Agritopic

November 2021

CUSTOM BLENDS

Custom Blends allow fertilisers to be tailored to individual farm and paddock needs. Several nutrients can be applied in the one application, at the required rates. Mistakes, however, can be made in their formulation. Some ingredients have poor compatibility when mixed together, adversely affecting storage and handling characteristics, while trace elements may be added at either too low or too high a rate due of uncertainty as to their application rates. As a result, deficiency may remain uncorrected, or toxicity may be induced. This Agritopic has been prepared to provide an insight into Incitec Pivot Fertilisers blending procedures, and to assist in formulating the appropriate blends.

What are the most economical ingredients?

Usually, these will be Urea if you require nitrogen (N), DAP if you require phosphorus (P) and Muriate of Potash if you require potassium (K). MAP is often preferred to DAP in grain and cotton, and SuPerfect in pasture. If you require sulfur (S), it is usually best applied as Gran-am in crops, and as SuPerfect in legume-based pastures. Sulfate of Potash is not an economical way to apply sulfur. It should only be used where the chloride in Muriate of Potash is detrimental.

Are all blend ingredients compatible?

Incitec Pivot Fertilisers classifies blend ingredients as being “Compatible”, having “Limited Compatibility”, or being “Incompatible”. Most fertilisers can be mixed together. Some, however, cannot, as they either react with each other, or the resultant blend has a depressed Critical Relative Humidity (CRH).

The Critical Relative Humidity (CRH) is the relative humidity (at a given temperature) above which a fertiliser readily absorbs moisture from the atmosphere, and below which it will not absorb atmospheric moisture. The higher the CRH, the less likely the product is to absorb moisture.

The CRH of fertilisers such as Urea, DAP, MAP, SuPerfect and Muriate of Potash is typically in the range of 70 – 90%. The CRH of ammonium nitrate-based fertilisers, such as Cal-Am and Nitrophoska Special, is much lower, at around 60%. Blends in which Cal-Am and Nitrophoska Special are used should only be ordered as required and used quickly. They should not be stored for extended periods.

Kieserite (magnesium sulfate) and Zinc Sulfate Monohydrate also have a CRH around 60%. Generally speaking, the Critical Relative Humidity of blends is at best equal to that of the blend ingredient with the lowest Critical Relative Humidity. It is often depressed below this figure.

The following table shows the extent to which the CRH of blends in which Urea is used is depressed. Urea itself has a CRH of 73%.

Ingredient	CRH	CRH in Blends with Urea
Ammonium Nitrate (Constituent in Cal-Am and Nitrophoska Special)	59	18
Ammonium Sulfate (Gran-am)	79	56
Diammonium Phosphate (DAP)	82	62
Monoammonium Phosphate (MAP)	92	65
Potassium Chloride (Muriate of Potash)	84	60

As the data indicates, Urea and Ammonium Nitrate are incompatible in dry blends. The resultant blend has a depressed CRH (less than 20%). It will rapidly absorb moisture. For this reason, Urea is not blended with Cal-Am or Nitrophoska Special.

Of the ammonium phosphate fertilisers, DAP, which has a higher nitrogen content, is more likely to absorb moisture than MAP. Consequently, blends containing DAP are more likely to set in storage than blends containing MAP. It is recommended that DAP, and blends in which it is used, not be placed in silos.

DAP's hygroscopicity is one of the reasons why MAP is preferred to DAP in grain growing areas. The other is that the extra nitrogen in DAP is more likely to burn the roots of emerging seedlings if the fertiliser and seed are placed in direct contact with each other.

In general, the greater the number of ingredients used in a blend, the poorer its keeping qualities. Keep the number of ingredients to a minimum!

The following graph summarizes an investigation into the incidence of complaints received by Incitec Pivot Fertilisers on the use of its products in 2011/12.

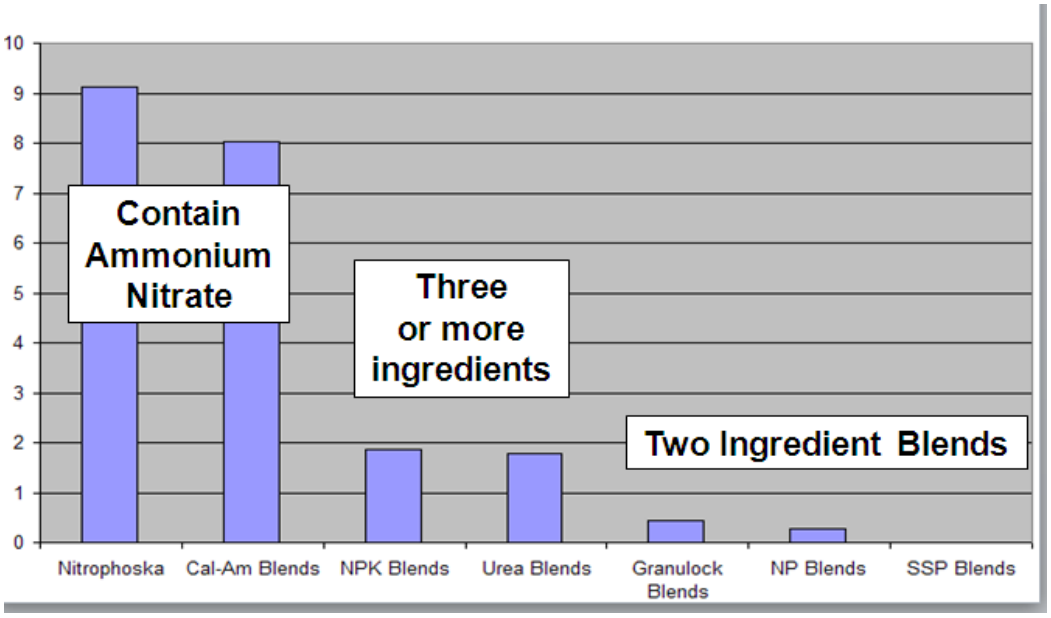

Figure 1: Complaints per 10,000 tonne of product (2011-12).

What blend ingredients are incompatible?

In addition to blends of urea and ammonium nitrate-based fertilisers (discussed above), blends of Urea and superphosphate (SuPerfect) are treated as incompatible.

