planting, 16.6% of total nitrogen treatment applied at six (6) weeks after emergence, and 16.6% of total nitrogen treatment applied at the flag leaf stage of the plants.

Previous crop rotation during the summer season was Maize at both the Douglas and Taung localities.

Normal crop protection and irrigation practices were followed at both trial localities during the growing season.

Both trials were planted with a Wintersteiger plot planter and harvested with a Hege 125C plot harvester.

Samples were weighed and quality analysed by SABBI.

Data were analyzed by means of the Co-Stat statistical software, and analysis of variance was performed using the Randomized Complete Block Design (RCBD) method.

Fertiliser treatments were performed on top of 80 Kg/Ha applied at the locality.

Analyses of variance were performed on a least significant difference (LSD) level at the 90% confidence interval.

Significant differences are represented by alphabetical letters in the following order:

- ☞ Puma: Letters A – G, with the letter A, representing highest significance.
- ☞ Cocktail: Letters H – Z, with the letter H, representing the highest significance.
- ☞ Any treatments containing the same alphabetical letter do not differ significantly.

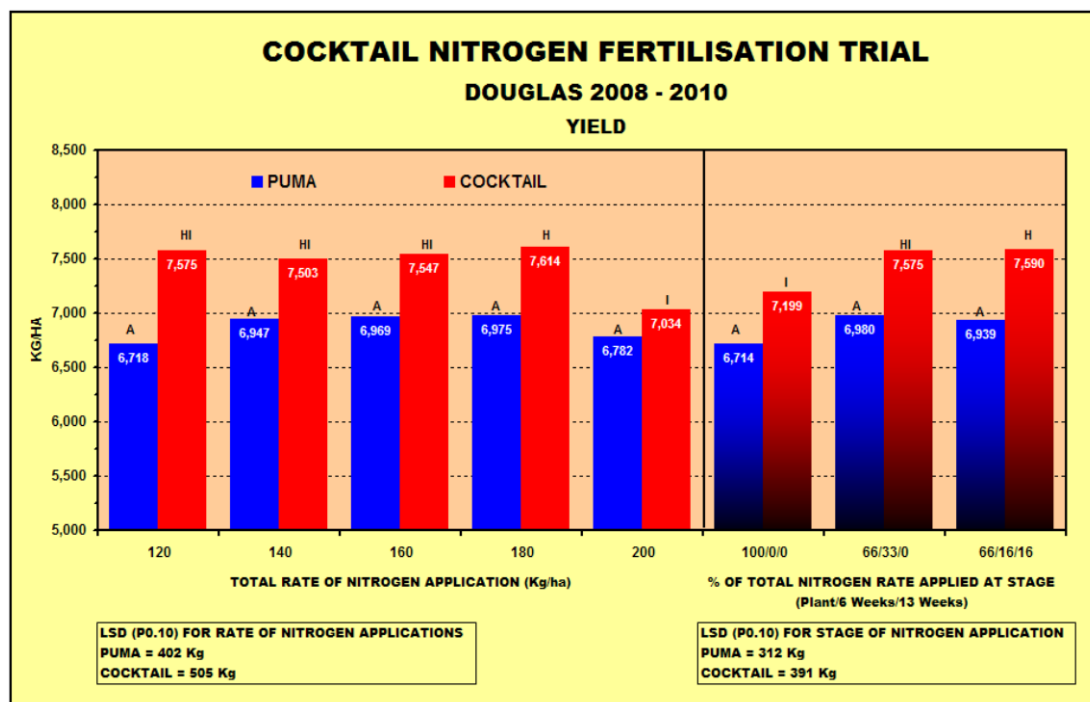
Analyses to be reported on include the influence of the main effects and also the effect of the interactions between the different treatments for the two combined year's data, on the following parameters:

- ☞ Yield (kg/ha)
- ☞ Kernel Nitrogen Content (TN Percentage)
- ☞ Kernel Plumpness (Percentage)
- ☞ Screenings (Percentage)
- ☞ Economical analyses (Gross income less nitrogen cost in rand per hectare)

