PROGRAM: The Vegetable Industry

PROJECT: Bamboo Research 2002-03

Project Officer: M. Traynor

Location: CPHRF and two grower sites

Objectives:

Trial irrigation and fertiliser inputs and scheduling for optimum shoot production for D. asper and D. latiflorus conducted on established planting at CPHRF and two grower sites.

Investigate thinning rates on grower sites with D. asper and D. latiflorus in relation to shoot size and yield.

Correlate leaf nitrogen levels with shoot sap nitrate levels to develop a simple nutrient monitoring system for growers.

Background:

The Horticulture Division of DBIRD together with the Central Queensland University is participating in a three year ACIAR (Australian Centre for International Agricultural Research) funded project titled "Improving and maintaining productivity of bamboo for quality timber and shoots in Australia and the Philippines". Although this project includes research on timber production, the Division will concentrate its involvement on the production of quality vegetable shoots.

Method:

Research is being conducted on the two species identified as having strong potential as vegetable shoot producers. These are *Dendrocalamus asper* and *Dendrocalamus latiflorus*. Along with the established trial planting at CPHRF, the farms of the two largest commercial producers of these two species were selected as additional trial sites. The producers are Mr. Richard Kingsley of Bamboo Planet Earth Pty Ltd (D.asper) and Mr Phil Vivian of Pal Enterprises (D.latiflorus). All experiments on the three 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:

This report covers the progress of the second year of the project. All experiments were established on the three trial sites 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 of all sites in October 2001.

The initial thinning of all treatments was done in late 2001 and the diameters of all remaining culms were recorded to test uniformity. Shoot selection to satisfy all thinning treatments was conducted during the 2001-02 wet season. The first thinning operation to maintain the specified standing culm densities was done in July 2002. Shoot selection was again conducted during the 2002-03 wet season. Fertiliser and irrigation response data was collected during 2002. The first shoot yield data was recorded during the 2002-03 wet season.

Fertiliser Use

The CPHRF and Vivian sites used a mineral NPK blend of 15:4:11. An organic product with NPK of 5:3:1.5 was used at the Kingsley site. Fertiliser treatments commenced after initial leaf and soil nutrient testing of all sites in October 2001. Fertiliser was applied to the 20^2 m irrigated area around each clump. In other words, 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, during and at the end of the shooting season:

- Sample to determine nitrogen (N) content.
- Application of required rate of N per hectare.
- Sample after three weeks to measure the response.

Progress

Fertiliser treatments commenced after initial leaf and soil nutrient testing of all sites in October 2001. Where the leaf testing of the 100% treatment showed that 3% leaf N had been reached then 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. The planned testing of shoot sap nitrate to correlate with leaf nitrogen levels was not conducted during the 2002-03 shoot season, but is set as a priority for next season.

Nitrogen application and response for the CPHRF site showed the 100% N inputs over the past year had kept the leaf N level fairly constant until a pronounced drop in November. The leaf test in early October showed 3% N had been reached and therefore no N was applied, but with the onset of shooting the leaf N content dropped rapidly. It needs to be noted that the CPHRF site has by far the better soil structure of the three trial sites and also has a history of fertiliser application during a previous trial. Despite this the response to the two rates of nitrogen applied is expressed in the treatment yields.

At the Vivian site the N application and response data showed that leaf N levels were increasing dramatically from 25% through to 200% which is consistent with the yield increases across those treatments.

For the Kingsley site, the increasing rates of applied organic fertiliser had little effect on leaf N levels over the past year. The N in organic fertiliser must be decomposed by microbes (mineralised) before it can be taken up by plants. This process releases ammonium ions into the soil. If the roots or rhizome of the bamboo require N then the ammonium form of N will move to those parts of the clump. In contrast, when the nitrate form of N used on the other sites enters the plant it is immediately translocated to the leaves. This could help explain why the leaf N shows minimal response at this site while the response within the treatment yields is strong.

Irrigation

All irrigation treatments are based on mean monthly daily evaporation replacement. The irrigated area was 20 m^2 around each clump.

Monitoring

All treatments were monitored twice weekly with tensiometers at 20, 40 and 80-cm depths and once a week with the Diviner Moisture Probe to 1 metre depth. All water inputs were metered and recorded. Tensiometers measure the soil water potential or the energy required for roots to remove water from the soil. Maintaining the tensiometers within their working range of 0 to 80 cb has been difficult in poorer quality soils with low water holding capacity. The Diviner measures volumetric soil water content (VSWC) at 10-cm increments and monitoring sites require no maintenance.

Progress

Irrigation treatments commenced in May 2002 and interpretation of the data for the Diviner Moisture Probe is discussed for each trial site. Data is the average of three replicates and depths of 10, 20, 30, 60, and 100 cm of the soil profile were selected for close examination. Total profile water to 60-cm depth for all sites was also examined.

