

## How much nutrient to put on

The tables below show an estimate of the amount of nutrients (in kilograms per hectare) removed from the tree in the fruit according to fruit variety and yield (in tones per hectare). These are known as crop nutrient removal rates. Crop nutrient removal rates are a starting point for estimating how much of each nutrient needs to be replaced annually. If the nutrients aren't replaced, the mining of the soil will reduce nutrient availability over time and this can be difficult to correct.

**NOTE:** Estimates of the amount of nutrients lost to the environment and through leaf fall and pruning need to be added to the below crop nutrient removal rates account for total nutrient use in the orchard.

### Navels

Nutrients (kg/ha)	Tones of fruit per hectare				
	10	20	30	40	50
Nitrogen (N)	18	35	53	71	89
Phosphorus (P)	2	4	7	9	11
Potassium (K)	27	53	80	106	133
Calcium (Ca)	7	14	22	29	36
Magnesium (Mg)	2	4	7	9	11



### Mandarins

Nutrients (kg/ha)	Tones of fruit per hectare				
	10	20	30	40	50
Nitrogen (N)	15	31	46	61	77
Phosphorus (P)	2	3	5	6	8
Potassium (K)	21	41	62	82	103
Calcium (Ca)	5	10	15	20	25
Magnesium (Mg)	1	2	3	4	6



### Grapefruit

Nutrients (kg/ha)	Tones of fruit per hectare				
	10	20	30	40	50
Nitrogen (N)	11	21	32	42	53
Phosphorus (P)	1	3	4	5	7
Potassium (K)	20	40	60	80	101
Calcium (Ca)	4	8	12	16	21
Magnesium (Mg)	1	2	3	4	6



## When to put nutrient on

Summary of nutrient application times given as a percentage of annual application

	Nitrogen	Phosphorus*	Potassium	Calcium
Pre-bloom to Flowering	40-50%	100% (50%)	30-40%	70-80%
Cell Division	25%	(50%)	30-50%	
Cell Expansion	25%		30%	

\* Figures in brackets refer to phosphorous applied through fertigation

## Example fertiliser program

**NOTE:** This program only replaces nutrient removed by the fruit and does not account for nutrients used in tree growth and environmental losses. Environmental losses vary according to climate, soil type, the form of fertiliser used (particularly nitrogen), the frequency of fertiliser application and other management practices (particularly irrigation). You need to add extra fertiliser over and above that removed by the crop to account for these losses.

Bob has a block of Washington navels that produce about 40 tones of fruit per hectare a year.

### Navels: crop nutrient removal (kg/ha)

	Tones of fruit per hectare				
	10	20	30	40	50
Nitrogen (N)	18	35	53	71	89
Phosphorus (P)	2	4	7	9	11
Potassium (K)	27	53	80	106	133
Calcium (Ca)	7	14	22	29	36
Magnesium (Mg)	2	4	7	9	11

To develop a fertiliser schedule, Bob multiplies the amount of each nutrient to be applied annually by the percentage required at each growth stage.

For example, Bob needs to apply 70 kilograms of nitrogen per hectare per year. 50% of annual nitrogen is applied in the pre-bloom to flowering stage (August to October):  $0.5 \times 70 = 35$ . Therefore Bob will apply 35 kg/ha nitrogen in split applications from August to October.

### Bobs fertiliser schedule: nutrient applied in kilograms per hectare

	Nitrogen	Phosphorus	Potassium	Calcium
<b>Total annual requirement</b>	<b>70 kg/ha</b>	<b>9 kg/ha</b>	<b>106 kg/ha</b>	<b>29 kg/ha</b>
Pre-bloom to Flowering <i>August to October</i>	35 kg/ha (50%)	9 kg/ha (100%)	32 kg/ha (30%)	20 kg/ha (70%)
Cell Division <i>November to December</i>	17.5 kg/ha (25%)		42 kg/ha (40%)	
Cell Expansion <i>January to April</i>	17.5 kg/ha (25%)		32 kg/ha (30%)	9 kg/ha (30%)

The next step is to look at the products available to achieve these rates keeping in mind the effectiveness and impacts of different formulations. In the case of Nitrogen, application of urea to cold soils, nitrate forms of nitrogen such as calcium nitrate ( $\text{CaNO}_3$ ) are a much better option when temperatures are low.

### Calculating fertiliser application

It is best to look at each growth/phenological stage separately when working out what fertilisers to buy. If you work out your budget based on annual requirement you may apply incorrect forms of nitrogen at the wrong time of year.

Example: If you need to apply 35 kg/ha Calcium this is equivalent to 184 kg/ha of Calcium Nitrate (19% Ca & 15.5% N). If you apply 184 kg/ha Calcium Nitrate you are also applying 29 kg/ha Nitrogen. If you need to apply 36 kg/ha Potassium this is equivalent to 94 kg/ha of Potassium Nitrate (38% K 7 13% N). If you apply 94 kg/ha Potassium Nitrate you are also applying 12 kg/ha Nitrogen. You have now applied 41 kg/ha of nitrogen with your calcium and potassium applications.