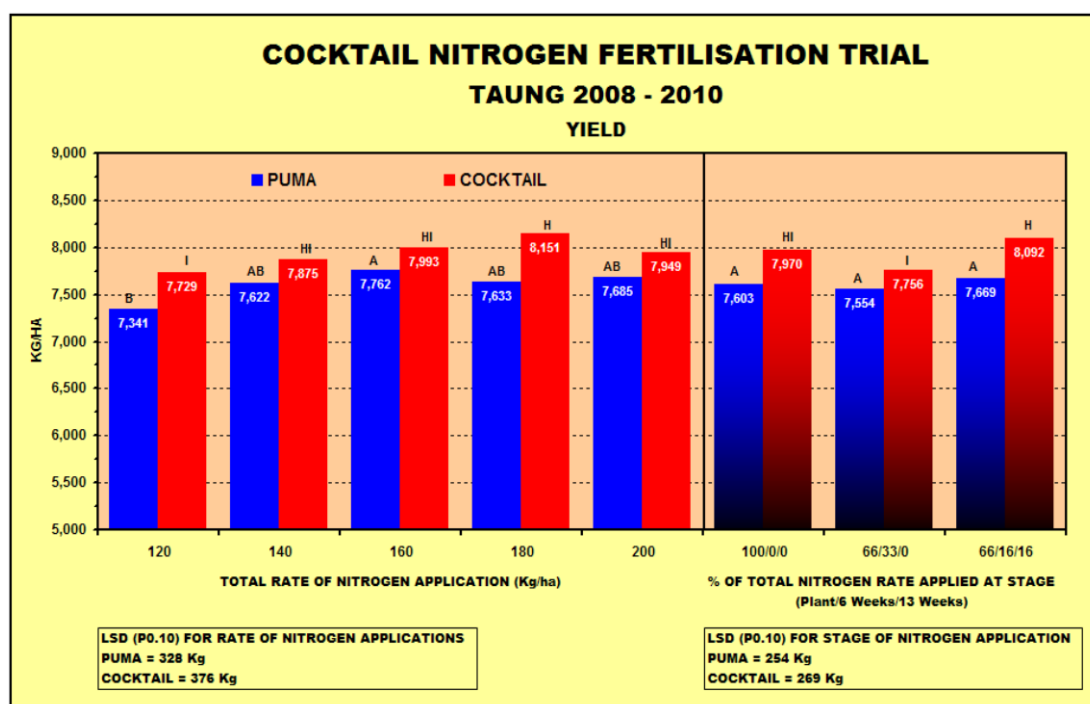
**Findings:**

**Main effects on Yield: (kg/ha)**

DOUGLAS

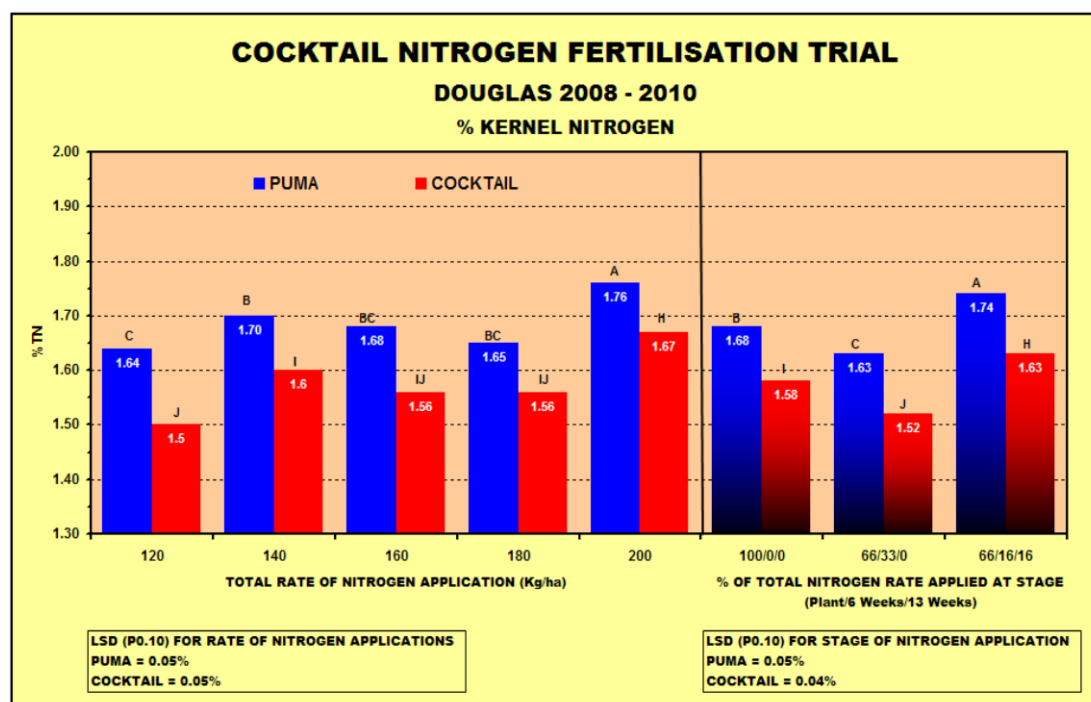


