



Fertiliser selection and use

Plants require a broad range of nutrients for healthy growth. They require an optimum amount of each nutrient and they also require them to be available at the right time. For most nutrients, especially when grown in pots, plants need a consistent and ongoing supply throughout their life. For most growers, this is achieved by supplying high-quality controlled release fertilisers.

Controlled release fertilisers

Controlled release fertilisers (CRF) are fertilisers that have been completely coated by a resin or polymer. The coating slows water absorption by the fertiliser and regulates nutrient diffusion into the soil (Figure 1).

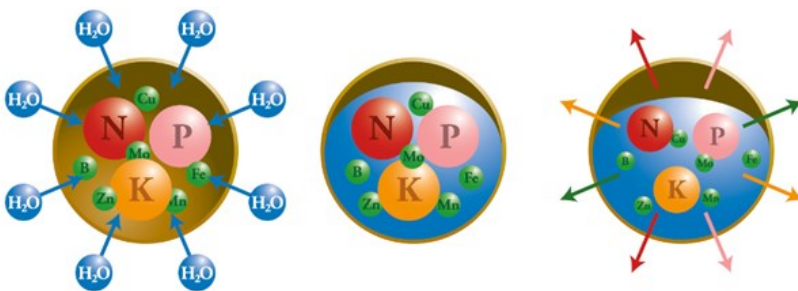


Figure 1. The process of nutrient release from CRF's.

It is challenging to manufacture CRF's that provide the same rate of nutrient delivery from each batch. The highest quality CRF's, such as Osmocote Exact, are tested extensively before sale to ensure a precise nutrient release. This ensures safety and reliable performance when used in nurseries. Due to its safety, plant roots are often seen to grow around and in direct contact with Osmocote granules (Figure 2).

The rate of nutrient release and how long a CRF will supply nutrients is determined during manufacture by altering the coating thickness. Osmocote is labelled with different longevities, from as little as 6 weeks and up to 18 months, to allow growers to select products that will feed for the entire production period, or until repotting, for most crops. The longevity label indicates the period that the fertiliser will continually release nutrients after application.

The first generation of Osmocote was the original controlled release fertiliser, developed in 1965. Osmocote revolutionised fertiliser use in nursery crops. For the first time, one application of fertiliser could feed a crop until sale.

Osmocote substantially improved the safety of fertiliser application to crops and reduced nutrient leaching from pots. This allowed growers to easily transition to soil-less growing media. Thus, the growing system that we know today was born.



Figure 2. Osmocote provides incredible safety and efficiency with plant roots preferring to grow around and in direct contact with Osmocote granules.

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Effect of Temperature

Controlled release fertilisers release nutrients at a faster speed in warm temperatures and a slower speed in colder media. Osmocote will release nutrients at any temperature above 0°C and release conditions are tested up to 100°C to ensure the coating is structurally sound well beyond growing temperatures. The labelled release rate of Osmocote is referenced to 21°C, though ICL can provide growers with release rates at all production temperatures. A 21°C reference is appropriate because most production centres in Australia and New Zealand have similar average day and night temperatures, particularly during the warmer months (Table 1).

Table 1. Average air temperatures (°C) of cities in Australia and New Zealand (www.bom.gov.au, www.niwa.co.nz).

Location	Average day and night temperature (°C)		
	April - September	October - March	Annual
Adelaide	13.8	21.0	17.4
Auckland	12.8	17.5	15.1
Brisbane	17.1	23.7	20.4
Cairns	23.0	26.8	25.0
Christchurch	9.1	15.4	12.2
Melbourne	11.4	17.8	14.6
Hobart	10.1	15.2	12.7
Perth	15.1	21.7	18.4
Sydney (Dural)	13.2	20.2	16.7

Growers often expect that temperature has a large effect on nutrient release rate. However, Osmocote is quite resistant to temperature changes. Measurements have shown that a 6°C increase in average temperature (equating to the difference between Melbourne and Brisbane) will increase the release rate of Osmocote Exact 12-14M by less than 10% of the nutrient applied, cumulative over the life of the product. This equates to a relatively minor increase in nutrient release, especially as we are comparing cool temperate and subtropical growing environments.

Selecting the correct longevity and rate



ICL's recommended application rates account for differences in the nutrient release from each longevity. When applied at the recommended rate, each longevity will supply nutrients to the crop at an approximately equivalent rate, which means that plants grown with 7 g/L of 12-14M Osmocote will receive, on average, similar amounts of nutrient each day as plants grown with 5g/L of 5-6M Osmocote (Table 2). Because of their differences in longevity, the two fertilisers would maintain that supply for different periods of time.

