Agnote

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Rambutan Irrigation Requirements and Management

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The native environment of the rambutan (wet tropics) is characterised by high rainfall (evenly distributed), high humidity, low evaporation rates and average minimum temperatures above 20^{o}C. In the Top End of the NT the rambutan is grown in a wet/dry tropical environment where evaporation exceeds rainfall for approximately eight months of the year and humidity is low for 2-3 months of the year. Irrigation is vital to the survival and productivity of rambutan in our environment.

The monitoring of water requirements on a number of Top-End rambutan farms has enabled the development of irrigation recommendations based on 'crop factors' (Table 1). A crop factor (CF) expresses tree water use, for optimum production, in relation to evaporation from an open pan. For example, if the evaporation rate is 10 mm per day and optimum tree water use is 6.0 mm per day then the CF = 0.6.

Once crop factors and evaporation rates are known, it is relatively easy to calculate irrigation inputs. Crop factors and evaporation express water use in terms of mm/day. Millimetres are converted to litres by taking into account the canopy area of the tree. The important rule to remember is that 1.0 mm of rain or irrigation per square metre is equal to 1.0 litre.

WATER REQUIREMENT CALCULATION

The example calculation below shows the steps required to calculate water requirements.

1. Use the crop factor for the appropriate growth period in Table 1. Example; End of Wet to flowering; CF = 0.76.

2. Select the appropriate average evaporation rate from the table. Average evaporation rate = 7.1 mm/day.

3. Measure the tree canopy radius (diameter/2) of at least 10 trees and calculate the average tree radius. Example radius (r) = 3.0 m

4. Calculate canopy area as follows; using the formula for calculating the area of a circle

$$\begin{aligned} \text{Canopy area} &= \text{pi x } (r)^2 \\ &= 3.1416 \text{ x } (3)^2 \\ &= 3.1416 \text{ x } 9 \\ &= 28.0 \text{ m}^2 \end{aligned}$$

5. Calculate irrigation inputs using the following formula;

$$\begin{aligned} \text{Irrigation inputs} &= \text{evaporation rate (mm/day) x CF x canopy area (m)}^2 \\ &= 7.1 \text{ x } 0.76 \text{ x } 28 \\ &= 151 \text{ litres per tree per day} \end{aligned}$$

6. Repeat the above for the various growth periods and for trees of various ages. Use Table 2 to assist the calculation process.

Remember the above calculation is a starting point. Ideally you need to monitor soil moisture, using a reliable soil moisture monitoring system. Tensiometers are reliable, relatively inexpensive and easy to use. They should be installed in nests of three at 20, 40 and 80 cm depths with 2 to 3 nests per irrigation block. The shallow tensiometers help you decide when to irrigate and the information from the deep tensiometer helps you decide the length of irrigation. During fruit filling tensions at 20 and 40 cm should be maintained in the range 10 to 30 kPa and irrigations applied appropriately (probably daily). Tensiometer readings at 80 cm should be monitored to help detect cases of over or under watering. See Agnote D18 “An Introduction to Irrigation of Horticultural Crops” for more information.

GENERAL RAMBUTAN IRRIGATION RECOMMENDATIONS

Rambutans are shallow rooted by nature, with approximately 80% of the fine root system found in the top 15 cm of the soil surface. Unlike many other tree species they do not have mechanisms which allow them to tolerate low levels of soil moisture. The trees are sensitive to drought with leaf drop occurring within three days and full leaf drop occurring after 10 days without water. Other points to consider when irrigating rambutans are as follows:

- Ensure that the output from your sprinklers is uniform across the block. If not seek advise from an irrigation designer.
- Monitor soil moisture regularly, preferably with tensiometers; however digging a hole with an auger is also useful.
- Maximise the wetted area under the tree (60-80 % of the canopy area).
- Irrigate frequently during fruit filling (daily and possibly twice daily).
- Apply longer irrigations once a week to maintain adequate moisture levels at depth.
- Use a light mulch to improve water retention at the soil surface.
- Keep the area under the tree free of weeds.
- Be prepared to irrigate during dry periods in the wet season.

IRRIGATION MANAGEMENT TO ENCOURAGE UNIFORM FLOWERING

Work carried out by the Horticulture Division has shown that six to eight weeks mild pre-flowering moisture stress can result in earlier and more synchronous flowering. In the Top End environment the response to this treatment is dependent on the onset of the dry season with cooler nights (temperatures lower than 20^{o}C) overriding the effect of water stress. However, growers who wish to experiment with this technique need to use the lower crop factor (0.5) for the period "end of wet to flowering". We suggest that droughting be carried out with the following considerations:

- Irrigation should occur no less frequently than every second day, with reduced durations relative to full watering as calculated using a CF of 0.5.
- Soil moisture monitoring with tensiometers should be carried out and the data recorded.
- Tensiometer readings at 20 and 40 cm depth should be allowed to reach 80 and 60 kPa, respectively.
- Growers should monitor tree health daily, with particular emphasis on premature yellowing of older leaves within the canopy or early leaf wilting.
- The length of the stress period should be approximately four to six weeks prior to the proposed date of flowering.
- Full watering, with saturation to depth should occur at the end of the stress period to refill the soil profile.

CONCLUSIONS

Rambutans do respond positively to regular irrigation. This is extremely important in our environment where low humidity, high day temperatures and windy conditions during flowering and early fruit-set result in high tree water requirements.

Monitoring of water inputs and soil moisture along with regular fertiliser inputs will assist growers in attaining maximum productivity.

For more information on irrigation management contact the Horticulture Division Irrigation Officer, Chris Wicks, DBIRD.

REFERENCES

Lim, TK, Luders, l., Diczbalis, Y. And Poffley, M. (1997). Rambutan nutrient requirement and management. NT Department of Primary Industry and Fisheries Technical Bulletin No. 261.

Table 1. Suggested crop factors developed for the NT from monitoring work and water requirements based on a canopy area of 30 m^2

Growth Period	Crop factor (CF)	Mean evaporation rate (mm/day)	Water requirements# (L/tree/day)	Water requirements# (L/tree/wk)
End of wet to flowering	0.5*-0.76	7.1	162	1,134
Flowering	0.99	7.4	219	1,533
Fruit filling	1.21	8.0	291	2,037
Harvest to end of wet	1.0	6.0	180	1,260

- Based on a canopy area of 30 m^2
* - Lower crop factor to be used when trying to promote earlier uniform flowering.

Table 2. Water requirement calculation

Block Number .....
Av. Diameter of 10 trees = ...m
Radius = Diameter/2 = ...m

Growth period	Crop factor (CF)	Mean evaporation (mm/d)	Tree radius (m)	Canopy area (m^2)	Water requirement (L/t/d)	Water requirement (L/t/week)
End wet to flowering	0.76 (0.5)	7.1				
Flowering	0.99	7.4				
Fruit filling	1.21	8.0				
Harvest to end of wet	1.0	6.0				
Example						
End wet to flowering	*~~0.76~~ #(0.5)*	*7.1*	*2.5*	*19.6*	*69.5 (70)*	*490*

- Example calculation carried out using lower crop factor to encourage uniform flowering

Block Number .....
Av. Diameter of 10 trees = ...m
Radius = Diameter/2 = ...m

Growth period	Crop factor (CF)	Mean evaporation (mm/d)	Tree radius (m)	Canopy area (m^2)	Water requirement (L/t/d)	Water requirement (L/t/week)
End wet to flowering	0.76 (0.5)	7.1				
Flowering	0.99	7.4				
Fruit filling	1.21	8.0				
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