TAUNG

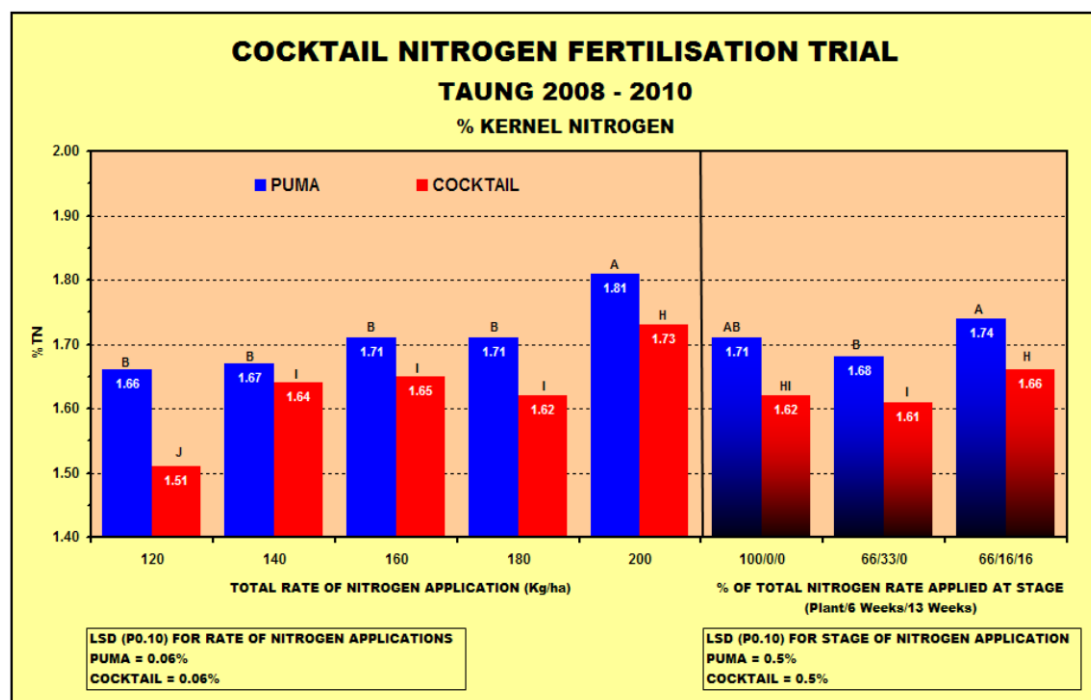


## Main effects on Kernel Nitrogen content (%TN)

DOUGLAS