Table 2. Longevity range of Osmocote fertilisers, recommended application rates and resulting nutrient delivery.

Osmocote Exact Longevity	Recommended rate (g/L or kg/m ³)	Average nutrient delivery at rec. rate (mg/litre/day)
3-4M	3-4	13-17
5-6M	4-5	13-16
8-9M	5-6	14-17
12-14M	6-7	13-15
16-18M	8-10	12-15

For most crops CRF should be applied once per crop production cycle or until repotting. Topdressing fertiliser is usually not necessary unless crops remain in the same pot for more than 16-18 months. If CRF is not lasting the full longevity, it may indicate that a higher rate needs to be applied at potting. Topdressing is labour intensive, it increases the nurseries overall fertiliser budget and surface application of nutrients can encourage weed growth. Occasionally topdressing may be required on crops that have been held longer than planned. However, it is often better to replot these plants and CRF can be reapplied at the same time.

The CRF application rate should be determined after choosing what longevity to apply. For most crops we recommend the rate ranges in Table 2. The higher rate is usually recommended for premium stock and faster growing plants.

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Dilution effect when repotting

When repotting and fertiliser is incorporated in the media it is important to increase CRF rates to account for the dilution effect. Small plugs have an insignificant root volume, but larger pots contain large root systems in which the initial application of CRF is likely to have been exhausted. The existing root system may take up enough space in the new pot to significantly dilute the fertiliser supply from the new media (Figure 3). The rate of CRF incorporated into the new media should be increased to compensate according to:

$$\text{Required fertiliser rate (g/litre)} = \frac{\text{Target application rate (g/L)}}{\text{Volume of new media (L)}} \times \text{Total pot volume (L)}$$

For example, if the target CRF rate is 6 g/L and we are potting-up from a 2-litre pot into a 5-litre pot, 10 g/L of CRF would need to be incorporated into the new media prior to repotting (Table 3). The additional CRF can alternatively be applied by topdressing or as a dibble application. If applying at more than 14 g/L, please contact ICL to discuss options first.



Figure 3. Large existing root systems take up significant space when repotting older stock. The incorporated CRF rate may need to be increased to achieve the target application rate.

Table 3. Incorporation rate of CRF (g/L) required to achieve 6 g/L when accounting for the dilution effect

		New pot size (L)							
		1.3	2	3	4	5	7	8	14
Initial pot size (L)	0.5	9.8	8	7.2	6.9	6.7	6.5	6.4	6.2
	1.3		17.1	10.6	8.9	8.1	7.4	7.2	6.6
	2			18.0	12.0	10.0	8.4	8.0	7.0
	3				24.0	15.0	10.5	9.6	7.6
	4					30.0	14.0	12.0	8.4
	5						21.0	16.0	9.3
	7							48.0	12.0
	8								14.0

Application methods and safety to crops

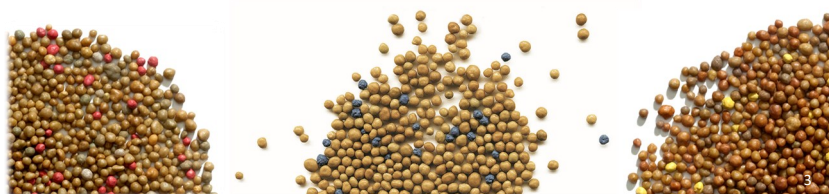
CRF can be applied by incorporating the fertiliser throughout the growing media, by dibble application (application of the correct dose in one place, often directly below the plant) or by topdressing on the surface of the pot. CRF can be incorporated by the media supplier or in dedicated mixers onsite. CRF is usually dibbled inline on potting machines or can be dibbled using a calibrated spoon, which is common practice when repotting large, established trees. Most dibbling methods in pots up to 10L concentrate fertiliser in one place close to the plant roots. Therefore, when dibbled, the release rate and safety of the fertiliser is paramount. To ensure plant growth is not negatively impacted, dibbled CRF should have reliable release rates (batch-to-batch), have a minimum longevity of 5-6M and, like Osmocote Exact, be chloride free. For these reasons we recommend Osmocote Exact for optimum safety when dibbling



Figure 4. One form of dibble application.

Marker Prills

Osmocote Exact is the only CRF that contains different coloured marker prills for each longevity. Marker prills help staff to easily identify which product is in use, which can help avoid costly mistakes such as the wrong CRF being applied. Marker prills also help to identify the CRF after application and throughout the life of the crop. This is invaluable when checking plant growth and auditing work.



