Agnote

No: D37

February 2002

Fertilisation and Fertigation of Rambutan

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The establishment of fertiliser recommendations for fruit trees must be based on rational interpretation of sound plant and soil analyses taking into account the crop phenology, crop nutrient removal, leaf nutrient status, soil type and characteristics, meteorological conditions and sources of fertilisers used.

RAMBUTAN NUTRIENT REMOVAL

Studies here and elsewhere have shown that rambutan removes a lot of nitrogen (N) and potassium (K) from fruits and harvested twigs. In rambutan fruit, the sequence of nutrient removal is as follows: nitrogen>potassium>calcium>magnesium>phosphorus (N>K>Ca>Mg>P). Our crop nutrient monitoring studies show that rambutan requires more N and K than P especially during fruit development. For every 100 kg of fruit and 100 kg of twigs removed per hectare, the following amounts of macro-elements are removed:

Fruits = N - 199 g, P - 26.8 g, K - 152 g, Ca - 72 g, Mg - 36.78 g

Twigs = N - 256 g, P - 390 g, K - 240 g, Ca - 171 g, Mg - 32 g.

During harvest the weight of twigs harvested with the fruits is around 10% of the fruit weight harvested. We have to replenish this amount as well as the amount of nutrients consumed for root, leaf and twig/branch growth; nutrients removed by pruning branches; nutrients lost from leaching, volatilisation and immobilisation in the soil. Also, in general fertiliser usage, we have to account for the expected efficiencies which are approximately 30-70% for added N, 5-30% for added P, 50-80% for added K.

RAMBUTAN GRANULAR FERTILISER SCHEDULE

A suggested schedule for rambutan is:

Planting hole

During planting, 200 g superphosphate, 100 g dolomite and 1 kg well decomposed organic manure are thoroughly mixed with top soil in the planting hole.

Non-bearing tree

The recommendation for a non-bearing tree is: NPK= 10:4:8 grade fertiliser applied five to six times per year for years 1 and 2, commencing three months after planting. The rates are:

Year 1 0.5 kg/tree/year,

Year 2 1 kg/tree/year.

Bearing trees

Using the current NPK fertiliser 11:8:12 grade for fruiting trees, comparatively much P is wasted. In fact the composition of all three elements can be reduced. The NPK granular fertiliser should be chloride free as rambutan is extremely sensitive to chloride levels higher than 0.018%. Chloride toxicity is usually characterised by yellowing of leaves and death of leaf margins and tips, often accompanied by defoliation of young leaves. An adequate amount of chloride is provided by irrigation water and by chloride impurities in fertiliser mixtures.

A suitable fertiliser for fruiting trees should contain NPK in the ratio 10:5:9. It should be chloride free and should be applied as shown in Table 1.

The above quantities have to be adjusted according to leaf nutrient levels revealed by regular leaf and soil nutrient analyses. Also, if rambutan trees are heavily pruned more nutrients should be applied in that year.

Based on our crop phenological studies and analysis of the crop nutrient requirement using a modified DRIS technique, rambutan consumed more nitrogen and potassium than phosphorus, especially during fruit set and development. Rambutan fruit requires macro-nutrients in the following order: N>K>Ca>Mg>P. Thus, a fertiliser schedule of four to five times a year is recommended as shown in Table 2. The end of harvest application in December-February can be split into two if the rain is intensive and prolonged. The application during fruit development can also be split into two if the flowering and fruiting is protracted. It is imperative that trees be irrigated shortly after the fertiliser has been applied to facilitate plant uptake and to minimise losses from leaching, run-off, etc.

ORGANIC FERTILISER APPLICATION

Organic fertilisers such as animal manure should only be used as supplements because they are very low in macro-elements and large amounts are needed to equate to inorganic fertiliser. However, they should be used to improve soil structure and water holding capacity as well as soil fertility. Guidelines for use of organic fertilisers are shown in Table 3.

CALCIUM AND MAGNESIUM REPLENISHMENT - LIMING

Calcium deficiency is common on very acid soils or even those that have a somewhat low pH. In these soils calcium becomes 'fixed' making it unavailable. Calcium deficiency may also occur in soil with a high nitrogen or phosphorus content.

Calcium and magnesium can be replenished by using dolomite which contains 15-22% Ca and 8-20% Mg depending on the source. Gypsum and lime, which supply only calcium, can be used to replenish the calcium removed. Calcium deficiency can also be easily corrected by foliar sprays of calcium nitrate (5-15 g/L) or calcium chelate (2-3 g/L) etc. Such calcium compounds should never be used with sulphate salts of other elements as this will result in precipitation of the insoluble calcium sulphate.

The usual practice is to lime the soil to correct soil pH with dolomite, dolomite and lime or dolomite and gypsum. Lime alone is very effective in raising the pH but supplies only Ca whereas dolomite supplies magnesium and calcium as well as lifting the pH. Gypsum alone has a negligible effect on pH change and should only be used for correcting calcium deficiency. The actual amount of lime or dolomite to use to correct the pH depends on the soil type, soil pH and fertiliser source. For example to raise the pH from < 5 to 6 may require up to 5 tonnes/ha of lime or dolomite. Liming is recommended once a year for rambutan, as most soils are low in calcium, and this may be done in January/February or May/June.