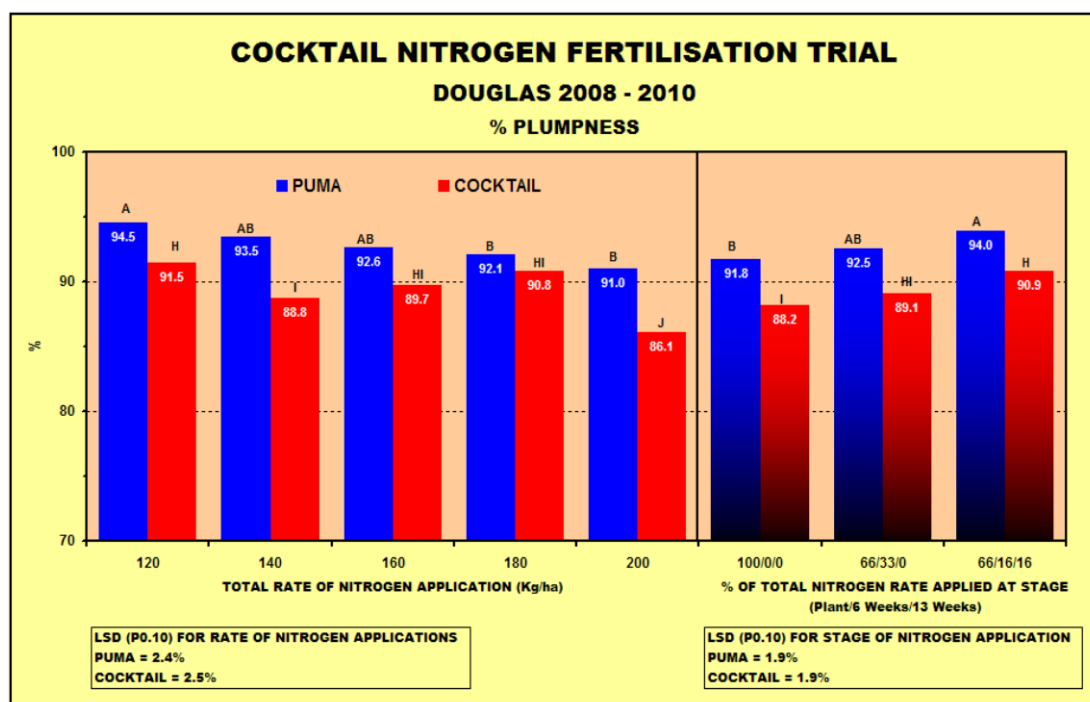


TAUNG

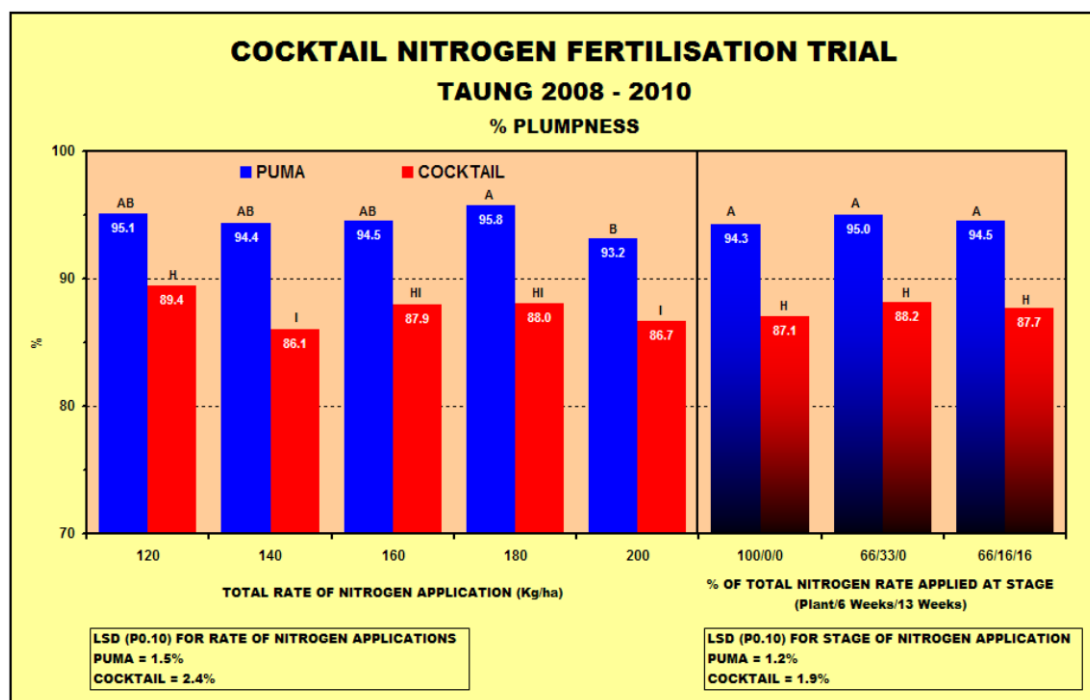


Main effects on % Plumpness: (>2.5mm)