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Starter fertilisers

Even after composting, ongoing microbial activity is inevitable in bark as a broad range of non-pathogenic fungi and bacteria continue to consume carbon within the media. Composted pinebark has a high carbon to nitrogen ratio, so microbes will absorb some of the nitrogen applied in the fertiliser. Starter fertilisers containing nitrogen are commonly incorporated into bark-based media to compensate. Starter fertilisers, such as Osmoform, contain slow release nitrogen that will provide 6-8 weeks of additional nitrogen supply. Osmocote Start is a fully coated controlled release starter fertiliser that provides 6 weeks of additional nutrient supply. Conventional (uncoated and soluble) starter fertilisers are readily lost by leaching (Table 4), therefore slow or controlled release starters are significantly more efficient.

Trace element packages

Plant uptake of some trace elements, especially boron and calcium, is strongly affected by plant transpiration rates. Under humid conditions with insufficient air flow (e.g. when a glasshouse or polytunnel is closed) transpiration slows and the uptake of trace elements to growing points is restricted. Under these conditions, plants may be unable to take up trace elements, even if sufficient fertiliser has been provided (Figure 5). For susceptible crops (particularly bedding plants, herbs and vegetables) it is essential to maintain adequate airflow so that trace element uptake can occur.



Figure 5. Insufficient air flow can limit boron and calcium uptake, which can lead to distortion of new leaf growth.

Water Soluble Fertilisers

Water soluble fertilisers (WSF), such as Peters and Universol, are dissolved in water and applied as a liquid. The most efficient way to apply water soluble fertilisers is by accurately dosing the dissolved fertiliser into an irrigation system. Water Soluble Fertilisers suit intensive glasshouse production where plants are grown on flooded benches or where the fertiliser can be applied at low rates, regularly, through spray booms or dripper systems. Water soluble fertilisers are unsuitable for general container nursery stock production where irrigation is applied by sprinklers. A larger proportion of the fertiliser would fall in the spaces between pots and the distribution pattern could be affected by wind.

Growers need a laboratory test of their irrigation water prior to selecting WSF's. Hard water that is high in calcium may need treatment before dissolving fertilisers that are high in phosphorus or sulphur. Soft water requires the addition of calcium and magnesium fertiliser, but this may need to be mixed into a separate tank to phosphorus and sulphur. ICL have produced unique Peters and Universol formulations that are designed specifically for hard or soft water. This takes out a lot of the guess work when selecting the right WSF and can allow growers to use a much simpler single tank and injector system. For further information please contact ICL.



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Nutrient Loss from Pots

Good quality growing media is freely draining. Drainage promotes healthy root growth because it allows oxygen to penetrate the media. Drainage water may also carry nutrients that can increase algal growth on paths and in dams and waterways. Controlled release fertilisers are highly effective at reducing leaching (loss of nutrients in drainage water) because they are not immediately soluble and they slowly release nutrients over an extended period. Osmocote was designed to closely match the release rate of nutrients to the rate of uptake by plants. As a result, trials have shown that Osmocote substantially reduces nutrient leaching from pots compared to water soluble and conventional starter fertilisers (Table 4).

Table 4. Leaching rates of nitrogen and phosphorus from nursery pots following the application of water soluble fertilisers (fertigation), compound starter fertiliser and Osmocote Exact 12-14M.

Pot size (litres)	Nitrogen			Phosphorus		
	Water Soluble (WSF)	Starter Fertiliser	Osmocote Exact 12-14M	Water Soluble (WSF)	Starter Fertiliser	Osmocote Exact 12-14M
<1	50%	40%	6%	50%	40%	4%
1-2	45%	30%	5%	45%	30%	3%
>2	40%	20%	4%	40%	20%	2%

Ultimate in Safety and Performance

The choice of fertiliser and application rate can have a direct effect on the profitability of nursery businesses. Plants need to be of a high quality and ready on time. Stock losses or production delays will directly affect sales and unnecessary topdressing increases labour costs. The use of a high quality CRF, such as Osmocote, may be the most efficient option for the following reasons:

- Osmocote Exact has the tightest performance specifications and testing criteria of any controlled release fertiliser. Nutrient release is tested from every batch to ensure that it performs reliably every time.
- Osmocote resists temperature fluctuations and is chloride free to ensure ultimate safety to plants.
- Coloured marker prills in Osmocote Exact help with product identification, because it is easy to mistake one fertiliser for another in busy potting sheds.
- Trace element delivery has been improved to supply evenly throughout the life of the fertiliser.
- Trials have shown a dramatic reduction in nutrient leaching compared to alternative fertilisers.



Please contact ICL for further information or to discuss fertilisers options that might be right for your business.



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