When mixed together, chemically bound water of crystallization in the superphosphate is freed, causing the blend to become wet and sticky.

An exception to this rule is made ex some Distribution Centres in southern Australia, e.g. Geelong and Portland, for Urea plus SuPerfect blends that are taken directly to farm and spread on pasture on the same day. Such blends are unsuitable for use in cropping. They cannot be applied through precision application equipment, e.g., boxes fitted with worm drives or air-seeders, nor should they be bagged, or stored for any period of time.

What blend ingredients have Limited Compatibility if mixed together?

Blends containing ingredients with Limited Compatibility may absorb moisture, causing the product to set in storage and/or be difficult to apply. This may occur within a matter of days, depending on the physical quality of the fertiliser, prevailing weather conditions, and the way it is stored and applied. The blend should be used as soon as possible. It should not be stored for an extended period.

Problems may not be experienced on every occasion these blends are supplied. Compatibility is more likely to be an issue under humid conditions.

Table 1: Examples of ingredients that have Limited Compatibility together in blends

Urea	Magnesium Oxide Copper Granules Zinc Sulfate Monohydrate
DAP	SuPerfect Magnesium Oxide
SuPerfect	Zinc Sulfate Monohydrate
Kieserite	With most ingredients, given its hygroscopic nature.

Given farmer expectations that blends should be of reasonable quality, Incitec Pivot Fertilisers will advise on the Quote if the blend contains ingredients that have Limited Compatibility. The Agent or Dealer in turn should advise the end user customer.

Incitec Pivot Fertilisers will not accept claims for loss of quality or application difficulties for blends containing ingredients with Limited Compatibility. The cause of the deterioration in quality rests with the decision to blend the ingredients together, not the quality of the individual components of the blend.

What equipment is used to make blends?

Volumetric or Screw Blenders are used at most Incitec Pivot Fertilisers' Distribution Centres. The blend ingredients are stored in bins, from which they are augered to a central auger or belt, from where they are conveyed to the bulk despatch point or bagging equipment. The equipment is calibrated for each blend ingredient, taking into consideration its bulk density and flow rate.

Two sets of bins are used, large bins and augers for the major ingredients, e.g. Urea, Gran-am, DAP, MAP and Muriate of Potash, and a set of smaller bins and augers for the trace elements and specialty fertilisers, which are added at lower rates.

Both sets of augers operate best if the other ingredients are being fed at comparable rates. A 50:50 blend, for instance, will be more consistent in its analysis, than a 90:10 blend when one auger is operated at a high speed, and the other turns slowly.

What are the minimum addition rates used in blends?

Experience has shown that the large hoppers do not feed properly at addition rates below 7%. In the interest of providing customers with blends that are reasonably consistent in their analysis and meet their needs, this (7%) is the minimum rate of addition that has been set for ingredients fed through the large hoppers. The small hoppers feed best in the range of 2 – 7 %. A minimum addition rate of 1% has been set for most ingredients fed through the small hoppers.

The SuPerfect Concentrates, used to add copper, molybdenum and cobalt to SuPerfect and SuPerfect Potash blends for pasture, can be added through either the large or small hoppers. The minimum concentration at which the SuPerfect Concentrates can be requested in blends has been set at 3%. Below this concentration, these products will not usually supply enough copper, molybdenum or cobalt to be effective. Typical concentrations at which they are used with SuPerfect are:

- 4 – 12.5% SuPerfect Mo 0.2% and
- 12.5% SuPerfect Co 0.12%.

What options are available if a major ingredient is required at concentrations below 7%, or a trace element fertiliser at concentrations below 1%?

This is most likely to occur with fertilisers that supply a number of nutrients and therefore have to be applied at high rates, e.g. NPK blends, rather than NP or PK blends. The nutrients most likely to be involved are phosphorus (P), and the trace elements.

Consideration can be given to applying the nutrient(s) in question on a less regular basis, at a higher rate, so that over the course of time, much the same rates of nutrient are applied. For example, in sugarcane, phosphorus can be applied to the plant crop and early ratoons, and left off the older ratoons, so as to apply the same amount of phosphorus over a crop cycle.

In tree and plantation crops, two different fertilisers can be formulated, one with the nutrients in question, one without, and these can be alternated during the growing season, e.g. every second or third time. With immobile elements such as phosphorus (P), copper (Cu) and zinc (Zn), there may be no need to apply the element more often than once per annum, while nitrogen and potassium need to be applied on a more regular basis.

Where these nutrients (P, Cu, Zn) are applied on an annual basis, it is generally recommended that this be done in the late winter, prior to the spring flush and new growth. This will allow blends that are more consistent in their analyses to be supplied and used.

What are the maximum addition rates?

For most ingredients fed through the large hoppers, there are no maximum addition rates. For ingredients fed through the small hoppers, the maximum addition rate has been set at 20%. To achieve addition rates this high, a second and sometimes a third bin has to be cleaned out and used. The small hoppers feed best in the range of 2 – 7 %. As trace elements (micronutrients) are required at low rates, it is uncommon for addition rates above 7% to be requested.

For some blend ingredients, lower limits have had to be imposed on security or occupational health and safety grounds. Many trace element fertilisers are classified as Hazardous. Above certain concentrations, blends in which they are used may also be classified as Hazardous. Safety Data Sheets (SDS) are required for these blends, specifying all the ingredients that are present in hazardous amounts. Incitec Pivot Fertilisers has not prepared SDS to cover all possible scenarios. The combined maximum at which ingredients fed through the small hoppers can be requested in blends is 25%.

Details on compatibility and addition rates are provided in the following tables.