DOUGLAS

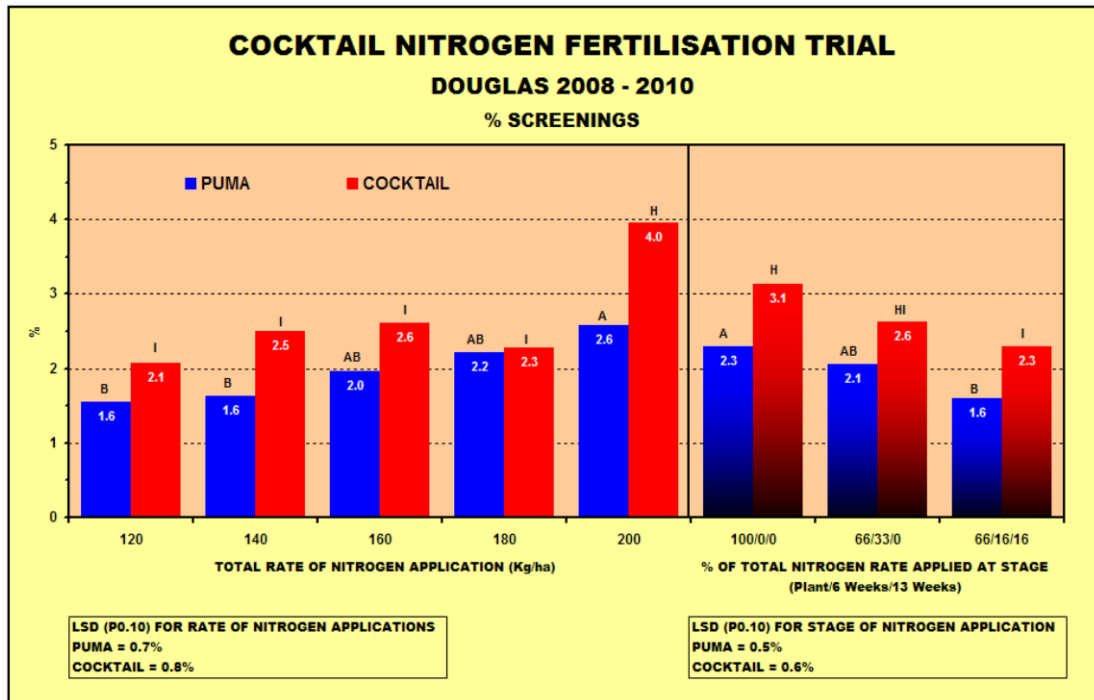


TAUNG

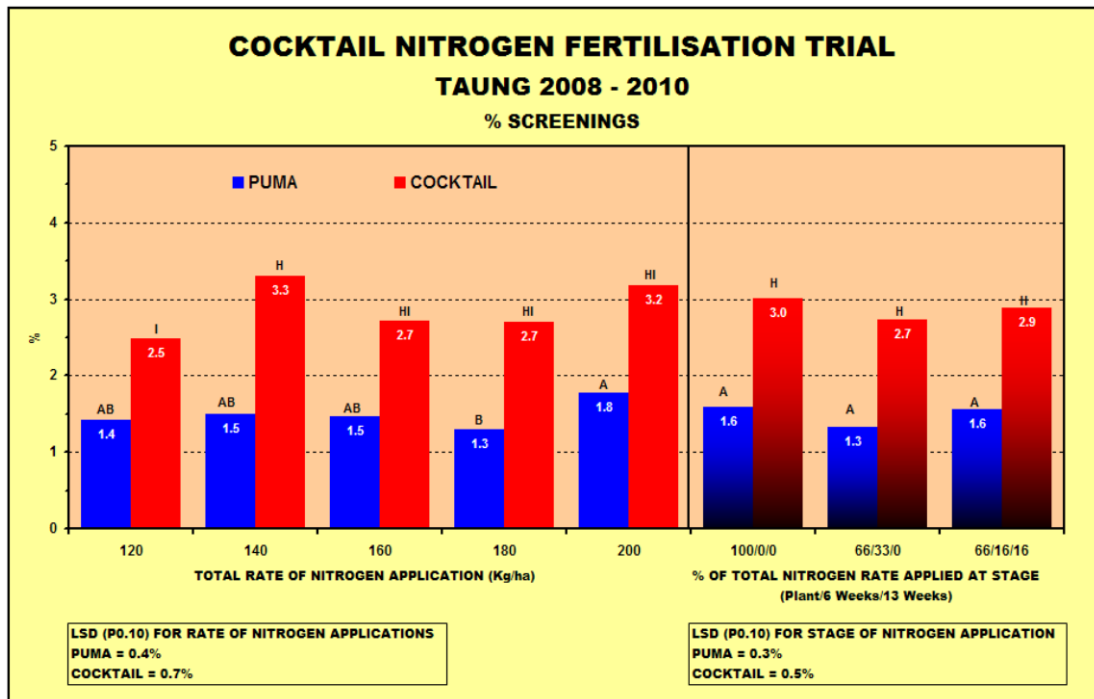


Main effects on % Screenings: (<2.2mm)

