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**PROJECT: Bamboo Research 2003-2004**

**Project Officer: M. Traynor**

**Location: CPHRF and a grower site**

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**Objectives:**

*To trial irrigation and fertiliser inputs and scheduling for optimum shoot production for *Dendrocalamus latiflorus* conducted on established planting at CPHRF and one grower site.*

*To investigate thinning rates on grower sites with *D.latiflorus* in relation to shoot size and yield.*

*Change to objectives*

Research work has been discontinued at the Kingsley site due to the withdrawal of the owner from the project because of the upcoming sale of the property. Experiments are now confined to *D.latiflorus*.

The proposed work to correlate leaf nitrogen levels with shoot sap nitrate levels has not progressed. Research results from the Eumundi site in Queensland show no consistent correlation. Trends also indicate that the major application of nitrogen needs to be done at least four to six weeks before the first shoot emerges and possibly even earlier. Monitoring shoot nitrate once shooting has started may be useful but is no longer considered a priority objective.

**Method:**

Research is being conducted on *Dendrocalamus latiflorus*. This species is a proven producer of quality vegetable shoots and is the major species planted and marketed in the NT. Along with the established trial planting at CPHRF, the property of Mr Phil Vivian of Pal Enterprises is the second trial site. All experiments on the two trial sites are fully randomised with three replicates. Treatments combine irrigation, fertiliser and thinning trials for the purpose of defining management practices for optimum shoot yield and quality. For details on these experiments refer to the 2001-02 Technical Annual Report.

*Progress of research work*

All experiments were established before the start of the 2002 dry season. Irrigation systems to satisfy the requirement of the experiments were established and monitoring sites were installed in March 2002. After sprinkler flow tests were completed, the irrigation treatments commenced in May 2002. Fertiliser treatments commenced after initial leaf and soil nutrient testing in October 2001. The initial thinning of all treatments was done in late 2001 so that each clump had its specific culm density.

*2001-02*

Shoot selection to satisfy all thinning treatments was conducted during the 2001-02 wet season and given a colour ID marking. The first thinning operation to maintain the specified standing culm densities was done in July 2002. Fertiliser and irrigation response data was collected during 2002.

*2002-03*

Shoot selection was conducted during the 2002-03 wet season and given a colour ID marking. The first shoot yield data was recorded during the 2002-03 wet season. Collection of fertiliser and irrigation response data continued during 2003. The second thinning operation was done in July 2003.

#### *2003-04*

Shoot selection was again conducted during the 2003-04 wet season and given a colour ID marking. All clumps now have three generations of marked culms. The second set of shoot yield data was collected over the 2003-04 wet season. The monitoring of fertiliser inputs continued over the shooting season.

#### *Fertiliser treatments*

1. 100% treatment. To test the assumption that leaf nitrogen concentration of 3% is optimal for photosynthesis and therefore production. Nitrogen inputs/ha are calculated using the nitrogen response equation for bamboo developed by the project's principal investigator Prof. D. Midmore. The objective is to reach and maintain 3% nitrogen in the leaf during the shooting season.
2. 25% of fertiliser inputs as determined for treatment 1.
3. 200% treatment. Double treatment 1 fertiliser inputs.

### *Fertilising*

- ? Both trial sites used a mineral NPK blend of 15:4:11 fertiliser. Treatments commenced after initial leaf and soil nutrient testing in October 2001. Fertiliser was applied to the 20<sup>2</sup> m irrigated area around each clump meaning that the per-hectare rate was applied on a per-clump basis.

### *Monitoring*

- ? The fertiliser experiments are based on leaf nutrient analysis. The first fully expanded leaves were collected from branch terminals of one-year old culms. All monitoring was conducted on designated sample clumps from each replicate of each treatment and standardised on the 100% irrigation treatment. The following sampling strategy was followed before and during the shooting season.

1. Sample to determine nitrogen content.
2. Application of required rate of nitrogen / ha.
3. Sample after three weeks to measure the response.