Blend Ingredient Compatibility and Addition Rates

Ingredient	Incompatible with:	Limited Compatibility	Addition Rate (%)	Comments
Urea	Cal-Am Nitrophoska Special SuPerfect (and, Mo & Co Concentrates) Kieserite	Magnesium Oxide Copper Granules Manganese Sulfate Zinc Sulfate Mono	> 7	Urea is an economical source of nitrogen (N). Blends of Urea and SuPerfect are treated as incompatible in most markets. They are available ex some Distribution Centres in southern Australia, e.g. Geelong and Portland, for despatch direct to farm for spreading on pasture on the same day.
Cal-Am	Urea Sulfur Bentonite Magnesium Oxide Kieserite Copper Granules		7 - 55	Cal-Am is Incitec Pivot's name for Calcium Ammonium Nitrate (CAN). Blends containing more than 55% Cal-Am are classified as SSAN (Security Sensitive Ammonium Nitrate). DAP is used as the phosphorus source in blends containing more than 25% Cal-Am. DAP is alkaline and has fire retardant properties, which makes the blend inherently safer to store and handle. Apart from Zinc Sulfate Monohydrate, Cal-Am should not be blended with metallic trace elements (Copper Granules, Manganese Sulfate and Granulock Big Z), which may sensitize the blend to decomposition. Cal-Am has a low Critical Relative Humidity. Blends in which it is used should be ordered as required and used quickly.
Gran-am		Kieserite	> 7	Gran-am is Incitec Pivot Fertilisers' name for granulated ammonium sulfate (Sulfate of Ammonia). Gran-am may be used as a source of nitrogen, e.g. in NPK blends for horticulture. Elsewhere, e.g. sugarcane, grain, cotton, forage crops and dairy pasture, it is commonly used as a source of sulphur, in combination with other nitrogen fertilisers. Gran-am supplies sulfur in the sulfate form, which is readily available for plant root uptake. This is the form in which sulfur should be applied in planting fertilisers, and in fertilisers that are side dressed during the growing season.
DAP		SuPerfect Magnesium Oxide	> 7	DAP is an economical source of phosphorus (P) for use in blends for horticulture, sugarcane and dairy pasture.

Ingredient	Incompatible with:	Limited Compatibility	Addition Rate (%)	Comments
		Kieserite		DAP, and blends in which it is used, should not be placed in silos. MAP should be used in preference to DAP if the blend is to be placed in a silo.
MAP		Kieserite	> 7	MAP is often preferred to DAP in planting fertilisers for grain crops and cotton. MAP has a lower nitrogen content than DAP, so it is less likely to affect germination and emergence.
Granulock SS				Granulock SS is a sulfur fortified MAP fertiliser.
Granulock Z		Kieserite	> 7	Granulock Z is a zinc enriched MAP fertiliser. It is used in place on MAP and DAP in grain and cotton where zinc is required at planting.
SuPerfect	Urea (see comments)	Kieserite Manganese Sulfate Zinc Sulfate Mono	> 7	SuPerfect is Incitec Pivot Fertilisers' name for Single Superphosphate. SuPerfect is primarily intended for use in pasture. It should not be used as the sole source of phosphorus in planting fertilisers for annual horticultural crops, as it is high in cadmium (300 mg Cd/kg P max.). Fertilisers that contain less than 150 mg Cd/kg P are recommended for use in tuber, root and leafy vegetable crops such as potatoes, carrots, onions, lettuce, spinach and silver beet, and in other risk situations. Blends of SuPerfect and Urea are treated as incompatible in most markets. They are available ex certain Distribution Centres in southern Australia, e.g. Geelong and Portland, for despatch direct to farm for spreading on pasture on the same day.
Muriate of Potash		Kieserite	> 7	Muriate of Potash (potassium chloride) is an economical source of potassium (K). It is used in pastures; sugarcane; maize, hay and silage crops; and many horticultural crops.
Sulfate of Potash		Kieserite	> 7	Sulfate of Potash is a more costly source of potassium than Muriate of Potash. It is often used where Muriate of Potash, which has a higher Salt Index, may damage crop roots, e.g. in planting fertilisers in sensitive crops such as French Bean, and in shallow rooted tree crops such as Avocado and Macadamia; and where the chloride in Muriate of Potash may be detrimental or affect the quality of farm produce.
Nitrophoska Special	Urea	Kieserite Zinc Sulfate Mono	> 7	Nitrophoska Special is a compound NPK fertiliser, containing 30% ammonium nitrate. Like other ammonium nitrate-based fertilisers, it has a low Critical Relative Humidity. Blends in which it is used should be ordered as required, and used quickly. Consideration should be given to reformulating the blend using Gran-am, DAP and Sulfate of Potash in its place. Incitec Pivot Fertilisers does not use Cal-Am, and metallic trace elements other than Zinc Sulfate

Ingredient	Incompatible with:	Limited Compatibility	Addition Rate (%)	Comments
				Monohydrate, in blends with Nitrophoska Special.
Sulfur Bentonite	Cal-Am Nitrophoska Special	Kieserite	7 – 20	Sulfur Bentonite contains 90% sulfur (S) in the elemental form. It must be converted to the sulfate form in the soil to be of use to plants. Sulfur Bentonite is intended for use in pastures. It is not recommended in annual crops where a quick response to sulfur is required. Sulfur needs to be applied in the sulfate form in these situations, e.g. as Gran-am. Sulfur dust, which is flammable and potentially explosive in air, may be generated when Sulfur Bentonite is being handled. To manage the safety risks in blending facilities, Incitec Pivot Fertilisers has imposed a maximum limit of 20% for Sulfur Bentonite in blends.
Magnesium Oxide			1 – 10	Magnesium Oxide is a dusty product. A maximum limit of 10% has been set to manage the dust hazard in the blending facilities.
Kieserite	Urea Cal-Am	All other ingredients	3.5 - 20	Kieserite (magnesium sulfate) is hygroscopic. It readily absorbs atmospheric moisture, affecting the quality of blends in which it is used. Kieserite is only available for use as a blend ingredient in southern Australia (Victoria, South Australia and Tasmania). It is not used in blends with Urea or Cal-Am and is treated as having Limited Compatibility with all other ingredients. Kieserite is not stocked and used as a blend ingredient at Distribution Centres on the east coast of Australia where the environment is more humid, i.e. Newcastle, Brisbane, Mackay, Townsville and Cairns. The minimum addition rate at which Kieserite is used is 3.5%, which supplies 0.5% magnesium (Mg). This is the minimum concentration of magnesium that can be declared on the product label under the fertilizer Australia Labelling Code of practice.
Granubor		Kieserite	1 – 20	Care needs to be taken with the use of boron. It is mobile in the soil, and toxicity is easily induced if applied at excessive rates or in the wrong way. It is recommended that Granubor not be used in planting mixtures that will be banded with/near the seed or transplants. If used in planting fertilisers, the fertiliser should be applied in a broad band along the intended position of the crop row, and then incorporated into the soil. Ulexite, a slow-release boron fertiliser, is available ex some Distribution Centres, for use in place of Granubor in forestry.
SuPerfect Cu 4% SuPerfect Mo 0.2% SuPerfect	As for SuPerfect.		> 1	These concentrates are used to add copper, molybdenum and cobalt to SuPerfect, and SuPerfect Potash Blends for use on pasture in southern Australia. They can be fed through either the small or large hoppers, depending on what concentration is required. The minimum concentration at which the SuPerfect Concentrates can be requested in blends