DOUGLAS

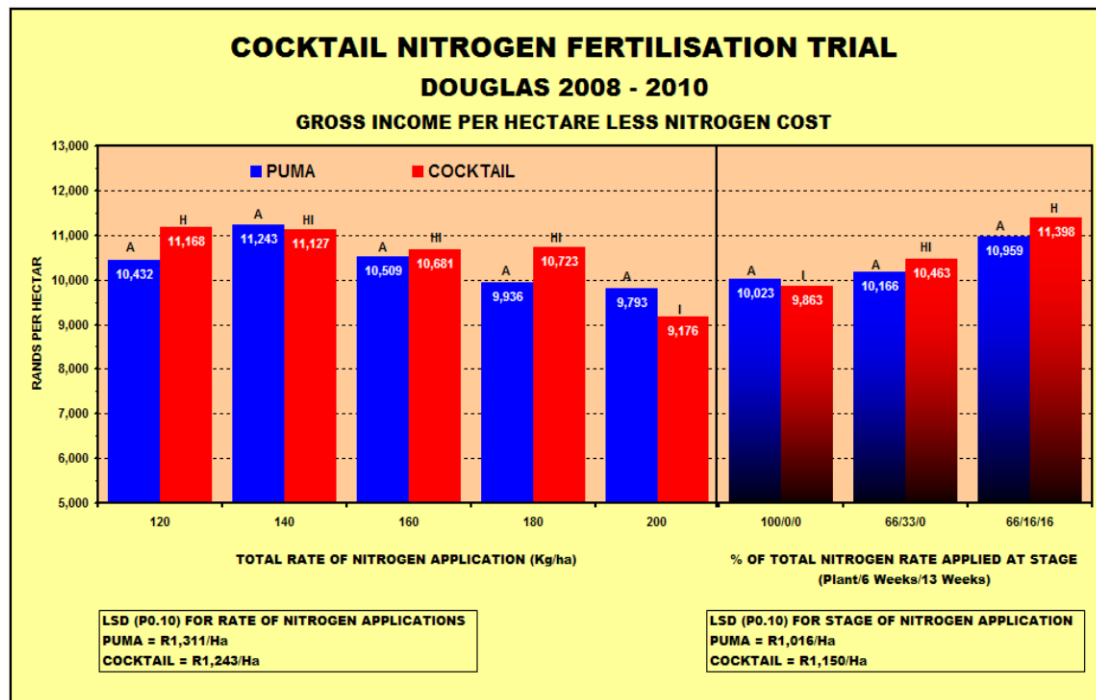


TAUNG

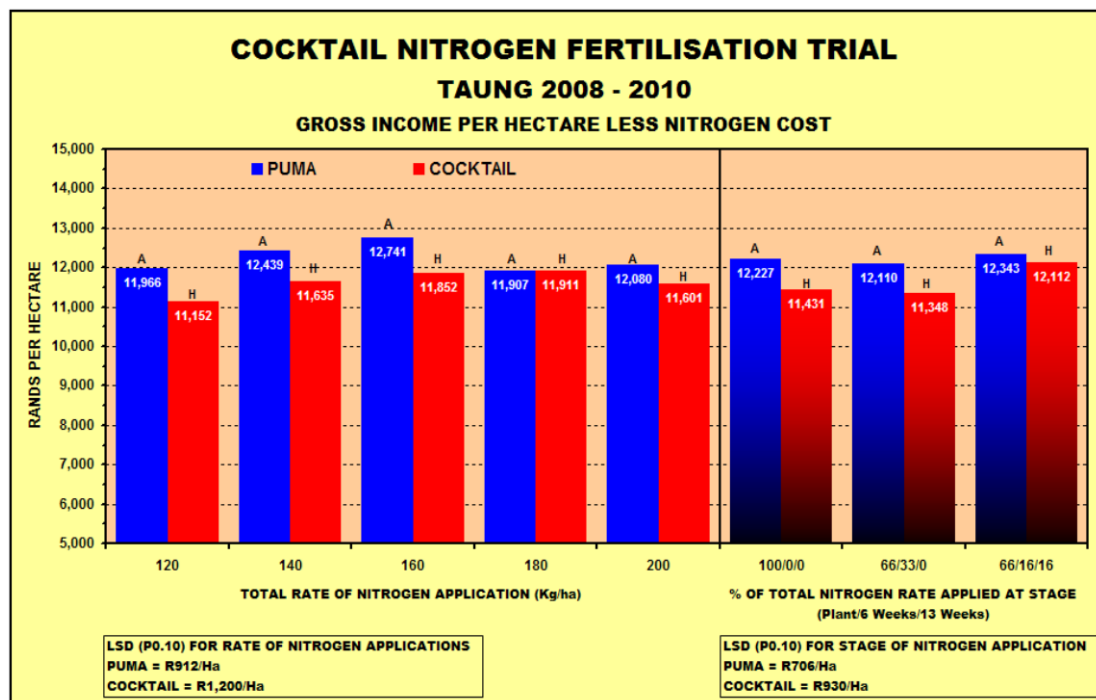


## Main effects on Gross Income less Nitrogen Cost (Rand/ha)

DOUGLAS



TAUNG



## Results:

### Main effects on Yield:

#### ☞ Douglas locality:

- A turning point was observed with the variety Cocktail at the **180 kg/ha** treatment rate, but this rate did not achieve a significantly higher yield than the 120, 140 and 160 kg/ha rates.
- A turning point was observed with the variety Puma at the **140 kg/ha** treatment rate, but this rate did not achieve a significantly higher yield than all the other rates.
- A split application treatment with the variety Cocktail, of **66/16/16** achieved the highest yield, but was not significantly higher than the 66/33/0 split treatment. The split application treatment of 66/16/16 however, obtained a significantly higher yield than the 100/0/0 single split application treatment, where all the nitrogen was applied at planting.
- A split application treatment with the variety Puma of **66/33/0** achieved the highest yield, but was not significantly higher than obtained with both the other two split treatments.

#### ☞ Taung locality:

- A turning point was observed with the variety Cocktail at the **180 kg/ha** treatment rate, with this rate achieving a significantly higher yield than the 120 kg/ha rate, but not significantly better than the other rates.
- A turning point was observed with the variety Puma at the **160 kg/ha** treatment rate, with this rate achieving a significantly higher yield than the 120 kg/ha nitrogen application rate, but not significantly higher than the 140, 180 and 200 kg/ha rates.
- A split application with the variety Cocktail of **66/16/16** yielded significantly higher than the 66/33/0 split application. No significant differences in yield were observed between the 66/16/16 split application and the 100/0/0 single split application where all the nitrogen was applied at planting.