### **Progress:**

Fertiliser treatments commenced after initial leaf and soil nutrient testing in October 2001. Where the leaf testing of the 100% treatment showed that 3% leaf nitrogen had been reached, no fertiliser was applied at that site. Although not presented in this report, the other major elements and trace elements were tested with each leaf sample. In most instances the higher rates of applied nitrogen have resulted in small increases in leaf nitrogen. The lower rate of the 25% treatment resulted in a negative response in some cases. It appears that even the high rates of applied nitrogen have not maintained the desired 3% leaf nitrogen. While the difference between the responses with the increasing rates of applied nitrogen is consistent it is not dramatic. The nutrient status of young leaves will vary with seasonal change. Nutrient demand increases with the onset of rhizome expansion (shooting) and the production of new roots and leaves. This is the period from October through to February. This trend is evident in the leaf nitrogen monitoring of the fertiliser treatments and is more pronounced in the 25% rate.

### *Irrigation treatments*

1. 100% irrigation schedule based on mean monthly daily evaporation replacement using a crop factor of 1.0. Irrigate twice daily.
2. 50% of treatment 1 inputs. Irrigate twice daily.
3. Drought treatment from April to September. Irrigate to 100% from October. Test the need for dry season irrigation.

### *Monitoring*

All treatments were monitored once a week with the Diviner moisture probe to 1-m depth.

Monitoring with tensiometers was not producing useful data and was not continued after the 2002 dry season. The Diviner measures volumetric soil water content at 10-cm increments.

### **Progress:**

Irrigation treatments commenced in May 2002 and the monitoring data for the Diviner moisture probe includes two dry seasons and is the average of three replicates. That data is not presented here although some interpretations and observations are discussed.

### *The CPHRF site*

Even though the 50% irrigation retained slightly more moisture at the shallow depths the VSWC of the drought and 50% treatments were very similar and much lower than the soil profile wilting points throughout both dry seasons. The 50% treatment only reached 20 mm VSWC following monsoon rain. Where the water was turned on the drought treatment at the beginning of October, it is clearly evident especially in 2003. Soil moisture then remained fairly similar to the 100% treatment. The VSWC at the shallow depths in the 100% treatment is significantly higher throughout both dry seasons compared to the other treatments. Only in this treatment are the 10, 20 and 30-cm depths maintained close to their wilting points for the CPHRF soil. An increase in water use is noted in the 100% treatment during September of both years. The data continues to show little water use by irrigated clumps over most of the dry season.

### *The Vivian site*

The VSWC at the shallow depths of the 100% treatment remained slightly higher than the 50% inputs over both dry seasons. Considerably more water was held at depths of 70 – 100 cm in the 100% treatment. This could indicate that the additional water of the 100% treatment was draining through the soil profile. It is interesting to note how the chart peaks of both wet seasons are very compressed compared with the CPHRF site. This is an indication of the lower water holding capacity of the Vivian site.

### *Thinning treatments*

1. Thin yearly to four each of one, two and three-year old culms. (4-4-4)
2. Thin yearly to four of one, two of two and two of three-year old culms. (4-2-2)
3. Thin yearly to two each of one, two and three-year old culms. (2-2-2)

These treatments test the effect of standing culm density and culm age on shoot size and yield. Shoots selected to grow into culms have a year ID marking. The yearly dry season thinning of treatments is conducted in July. The three thinning treatments are applied only at the Vivian site. The CPHRF site has the 4-4-4 thinning schedule across all experiments.

### **Progress:**

The first thinning operation to maintain the specified standing culm densities was done in July 2002. During the shoot harvest of 2002-03 the designated number of shoots were left in each clump to grow into culms. This was repeated for the 2003-04 harvest season. There are now three generations of experimental culms in each thinning treatment with their own colour identification marking.

### *Shoot yields*

Shoot harvests were conducted twice a week to ensure that shoots were within the accepted height to base diameter ratios of 2:1 and 3:1. Shoots were then trimmed ready for market before each shoot was weighed, measured and recorded. The yield data from the 2002-03 and 2003-04 shoot seasons has been collected and is in the process of being statistically analysed. The data presented in this report identifies trends attributed to the treatments over two harvest seasons.

### *Fertiliser treatments*

Tables 1 and 2 show the mean shoot number for the fertiliser treatments from both trial sites. The high number of small unmarketable shoots produced at both sites in 2002-03 dropped dramatically over the

2003-04 harvest. This could be attributed to a clump maturity effect and the treatments have only started to influence shoot size in the second harvest season. At the CPHRF site the 100% treatment yielded more shoots across all grades and the number of large shoots increased in both treatments in the 2003-04 harvest.

At the Vivian site the number of marketable shoots increases from the 25% treatment through to the highest rate of 200%, although in the 2003-04 harvest the difference in market yield between the 100% and 200% treatments was not as much as the previous season. Across both sites the 25% rate continues to yield significantly fewer marketable shoots.