Ingredient	Incompatible with:	Limited Compatibility	Addition Rate (%)	Comments
Co 0.12%				has been set at 3%. Below this concentration, these products will not usually supply enough copper, molybdenum or cobalt to be effective. Typical concentrations at which they are used are 10 – 20% 4 – 12.5% SuPerfect Mo 0.2% and 12.5% SuPerfect Co o.12%. The SuPerfect Concentrates are not stocked in NSW and Qld. Copper Granules is used to add copper to pasture fertilisers in NSW and Qld. If molybdenum is required ex Newcastle, Adelaide, Portland and Geelong, it can be applied as a sodium molybdate spray over a moving belt of fertiliser, at 0.025 or 0.05% Mo. SuPerfect Mo 0.025% is stocked at Brisbane and Cairns for sale as a pasture topdressing fertiliser.
Copper Granules	Cal-Am Nitrophoska Special	Urea Kieserite	1 – 20	Copper Granules is used to add copper to blends in NSW and Qld, e.g. for sugarcane and horticulture. It is also used to add copper to NPK blends for use in horticultural crops in the southern States.
Iron Granules	Urea Cal-Am	Kieserite	1 – 16	Iron Granules is only intended for use in lawns and turf. Iron Granules is not recommended for use elsewhere. At concentration above 16%, blends in which Iron Granules is used are classified as a S5 Poison. SDS have not been prepared to cover the use of Iron Granules in blends at these concentrations.
Manganese Sulfate	Cal-Am	Urea SuPerfect Nitrophoska Special Kieserite	1 – 20	Manganese Sulfate is primarily intended for use in planting fertilisers for grain crops on calcareous soils in southern Australia. It is treated as having similar compatibility in blends as Zinc Sulfate Monohydrate.
Zinc Sulfate Monohydrate		Urea SuPerfect Nitrophoska Special Kieserite	1 – 20	Zinc Sulfate Monohydrate (33% Zn) is used in tree and plantation crops, sugarcane, and vegetable crops planted at wide row spacings. Less concentrated zinc fertilisers should be used in other circumstances. Granulock Z is recommended in grain and cotton, as it provides a more even and better distribution of zinc in the crop row, i.e. more point sources. Zinc Sulfate Monohydrate has a low Critical Relative Humidity (CRH). This also applies to blends in which it is used. The CRH of blends that contain Urea and Zinc Sulfate Monohydrate is depressed.
Granulock Big Z	Cal-Am	Kieserite	> 1	Granulock Big Z (10% Zn) is used to bolster the zinc content of blends in which Granulock Z is used, if higher zinc application rates are required. Granulock Z is also used in preference to Zinc Sulfate Monohydrate in pasture blends. Being less concentrated, it provides more point sources of zinc in

Ingredient	Incompatible with:	Limited Compatibility	Addition Rate (%)	Comments
				the field. Granulock Z can be fed through both either the small or large hoppers, depending on what concentration is required.

Does Incitec Pivot Fertilisers check the agronomic suitability of Custom Blends?

No. Given the number of Custom Blends that are requested, this would be an onerous task. Furthermore, Incitec Pivot Fertilisers would need to be provided with details on the crop being grown, where, when and how the fertiliser was being applied, its application rate and frequency of application, and details on all other fertilisers being applied through the life of the crop, on an annual basis, or during the crop cycle. This is best done on farm, in consultation with local advisers.

To assist in this task and recognizing that mistakes are commonly made with micronutrients, notes have been prepared on specialty and trace element fertilisers and their use in the latter pages of this document.

BLENDER OPERATION

Volumetric (Screw) Blenders are used at most sites. Their efficiency can be maximized by keeping the following points in mind.

Ideally, blends should contain no more than four (4) major ingredients and no more than three (3) minor ingredients. Where more ingredients are requested than there are hoppers available, the blend has to be put through the production line a second time. This slows blending operations considerably.

Volumetric Blenders operate best if the ingredients being fed through either the large or small hoppers are being added in approximately equal amounts. For example, a 50:50 blend of ingredients fed through the large hoppers will be more consistent in its analysis than a 90:10 blend. The minimum concentration that can be requested for ingredients fed through the large hoppers is 7%.

The hoppers used to add Magnesium Oxide, Kieserite and the Trace Elements operate most effectively at addition rates between 2 and 7%. Orders will be accepted down to 1% (3.5% in the case of Kieserite, and 3% for SuPerfect Concentrates). To add more than 7% of any one of these ingredients, two or more hoppers need to be used, i.e. for concentrations between 7 - 20%. The SuPerfect Concentrates can also be fed through the large hoppers if necessary.

Long production runs ensure more consistent quality. The very first and very last potions of any batch run, when the blender is starting and stopping, will be more inconsistent in their analysis than that made when the blender is in the middle of the production run, and operating smoothly.

Blending is not an accurate science, and blend formulations should reflect this. While any formulation is accepted, keep in mind that any blend showing a fraction of a percent, i.e. decimal places, for ingredients fed through the large hoppers, implies a degree of precision that is not achievable.

For the major ingredients fed through the large hoppers, round the formulation to the nearest one percent, if not five percent. This may not be possible if trace elements are requested through small hoppers at fractions of a percent, in order for the formulation to add to 100%.

FORMULATION TIPS

The golden rule is to keep the number of ingredients in blends to a minimum. Do not use more ingredients than is necessary. Use one source of phosphorus (P) and one source of potassium (K). Do not mix nutrient sources unless it is absolutely necessary.