- The highest yield with the variety Puma was obtained with a **66/16/16** split application, but it was not significantly higher than the yields obtained with the other two split applications.

#### **Main effects on % Kernel Nitrogen content:**

##### **☞ Douglas locality:**

- The variety Cocktail achieved the highest %TN with a nitrogen application rate of **200 kg/ha**. This was significantly higher than obtained with the 120 – 180 kg/ha application rates.
- The variety Puma achieved the highest %TN with a nitrogen application rate of **200 kg/ha**. This was significantly higher than obtained with the 120 – 180 kg/ha application rates. A significant turning point was however observed at a **140 kg/ha** application rate.
- A significant increase in %TN was obtained with the three way **66/16/16** split application treatment for both Cocktail and Puma, when compared to the other split applications used.

##### **☞ Taung locality:**

- The variety Cocktail achieved the highest %TN with a nitrogen application rate of **200 kg/ha**. This %TN was significantly higher than obtained with the 120 – 180 kg/ha application rates.
- The variety Puma achieved the highest %TN with a nitrogen application rate of **200 kg/ha**. This was significantly higher than obtained with the 120 – 180 kg/ha application rates.
- The highest %TN obtained by the variety Cocktail, was with the **66/16/16** split application treatment. This was significantly higher than the %TN obtained with the 66/33/0 split treatment, but not significantly higher than the 100/0/0 split application where all nitrogen was applied at planting.
- The highest %TN was obtained by the variety Puma, with a **66/16/16** split application treatment. This was significantly higher than the %TN obtained with the 66/33/0 split treatment, but not significantly higher than the 100/0/0 split application where all nitrogen was applied at planting.

## Main effects on % Plumpness:

### ☞ Douglas locality:

- A decrease in % plumpness was observed with an increase in rate of nitrogen application for both Cocktail and Puma.
- The variety Cocktail obtained the highest % plumpness with a **120 kg/ha** nitrogen rate. This was significantly higher than with the 140 and 200 kg/ha application rates, but not significantly higher than with the 160 and 180 kg/ha nitrogen rates.
- The variety Puma obtained the highest % plumpness with a **120 kg/ha** nitrogen rate. This was significantly higher than with the 180 and 200 kg/ha rates, but not significantly higher than with the 140 and 160 kg/ha rates.
- An increase in % plumpness was observed with the split of nitrogen application rates for both Cocktail and Puma.
- The highest % plumpness was obtained by the variety Cocktail with a three way split of **66/16/16**. The % plumpness was however not significantly higher than obtained by the two way split of 66/33/0.
- The highest % plumpness was also obtained by the variety Puma with a three way split of **66/16/16**. The % plumpness was however not significantly higher than obtained by the two way split of 66/33/0.

### ☞ Taung locality:

- A slight decrease in % plumpness was observed with an increase in the rate of nitrogen application for both Cocktail and Puma.
- The variety Cocktail obtained the highest % plumpness with a **120 kg/ha** nitrogen rate. This was significantly higher than with the 140 and 200 kg/ha rate, but not significantly higher than with the 160 and 180 kg/ha nitrogen rates.
- The variety Puma obtained the highest % plumpness with a **180 kg/ha** nitrogen rate. This was significantly higher than with the 200 kg/ha nitrogen rate, but not significantly higher than obtained with the 120 – 160 kg/ha nitrogen rates.
- A slight increase in % plumpness was observed with the split of nitrogen application rates for both Cocktail and Puma, but no significant differences were observed between the three split application treatments for both the varieties.

- The highest % plumpness was obtained by the variety Cocktail with a two way split of **66/33/0**.
- The highest % plumpness was also obtained by the variety Puma with a two way split of **66/33/0**.

#### **Main effects on % Screenings:**

##### ☞ Douglas locality:

- An increase in % screenings was observed with an increase in the rate of nitrogen application for both Cocktail and Puma.
- The variety Cocktail obtained the lowest % screenings with a **120 kg/ha** nitrogen rate. This % screenings was significantly lower than obtained with the 200 kg/ha rate, but not significantly lower than with the 140 – 180 kg/ha rates.
- The variety Puma obtained the lowest % screenings with a **120 kg/ha** nitrogen rate. This was significantly lower than with the 200 kg/ha rate, but not significantly lower than with the 140 – 180 kg/ha rates.
- A decrease in % screenings was observed with the split of nitrogen application rates for both Cocktail and Puma.
- The lowest % screenings was obtained by the variety Cocktail with a three way split of **66/16/16**. This was significantly lower than obtained with the 100/0/0 split of all nitrogen applied at planting.
- The lowest % screenings was also obtained by the variety Puma with a three way split of **66/16/16**. This was significantly lower than obtained with the 100/0/0 split of all nitrogen applied at planting.