MICRO-NUTRIENT FERTILISATION

Fruit trees require these micro-elements in very sparing quantities. Deficiencies of micro-nutrients are easily detectable by visual qualitative symptoms. Rambutan trees in the NT usually suffer from deficiencies of zinc, iron and boron and sometimes manganese. Deficiencies of these elements can be corrected by foliar sprays or soil application. For foliar applications, sprays are timed to coincide with the appearance of new vegetative flushes, i.e. in January/February, March/April and May/June (because young leaves absorb the spray more readily than do old leaves). Soil application can be administered via soil drenching or fertigation. In cases of acute deficiencies, two to three consecutive sprays 10-14 days apart may be necessary. A small quantity of a wetting agent or 0.5-1% urea (low in biuret) can be added to aid absorption by the foliage.

Zinc deficiency can be corrected by using zinc chelate or zinc heptahydrate at 2 g/L spray, or the latter at 7-8 g/m^2 soil application or zinc oxide soil application at 5 g/m^2. Iron deficiency can be overcome by using iron chelate at 1 g/L spray or 2-3 g/m2 soil applied or 3-5 g/L ferrous sulphate spray. On calcareous soils or high pH soils avoid soil application. Manganese deficiency can be ameliorated by spray applications of manganese sulphate at 2 g/L or manganese chelate at 1 g/L. Boron (B) deficiency can be corrected by using borax or solubor. Borax is not compatible with other chemical sprays and is used on its own as 1-3 g/L sprays or 2-3 g/m^2 soil application. Solubor is more compatible and can be used at 0.5-2 g/L sprays but avoid mixing with zinc sulphate which results in precipitation of the insoluble salt. Copper deficiency is not common on rambutan because of sprays of protective copper containing fungicides used at rates of 5-10 g/L for control of diseases in rambutan. Molybdenum (Mo) deficiency can be corrected by liming soil or by sprays of sodium molybdate at 1 g/L.

FERTIGATION

Fertilisers can be applied through the irrigation system. This process is commonly referred to as "fertigation". Soluble forms of commonly available fertilisers are selected or special proprietary soluble/liquid fertiliser mixes can be used.

There are no tried and tested fertigation recipes for rambutan, however, a schedule can be calculated based on the granular fertiliser program. A regular soil and leaf nutrient monitoring program will allow modifications to be made. If fertigating, then the frequency of application should be increased to 10-12 times per year. A simple application schedule could be as presented in Table 4.

EXAMPLE OF A FERTIGATION MIX FOR 10 YEAR OLD TREES

Ideally, the fertilisers described above and shown in Table 5 should be added in three separate lots to 200 L of water per injection period to avoid any incompatibility problems. Mix 1 containing N, P and K can be made up of 18.5 kg MAP (monoammonium phosphate), 23.1 kg KNO3 (potassium nitrate), 7.32 kg K_2SO_4 (potassium sulphate) and 12.26 kg urea. Mix 2 includes Zn, Fe, Mn and Mo as in Table 5. Mix 3 consists of B by itself. Note the following mixes are examples only. If you wish to use other fertilisers do so after consulting with DBIRD Horticulture or your fertiliser supply representative. More details on rambutan fertilisation and fertigation are found in Technical Bulletin No. 261 "Rambutan Crop Nutrient Requirement and Management".

Table 1. Fertiliser schedule for a fruiting rambutan tree

Tree age (years)	Yield kg/tree/year	Fertiliser kg/tree/year	Nutrients in g/tree/year		
			N	P	K
3	10	2.0	200	100	180
4	15	2.5	250	125	225
5	20	3.0	300	150	270
6	30	3.5	350	175	315
7	40	4.0	400	200	360
8	50	4.5	450	225	405
9	60	5.0	500	250	450
10	75	5.5	550	275	495

Table 2. Frequency of fertiliser application

Frequency	Months	% of amount/year
4 (following late fruiting in the previous season)	January/February	30
	April/May	20
	July	25
	August/September	25
5 (following early fruiting in the previous season)	December/January	30
	March/April	20
	May/June	20
	August	15
	September/October	15

Table 3. Schedule and rates for chicken manure fertiliser

Tree age (years)	Amount kg/tree/year	Freq/ year	Dynamic Lifter® (g)				Common chicken manure (g)			
			N (4%)	P (3%)	K (1%)	Ca (7%)	N (5%)	P (2%)	K (1%)	Ca (3%)
3	2	1	80	90	20	140	150	40	20	90
4	4	1	160	120	40	280	200	80	40	120
5	5	2	200	150	50	350	250	100	50	150
6	6	2	240	180	60	420	300	120	60	180
7	8	2	320	240	80	560	400	160	80	240
8	10	2/3	400	300	100	700	500	200	100	300
9	10	2/3	400	300	100	700	500	200	100	300

Table 4. Schedule for fertigating rambutan

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Applications	1	2	1	1			1#	1	1	1	1	1

apply when greater than 50% of trees are in flower

Table 5. Fertigation injection requirements for 10 year old rambutan trees based on granular fertilser rates in Table 1

Nutrient	Annual requirement	kg/200 trees/year	g per injection
Nitrogen (N)	550 g/tree/year	110	10000
Phosphorous (P)	275 g/tree/year	55	5000
Potassium (K)	495 g/tree/year	99	9000
Zinc (Zn)	7 g/m^2/year, zinc sulphate	53	4800
Iron (Fe)	2.5 g/m^2/year iron chelate	19	1727
Manganese (Mn)	1.0 g/m^2/year manganese	7.6	690
Boron (B)	1.0 g/m^2/year, Solubor	7.6	690
Molybdenum (Mo)	0.1 g/m^2/year, sodium	0.76	69

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Department of Primary Industry, Fisheries and Mines

ISSN 0157-8243
Serial No. 715
Agdex No. 238/19