In general, the greater the number of ingredients, the more variable the analysis will be, and the poorer the storage and handling characteristics of the blend.

Follow these steps when formulating Planting Fertilisers for annual crops, e.g. grain and vegetables, and for plant sugarcane:

1. Start with phosphorus (P)

MAP or DAP are economical sources of phosphorus (P) where nitrogen is required as well as phosphorus and have good compatibility in blends with most other ingredients. Use MAP in grain and cotton, DAP in sugarcane and horticulture.

SuPerfect should not be used as the sole source of phosphorus in vegetables as it is high in cadmium.

2. Is sulfur (S) required?

If so, add Gran-am so as to apply the required amount of sulfur. Granulock SS, a sulfur fortified MAP fertiliser, may also be used. Do not use Sulfur Bentonite. It supplies sulfur in the elemental form which must be oxidized in the soil to the sulfate form before it is of use to plants. This is a biological process that occurs most quickly under warm moist conditions and is slowed over winter.

Sulfur Bentonite is not suitable for use where a quick response to sulfur is required, e.g. in planting mixtures for high sulfur demanding crops such as canola. Sulfur Bentonite is only intended for use on legume-based pasture on soils high in phosphorus, where it can be broadcast on the soil surface, allowing the sulfur granules to disperse on wetting. If Sulfur Bentonite is drilled into the soil, the dispersion of the granules will be restricted by the surrounding soil.

3. What about nitrogen (N)?

Don’t add extra nitrogen to planting fertilisers if there is no need to. The use of MAP or DAP at planting (or MAP or DAP plus Gran-am where sulfur is also required) will usually provide enough starter nitrogen. The balance can be applied pre-plant or during the growing season.

Too much nitrogen at planting can affect root development and early plant growth; and in higher rainfall areas, is at risk of being lost before the period of maximum plant root uptake. Furthermore, adding another ingredient will affect blend quality. Blend storage and handling characteristics will be reduced, and application difficulties are more likely to be encountered at planting.

If extra nitrogen is required, e.g. in grain crops where nitrogen cannot be applied pre-plant or during the growing season, the first choice, in most circumstances, will be Urea. Urea is economical and has better storage and handling characteristics than Cal-Am.

4. Is potassium (K) required?

If so, Muriate of Potash is the most economical potassium source. Sulfate of Potash may be preferred to Muriate of Potash in crops that are sensitive to root burn, e.g. French Beans, Avocadoes, Macadamias, and where the soil and/or irrigation water is saline. If Sulfate of Potash is used, the need for sulfur (step 2) can be reviewed. It should no longer be necessary to add Gran-am to the blend.

5. What about other nutrients?

If other nutrients, e.g. trace elements, are required, add them at an appropriate rate.

If the fertiliser is intended for use in tree and plantation crops, make sure that the trace elements will not be over-applied. Recommended application rates for trace elements are often made on the basis that the nutrient will be applied once per annum, prior to the spring flush, and not every time a NPK fertiliser is applied during the growing season.

Be careful when formulating blends with boron (B). Boron is very mobile in the soil and can damage roots and plants, particularly in planting fertilisers. It is usually best to apply boron at some other time than planting, e.g. pre-plant, during the growing season, and/or as foliar sprays.

If boron is incorporated into planting fertilisers for vegetable crops, the basal fertiliser should be applied in a broad band along the intended position of the crop row, and then incorporated into the soil. It should not be placed in narrow bands adjacent to the seed or transplant material during the planting operation.

Further information on the application of secondary nutrients and trace elements is provided on the following pages.

SECONDARY AND TRACE ELEMENTS

Calcium

In field crops and pasture, calcium (Ca) deficiency is normally associated with soil acidity and is managed through the application of lime.

In horticultural crops, there may be a need for supplementary calcium during the growing season to prevent calcium deficiency, e.g. blossom end rot in tomatoes, bitter pit in apples. This is normally managed through the use of Calcium Nitrate, e.g. in fertigation programs and foliar sprays.

Incitec Pivot Fertilisers sells two other products that contain calcium, Cal-Am and SuPerfect.

SuPerfect contains calcium in the forms of monocalcium phosphate and calcium sulfate (gypsum). These compounds are sparingly soluble but are soluble enough to release calcium in sufficient quantity to allow plant root uptake.

Cal-Am is Calcium Ammonium Nitrate (CAN). It is comprised of 80% ammonium nitrate and 20% calcium carbonate (calcite), also known as lime. The calcium carbonate is added to Cal-Am as a dilutant, so that the end product does not have to be transported and stored as a Dangerous Good, not for its nutrient value.

Calcium carbonate is insoluble. Its application in Cal-Am at planting or during the growing season will not be of immediate benefit to plants. Cal-Am should only be thought of as a nitrogen fertiliser.

The solubility of the above calcium compounds in water is shown in the following table. The calcium in Cal-Am is one thousand (1 000) times less soluble than that in monocalcium phosphate, and one hundred thousand (100 000) times less soluble than that in calcium nitrate.

Solubility of Calcium Salts in Water (20^{O} C).

Compound	**kg/100 L**
Calcium Nitrate	152
Monocalcium Phosphate	1.8
Calcium Sulfate	0.26
Calcium Carbonate	0.0014

Calcium Nitrate has a low Critical Relative Humidity (47%). Should it be used in blends, the blend will have poor storage characteristics.

Magnesium

Incitec Pivot Fertilisers uses two magnesium (Mg) fertilisers Magnesium Oxide and Kieserite (magnesium sulfate monohydrate). Both have their drawbacks.

Magnesium Oxide

Magnesium Oxide is insoluble. It should not be used where a quick response to magnesium is required. Magnesium should be applied in the soluble sulfate form in these circumstances. Magnesium Oxide is best applied to the soil surface, rather than be drilled into the soil.

In annual crops, Magnesium Oxide should be applied early in the fallow period, at the same time that lime would be applied. Wait until rain is received to soften and disperse the granules, and then incorporate into the soil.

In tree, vine and plantation crops, Magnesium Oxide can be broadcast over the root zone.

Magnesium Oxide is not recommended for use at planting, or during the growing season in annual crops where responses to magnesium are expected. The magnesium it contains will not be released quickly enough to be of immediate benefit to crops. In these circumstances, magnesium can be applied dry to the soil as Kieserite, or by applying Magnesium Sulfate Heptahydrate (Epsom Salts) in solution, either in fertigation programs, and/or foliar sprays.