**Table 1.** Mean shoot numbers for the fertiliser treatments at the CPHRF site

Grade (kg)	Shoots per clump 2002-03		Shoots per clump 2003-04	
	25% fertiliser	100% fertiliser	25% fertiliser	100% fertiliser
< 0.25	12.0	19.4	1.5	2.6
0.25 - 0.35	9.8	12.4	5.1	7.5
0.35 – 0.45	6.7	7.9	4.9	6.6
0.45 – 0.55	1.8	2.7	2.9	4.1
> 0.55	0.4	0.3	3.7	6.3
Market	18.7	23.3	16.6	24.5

**Table 2.** Mean shoot numbers for the fertiliser treatments at the Vivian site

Grade (kg)	Shoots per clump 2002-03			Shoots per clump 2003-04		
	25% fertiliser	100% fertiliser	200% fertiliser	25% fertiliser	100% fertiliser	200% fertiliser
< 0.25	15.1	21.8	30.7	6.1	7.7	8.0
0.25 - 0.35	4.5	10.2	12.8	6.3	12.0	10.9
0.35 – 0.45	1.4	3.2	5.6	2.8	5.2	7.8
0.45 – 0.55	0.3	0.8	1.7	1.1	1.5	2.7
> 0.55	0.1	0.2	0.7	0.3	0.7	1.1
Market	6.3	14.4	20.8	10.6	19.4	22.6

### *Irrigation treatments*

Tables 3 and 4 show the mean shoot number for the irrigation treatments from both trial sites. As with the fertiliser treatments the number of small shoots harvested in 2003-04 has dropped markedly. At the CPHRF site the drought treatment has yielded larger shoots than the other irrigated treatments. The yields across grades for the 50% and 100% treatments show little difference. At the Vivian site there has been a small increase in marketable shoots in the 2003-04 harvest but there continues to be little difference in market yield between the 50% and 100% water inputs.

**Table 3.** Mean shoot numbers for the irrigation treatments at the CPRF site

Grade (kg)	Shoots per clump 2002-03			Shoots per clump 2003-04		
	50% water	100% water	Drought	50% water	100% water	Drought
< 0.25	14.5	14.4	18.1	2.7	1.5	1.8
0.25 - 0.35	8.5	9.9	15.0	6.3	5.7	6.6
0.35 - 0.45	5.7	6.7	9.5	4.9	4.5	7.8
0.45 - 0.55	1.8	1.5	3.4	3.3	2.2	5.0
> 0.55	0.1	0.7	0.4	4.3	3.0	7.4
Market	16.0	18.9	28.2	18.8	15.4	26.8

**Table 4.** Mean shoot numbers for the irrigation treatments at the Vivian site

Grade (kg)	Shoots per clump 2002-03		Shoots per clump 2003-04	
	50% water	100% water	50% water	100% water
< 0.25	22.9	22.1	6.9	7.7
0.25 - 0.35	9.8	8.6	9.7	9.9
0.35 - 0.45	3.7	3.1	5.7	4.8
0.45 - 0.55	1.2	0.7	1.8	1.7
> 0.55	0.4	0.2	0.5	0.9
Market	15.1	12.6	17.7	17.3

*Thinning treatments*

Table 5 shows the mean shoot number for the thinning treatments at the Vivian site. The shoot harvest of 2002-03 yielded many more small shoots from the 222 treatment but the market yield between the treatments showed little difference. The market shoot number for the 2003-04 harvest shows an increase as the standing culm density increases from 6 to 12 culms. This is an interesting trend but the longer-term effects of culm density need to be tested.

**Table 5.** Mean shoot numbers for the thinning treatments at the Vivian site

Grade (kg)	Shoots per clump 2002-03			Shoots per clump 2003-04		
	222 thin	422 thin	444 thin	222 thin	422 thin	444 thin
< 0.25	28.4	19.3	19.8	8.1	6.8	7.0
0.25 - 0.35	8.8	8.7	10.1	8.6	9.7	11.1
0.35 - 0.45	3.1	3.8	3.4	3.8	5.9	6.1
0.45 - 0.55	0.7	1.1	1.1	1.1	1.9	2.4
> 0.55	0.3	0.4	0.2	0.2	0.8	1.1
Market	12.8	13.9	14.8	13.7	18.3	20.6

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