##### ☞ Taung locality:

- A slight increase in % screenings was observed with an increase in the rate of nitrogen application for both Cocktail and Puma
- The variety Cocktail obtained the lowest % screenings with a **120 kg/ha** nitrogen rate. This was significantly lower than with the 140 kg/ha rate, but not significantly lower than with the 160 – 180 kg/ha nitrogen rates.
- The variety Puma obtained the lowest % screenings with a **180 kg/ha** nitrogen rate. This was significantly lower than with the 200 kg/ha rate

application, but not significantly lower than with the 120, 140, 160 and 180 kg/ha rates.

- A slight decrease in % screenings was observed with the split of nitrogen application rates for both Cocktail and Puma
- No significant difference was observed between split applications for both the varieties Cocktail and Puma.
- The lowest % screenings was obtained by the variety Cocktail with a two way split of **66/33/0**.
- The lowest % screenings was also obtained by the variety Puma with a two way split of **66/33/0**.

### **Economic Analyses on Main Effects:**

#### **☞ Douglas locality:**

- A decrease in gross margin was observed with an increase in the rate of nitrogen application for both Cocktail and Puma.
- The variety Cocktail obtained the highest gross margin, with a **120 kg/ha** nitrogen rate. This was significantly higher than with the 200 kg/ha rate applications, but not significantly higher than with the 140, 160 and 180 kg/ha nitrogen application rates.
- The variety Puma obtained the highest gross margin, with a **140 kg/ha** nitrogen application rate. This was however not significantly higher than obtained with all the other application rates.
- An increase in gross margin was observed with the split of nitrogen application rates for both Cocktail and Puma.
- Both the varieties Cocktail and Puma, obtained the highest significant gross margin, with a **66/16/16** split application.
- The variety Cocktail's highest gross margin obtained with a three way split application of **66/16/16** was however not significantly higher than obtained with two way split of **66/33/0**.
- The variety Puma also obtained the highest gross margin with a three way split application of **66/16/16**, but no significant difference was observed between all three split application treatments for the variety.

#### ☞ Taung locality:

- The variety Cocktail obtained the highest gross margin with a **180 kg/ha** nitrogen rate. No significant differences were, however, observed between all the other application rates applied.
- The variety Puma also obtained the highest gross margin with a **160 kg/ha** nitrogen rate. No significant differences were, however, observed between all the other application rates applied.
- An increase in gross margin was observed with a split of nitrogen application rate for both Cocktail and Puma.
- Both the varieties achieved the highest gross margin with a three way split of **66/16/16**. No significant differences was, however, observed between the three split applications at both varieties.

#### Conclusions:

##### ☞ Douglas area:

- Cocktail – A total nitrogen rate of **120 kg/ha** obtained the highest gross income when applied with a three way split application of **66/16/16**. This rate, however, did not achieve a significantly higher gross income than the **140 – 180 kg/ha** rates.

A total application rate of **180 kg/ha** with a three way split application of **66/16/16**, would achieve a higher yield and higher kernel nitrogen content (%TN) than with the 120 – 160 kg/ha rates, depending on the soil type and rotation.

- Puma – A total nitrogen rate of between **140 kg/ha**, applied with a **66/16/16** split application, obtained the highest gross income. This application, however, did not achieve a significantly higher gross income than all the other rates, with either a **100/0/0** or a two way split **66/33/0** split applications.

##### ☞ Taung area:

- Cocktail - Total nitrogen rates of between **160 – 180 kg/ha**, applied with the three way split is the best option to increase yield and kernel nitrogen content (%TN), and to reduce the possibility of lodging on high yield potential situations.

- Puma – A total nitrogen rate of **160 kg/ha**, applied with a three way split of **66/16/16** would obtain the highest yield and gross margin, with a low possibility of lodging on high yield potential situations.

#### **Nitrogen Recommendations for the varieties Cocktail and Puma:**

##### **☞ Douglas area:**

- Total application rates for Cocktail should not exceed **180 kg/ha**.
- Total application rates for Puma should not exceed **160 kg/ha**.
- A three way split application of **66/16/16** achieved the highest yield, kernel nitrogen content, % plumpness and gross margin with both the varieties Puma and Cocktail.

##### **☞ Taung area:**

- Total application rates for Cocktail should not exceed **180 kg/ha**.
- Total application rates for Puma should not exceed **160 kg/ha**.
- A three way split application of **66/16/16** achieved the highest yield, kernel nitrogen content and gross margin with both the varieties Puma and Cocktail.