Kieserite

Kieserite is soluble and readily available for plant root uptake but is hygroscopic. Kieserite readily absorbs atmospheric moisture. Blends in which Kieserite is used have poor storage and handling characteristics and are classified as having “Limited Compatibility”. Kieserite is only stocked as a blend ingredient in southern Australia (Vic, SA, Tas). Kieserite is not stocked at the Distribution Centres on the east coast (NSW and Qld) where the climate is more humid.

Boron

Boron (B) is mobile in the soil. It moves with soil water away from the point of application and is subject to leaching. This has important implications on how Granubor (14.3% B) is applied. Granubor needs to be applied annually, i.e. each time a crop is planted, or at the start of the main growing season in tree crops, i.e. spring, if not more frequently. Soil applications of Granubor do not remain effective for several years, as is the case with micronutrients that are immobile in the soil, e.g. copper, zinc and molybdenum.

Root burn and toxicity can easily be induced if boron is applied at too high a rate or in concentrated bands, e.g. with or near the seed or transplants in planting fertilisers, or if it is distributed unevenly around trees.

Placement and timing are important. In vegetables and other annual crops, Granubor should be applied prior to planting, either as a pre-plant broadcast application or in a broad band along the position of the intended crop row, which can then be incorporated into the soil. Do not apply the crop’s complete boron requirements in narrow bands with or near the seed or transplants at planting. Only small amounts of boron (insufficient to meet the complete crop's requirements) can be safely used in planting mixtures applied this way. Alternatively, side-dress or foliar applications can be considered.

In tree crops, the fertiliser should be spread evenly under and around the trees, or in a broad band under and along the edge of the canopy or hedgerow. Do not apply closer than 30 cm to the trunk. As boron is subject to leaching, it will usually be best to split the seasonal or annual requirement for boron into a number of smaller applications (as is done with nitrogen).

Boron may not be required in young trees and vines before they have reached the reproductive (fruiting) stage.

The following table provides a guide to Granubor and boron application rates, per crop for annual crops, or per annum for perennial crops (trees, plantation crops and vines). Crops vary in their need for and tolerance of excess boron. The rates at which boron is required in some crops may be toxic to others.

Indicative Annual Granubor/Boron Application Rates.

Crop/Granubor Rate			**kg/ha B**
Tree Crops: 5 – 25 kg/ha Granubor, and typically, in the range of 10 – 20 kg/ha (1.5 - 3 g/m^2 of canopy cover). This is best split into 2 – 4 applications during the year or main growing season. Refer to the Granubor Use Directions for more specific advice.			0.75 – 3.5
Bananas: Apply 7 g/plant/application on two occasions each year. At 2 000 plants per hectare, this equates to an annual rate of 25-30 kg/ha of Granubor.			4
Grapes: 8 g Granubor per mature vine in August, which equals 12 kg/ha at 1 500 vines/ha. On very sandy soils, split this into two applications, at least four months apart.			1.5 - 2
Vegetables & Field Crops	**Crop**	**kg/ha Granubor**	
	Strawberry, French Bean.	2	0.3
	Maize	2 - 4	0.3 - 0.45
	Cucurbits	3	0.45
	Potato	4	0.6
	Cotton, Sunflower, Tomato	4 - 8	0.6 - 1.2
	Carrot, Celery, Lettuce, Onion	8	1.2
	Canola, Lucerne, Cabbage, Cauliflower, Beetroot.	8 - 12	1.2 – 1.8

With the exception of maize, boron is unlikely to be required in crops that are members of the grass family, e.g. winter cereals, sugarcane.

Granular Ulexite

Granular Ulexite (12% B) is a slow-release boron fertiliser that is available ex some distribution centres in Tasmania and on the southern Mainland. It is primarily intended for use in forestry where fertiliser (and boron) is not applied annually.

Ulexite contains boron in soluble (sodium borate) and insoluble (calcium borate) forms. The sodium borate provides a quick response, the calcium borate becomes available over a longer period of time. The dissolution of calcium borate in the soil is dependent on the soil pH. It will slowly dissolve on acid soils, as lime (calcium carbonate) does, but it may not become available or be effective on alkaline (high pH) soils.

Incitec Pivot Fertilisers is unable to advise on boron rates and the frequency at which boron should be applied in forestry. Seek professional advice before use, e.g. from forestry researchers.

Copper

Copper recommendations are generally made on the basis that copper is applied once every 5 to 10 years, e.g. in pasture, or in the planting mixture in sugarcane so as to last a crop cycle. In annual crops, and in perennial tree crops, copper can be applied in the same way, e.g. once every five years, or annually at lower rates. Cumulatively, the rates will be much the same over a number of years.

Where copper is known to be low, e.g. deficiency symptoms have been observed or soil and/or plant tissue analysis results are low, it may be best to initially apply copper at a high rate, and then apply annual maintenance applications at lower rates. Foliar sprays may also be required to help overcome the initial deficiency.

Copper is immobile in the soil. If surface applied without incorporation, it can be left stranded at the soil surface and be inaccessible to the roots of annual crops. Hence, if applied pre-plant during the fallow period in annual crops, it needs to be placed into the soil, or incorporated after application.

Root proliferation at the soil surface is better in tree crops and pasture,

<u>Copper Granules</u>

Copper Granules (Copper Oxysulfate) contains 25% copper. It is available as a blend ingredient in Qld and NSW, as well as southern Australia.

The recommended rate for Copper Granules in **pastures** on sandy soils is 8 kg/ha (2 kg/ha Cu) every 3 – 10 years.

In **sugarcane**, Copper Granules can be applied in the planting fertiliser at 40 kg/ha (10 kg/ha Cu) where copper deficiency (droopy top) has been observed, and at 20 kg/ha (5 kg/ha Cu) if soil copper is marginal. This should be sufficient to last a complete crop cycle (plant crop plus ratoons).