For the CPHRF site the drought and the 50% treatments show very similar VSWC throughout the dry season and all depths remained below wilting point for CPHRF soil. Only when 100% water was started on the drought treatment at the start of October did the shallow depths climb above wilting point. The 50% treatment did not reach those levels until the onset of heavy rain in February. For the 100% treatment it is clear where the watering began in early May after the dry down following the wet season. The shallow depths remained above their wilting points and fairly constant until late September when plant water use increased significantly. This reduction in water content continued until late October when rainfall events began to influence the monitoring. This water use is also noted in the 50% treatment to a much lesser extent. An interesting observation from this data is that there appears to be little or no water use by irrigated clumps over most of the dry season. This supports the belief that the clumps are essentially dormant during that period.

For the Vivian site there appears to be little difference in VSWC between the 50% and 100% inputs and the total profile water of both treatments remained much the same throughout the year. A small increase in water use can be seen around the end of September.

At the Kingsley site the 50% treatment was very dry at 10, 20, 30 and 60-cm depths throughout the dry season and the 100% treatment held considerably more water at the shallow depths during this period. Water use can be noted on both treatments around mid to late September. Although the difference is not great, the 100% profile consistently held more water.

Thinning

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. There is now two generations of experimental culms in each thinning treatment with their own colour identification marking.

Shoot Yields

When assessing yield data from the 2002-03 shoot season, a couple of points need to be noted. Plants on all three trial sites are only around four years old and may take several more years to reach their managed yield potential. Of the two species being researched only *D. latiflorus* produced shoot quantity of a marketable size. Experiments have been running for only one year and require a minimum of three years to be effective. The data is yet to be fully statistically analysed, but the results show some interesting trends.

Shoot harvest commenced in early October 2002 and finished in late March 2003. 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. Data from the three sites is discussed separately.

CPHRF Site (*D. latiflorus*)

At this site the 100% fertiliser rate produced more shoots than the 25% rate throughout most of the harvest period and the higher rate produced more shoots early in the season. With the irrigation treatments the total yield appears similar between the 50% and 100% inputs, although the higher rate resulted in earlier shooting compared with the other treatments. The droughting treatment has run for only one dry season and will require at least another year to confirm these results. While total yield seems comparable, it appears that dry season droughting delayed the start of shooting by several weeks compared with irrigated clumps. Planned measurements of dry season transpiration and photosynthesis of treatment clumps at CPHRF in 2003 will help explain these results.

Vivian Site (*D. latiflorus*)

This site includes a 200% fertiliser treatment, which clearly produced many more early shoots and easily surpassed the total yields of the other treatments. In the same areas the 100% rate out performed the 25% rate. With the irrigation experiments no earlier shooting of the 100% treatment was evident at this site. Yields over the shoot season appear similar for both treatments. In the first year of trials it was not expected that the thinning treatments would have any significant effect on yield. The higher early yields of the 222 treatment could be attributed to the fact that only two shoots need to be left to grow into culms. The longer-term effects of thinning are of most interest.

Kingsley Site (*D. asper*)

For the fertiliser experiments the increase in yield from the 25% treatment through to the 200% treatment is evident mainly in the second half of the shoot season. Early shooting associated with the 200% rate at the other sites has not occurred at this site. With irrigation at this site the higher yield of the 100% watering is clear and earlier shooting is very evident compared to the 50% treatment. As with the Vivian site, the 222 thinning treatment has yielded more shoots than the higher culm density treatments. Only the continuation of these treatments over several dry season thinning operations will fully test their effects on shoot yield.

General Comments on Experiments

The 100% irrigation treatment failed to provide the VSWC that was expected. This could be a result of unusually high evaporation in 2002 or the bamboo water requirement was underestimated in evaporation replacement calculations.

The yields from the 25% fertiliser treatment are obviously low and not likely to increase with continuation of that rate.

High rates of pre – shooting fertiliser seems to promote earlier shooting, a higher percentage of larger shoots and higher shoot number. Application as early as September could be worthwhile.

Studies of bamboo root distribution and seasonal activity would help with irrigation and fertiliser management.

Acknowledgements:

This research is partially funded by ACIAR and commissioned by the Plant Sciences Group at Central Queensland University. Thanks to commercial collaborators Richard Kingsley, (Bamboo Planet Earth) and Phil Vivian, (PAL Enterprises), the DBIRD Chemistry Laboratory for leaf nutrient analyses and the DBIRD biometrician, Mark Hearnden.

PROJECT: Asian Vegetables – Industry Development

Project Officers: **G. Walduck, M. Traynor, J. Thomas, G. Owens, K. Bui (Industry based IDO) and Dr. B. Thistelton (Entomology)**

Location: CPHRF

Objective:

Support the Asian vegetable industry and its organisation.

Introduction:

This industry is centred near Darwin with 50+ small growers producing a range of Asian vegetables for local and capital city markets. The main thrust of work in this area this year has been in supporting the grower organisation and the Industry Development Officer (IDO) and supplying information on better practice farming techniques through growers meetings, field days and printed material.

Major Activities and Outcomes

Assist industry and NTHA with preparation of a funding application for HAL/industry funded IDO. The application was successful and Kim Bui was appointed as vegetable IDO and is operating very effectively. DBIRD Horticulture staff are on the Management Committee together with industry representatives.

Prepare, print and distribute an English/Vietnamese publication of all current DBIRD printed information on Asian vegetables. This was a joint DBIRD/IDO project and has been distributed to NT