In **tree crops** Copper Granules can be applied at 20 – 40 kg/ha (5 – 10 kg/ha Cu) at intervals of around five (5) or more years. Spread evenly under and around the trees, and to the soil into which the roots will grow in the case of young trees. Alternatively, if copper is to be applied annually in tree crops, apply Copper Granules at 8 kg/ha (2 kg/ha Cu) per annum.

In **annual crops**, e.g. vegetables and grain crops, apply Copper Granules pre-plant at 20 – 40 kg/ha (5 – 10 kg/ha Cu) on clay soils, and 8 kg/ha (2 kg/ha Cu) on sands, at intervals of around five (5) or more years. The fertiliser should be drilled into the soil, or if broadcast, incorporated after application. If Copper Granules is applied annually with the basal fertilizer in crops planted at wide row spacings, a suggested application rate is 4 - 8 kg/ha (1 - 2 kg/ha Cu). Copper Granules is not recommended for use at planting in crops planted at narrow row spacings, e.g. winter cereals, as there will not be enough point sources of copper in the row to provide access for all plants. Uneven crop responses are likely.

Glaze Cu (CuTEC)

Copper (Cu) as Cuprous Oxide 573 g/kg (57.3% w/w). Glaze Cu is a trace element coating applied to straights and blends enabling a more even distribution of copper. Sprayed in 2 increments – 0.3% Zn & 0.5% Zn

- 0.3% Cu requires 0.53% Glaze Cu (2.3L)
- 0.5% Cu requires 0.88% Glaze Cu (3.9L)

Iron

Iron (Fe) is abundant in soils. Where iron deficiency occurs, it is not because there is not enough iron in the soil, but because the iron is present in forms that are not available for plant uptake. The same fate awaits soil-applied iron fertiliser. Where iron deficiency occurs, iron applied to the soil can be quickly converted to forms that are not available for plant uptake. Consequently, if iron is applied to the soil, it needs to be done at high rates, and such applications may be ineffective or short-lived.

Incitec Pivot Fertilisers stocks Iron Granules (Iron Oxysulfate), which contains 25% iron (Fe), for use in lawns and turf, where a typical application rate is 20 kg/ha (5 kg/ha Fe). As lawn grasses are shallow rooted and feed close to the soil surface, plant utilization of iron broadcast on the soil surface tends to be better than in deeper-rooted crops. Incitec Pivot Fertilisers does not recommend the use of Iron Granules elsewhere.

Economic responses to soil applied iron are unlikely in crops and pasture. If iron is required in horticultural crops, it is recommended that it be applied as a foliar spray. If iron is to be applied to the soil in crops, band applications are likely to be more effective than broadcast applications. As a guide, apply Iron Granules at planting, with the basal fertiliser, banded into the soil along the crop row, at:

- 40 kg/ha (10 kg/ha Fe) on heavy clay soils; and
- 2.5 – 10 kg/ha (0.5 – 2.5 kg/ha Fe) on sandy soils.

Higher rates may be required. In strawberries, apply Iron Granules at 1 – 2 g/m of row (0.25 – 0.5 g/m Fe).

Manganese

Like iron, manganese (Mn) is abundant in soils. Deficiency occurs because manganese is fixed in the soil, not because there isn't enough present. The main factor controlling manganese availability in the soil is pH. The more alkaline the soil, the more likely manganese deficiency is to occur. At low pH, i.e. in acid soil, manganese becomes more available and may reach toxic concentrations.

Manganese deficiency symptoms may be more prominent in the cooler wetter months and disappear during the warmer months of the year. Where deficiency occurs on alkaline soils, manganese needs to be applied at high rates. Such applications can be short-lived in their effect.

Incitec Pivot Fertilisers stocks Manganese Sulphate Granular (31% Mn) as a blend ingredient. It is primarily intended for use in planting fertilisers for crops grown on calcareous soils derived from limestone in South Australia.

Like phosphorus, manganese is best applied at planting, rather than pre-plant during the fallow period. This enhances its efficacy by:

- Reducing exposure to fixation sites, which would occur through mixing with the soil by cultivation during seedbed preparation.
- Minimizing the time available for fixation between application and crop establishment; and providing early access for plant roots.

Blending Manganese Sulphate Granular with MAP, which has an acidic effect on soil pH in the vicinity of the granules, may also help reduce fixation. A typical application rate for Manganese Sulphate Granular, when banded with the seed in planting fertilisers for grain crops in South Australia, is 10 – 20 kg/ha (3 – 6kg/ha Mn).

Foliar sprays are recommended elsewhere, e.g. vegetable and tree crops. Multiple applications may be needed. There will be no need to apply manganese fertiliser, either to the soil or foliage, where manganese-based fungicide sprays are used, e.g. mancozeb (Dithane M45). There is little evidence of manganese deficiency affecting pasture growth. If manganese is to be broadcast on alkaline soils, 50 – 100 kg/ha of Manganese Sulphate Granular (15 – 60 kg/ha Mn) may need to be applied.

Molybdenum

Molybdenum is important in nitrogen fixation in legumes. The *Rhizobium* bacteria in the root nodules of legumes have a tenfold higher requirement for molybdenum than the host plant. Though less common, molybdenum deficiency may still occur in non-legume plants. Cruciferous crops (particularly cabbage and cauliflower) and cucurbits have a high molybdenum demand.

Grasses are relatively tolerant of low molybdenum. Deficiency in cereals only occurs in extreme conditions. Molybdenum is most likely to be required on acid soils. Molybdenum is fixed in acid soils and is most available for plant uptake in alkaline soils.

Pasture

Molybdenum application rates in pasture are typically in the range of 25 - 100 g/ha Mo. Repeat applications may be required as frequently as every 3 - 4 years, or as far apart as once every 8 - 10 years; depending on the soil type, rainfall, pasture productivity and the rate at which molybdenum is applied.

Molybdenum can be added to pasture topdressing fertilisers in two ways:

- SuPerfect Mo 0.2% Concentrate, which is manufactured at Portland, and is used in southern Australia.
- Sodium Molybdate Solution, which is used at Newcastle.

Molybdenum is not available as a blend additive in Queensland. SuPerfect Mo 0.025% is stocked at Brisbane (Pinkenba) and Cairns for use on pasture. In NSW, Vic, SA and Tas, commonly requested concentrations of molybdenum with SuPerfect, and in other pasture fertilisers, are:

- 0.015% Mo
- 0.025% Mo
- 0.05% Mo

The amounts of molybdenum (g/ha Mo) applied at these concentrations at various product application rates are shown in the following table.

Amount of molybdenum (g/ha Mo) applied in molybdenum fortified products at various application rates.

Molybdenum Concentration (% Mo)	**Application Rate (kg/ha)**		
	125	**250**	**500**
0.015	-	38	75
0.025	31	63	-
0.05	63	-	-

The most commonly requested addition rate is 0.025% Mo. Lower concentrations, e.g. 0.015% Mo, are used where the fertiliser is applied at high rates, e.g. 250 – 500 kg/ha, and higher concentrations, e.g. 0.05% Mo, where low rates are applied, e.g. 100 kg/ha.

Crops grown in rotation with legume-based pastures should not need molybdenum if it has recently been applied during the pasture phase.

Crops

Molybdenum may be required in grain legumes, and in some vegetable crops. Where grain legume crops are to be grown, sodium molybdate can be sprayed onto the soil before planting and cultivated in as part of normal seedbed preparation operations, as an alternative to adding molybdenum to the planting fertiliser. As in pasture, repeat applications are not required for several years. If legume and non-legume crops are being grown in rotation, apply the molybdenum before planting a legume crop.

In vegetable crops that are susceptible to molybdenum deficiency, it is recommended that molybdenum be applied as a foliar spray, rather than to the soil. One or two sprays early in the growing season in the seed bed and/or field is all that is required, given that molybdenum is mobile in plants and is required in minute amounts.

Soil and foliar sprays allow a much more uniform distribution of molybdenum to be achieved in the field than is possible by adding it to the planting fertiliser. Molybdenum sprays might also be applied as part of other farming operations. Applying molybdenum to the soil with fallow herbicides, or to the foliage with insecticide and fungicide sprays, is convenient, provided there are no spray compatibility issues.

SuPerfect Mo 0.2%

SuPerfect Mo 0.2% Mo is mixed with ordinary SuPerfect and used in blends with SuPerfect and Muriate of Potash, to supply molybdenum (Mo) in pastures, ex Distribution Centres in southern Australia. It is not stocked in New South Wales and Queensland. The following table shows how much SuPerfect Mo 0.2% is required to supply molybdenum at various rates (g/ha Mo).

Amount of SuPerfect Mo 0.2% required to supply molybdenum (Mo) at various rates.

Molybdenum (g/ha Mo)	**SuPerfect Mo 0.2% (kg/ha)**
20	10
40	20
60	30
80	40
100	50

The following table shows how much SuPerfect Mo 0.2% must be added to a blend to achieve a concentration of 0.015%, 0.025% and 0.05% Mo in the final product.

Concentration at which SuPerfect Mo 0.2% needs to be added to blends to achieve various molybdenum concentrations in the end product.

Molybdenum Concentration (% Mo)	**SuPerfect Mo 0.2%**	
	%	**kg/t**
0.015	7.5	75
0.025	12.5	62.5 125
0.05	25	250

Sodium Molybdate Solution

Sodium Molybdate Solution, a 30% w/w solution of Sodium Molybdate (39% Mo) dissolved in water, is used to add molybdenum to pasture fertilisers at Newcastle, where the SuPerfect Mo 0.2% is not stocked. Sodium Molybdate Solution is applied as a spray over a moving belt of fertiliser. It is used at two rates, 0.025 and 0.05% Mo:

Zinc

Along with molybdenum in pasture, zinc is the most commonly requested micronutrient in blends. Zinc deficiency occurs on alkaline (high pH) soils, in which zinc is fixed in the soil, and on sandy soils that are low in zinc.

Zinc can be applied annually, i.e. each time a crop is planted, or at higher rates on a less frequent basis. Where applied annually, a typical application rate is 1 – 2 kg/ha Zn. Where applied on a less frequent basis, application rates vary, from 2 kg/ha Zn in pasture on acid sandy soils, to 10 kg/ha Zn in sugarcane and horticulture, and in alkaline clay soils cropped to grain and cotton, at intervals of around 5 years.

There are three options for applying zinc, as listed in the following Table. Each has its place.

Zinc Sources

Product	**% N**	**% P**	**% S**	**% Zn**
Granulock Z	11	21.8	4	1
Granulock Big Z	16.1	4.3	16.1	10

Zinc Sulfate Monohydrate	-	-	17.3	33

Granulock Z

Granulock Z is a zinc enriched ammonium phosphate fertiliser. It is comprised mostly of MAP, with 1% zinc (Zn). Granulock Z is primarily used in grain and cotton. These crops are normally planted with MAP, supplying the crop's complete phosphorus (P) requirements, and starter nitrogen (N). If zinc is required as well in grain and cotton, Granulock Z should be substituted for MAP.

The use of Granulock Z (1% Zn) ensures there are more point sources of zinc in the crop row than where blends with more concentrated zinc additives are used. This is important where zinc is applied annually in the planting fertiliser at low rates, e.g. 1 kg/ha Zn, particularly in crops planted at narrow row spacings, e.g. winter cereals such as wheat. If Granulock Big Z (10% Zn) or Zinc Sulfate Monohydrate (33% Zn) were used under such circumstances, there would not be enough point sources of zinc in the crop row to ensure every plant had access to zinc.

Granulock Big Z

Granulock Big Z contains 10% Zn. It has two main uses:

- In blends with Granulock Z, where higher rates of zinc are required than that provided by Granulock Z on its own.
- In pasture blends. Zinc is typically applied at 2 kg/ha Zn every five years in pasture on sandy soils low in zinc. The use of Granulock Big Z provides more point sources of zinc in the field than does Zinc Sulfate Monohydrate.

Zinc Sulfate Monohydrate

Zinc Sulfate Monohydrate contains 33% zinc (Zn). It is the most concentrated of the zinc additives used by Incitec Pivot Fertilisers. Situations where Zinc Sulfate Monohydrate is used include:

Tree and Plantation Crops, in which the roots from individual plants (trees) feed over a large area. Zinc can be applied annually, e.g. 1 – 2 kg/ha Zn per annum, or at higher rates, e.g. 10 kg/ha Zn at intervals of around five years. Where zinc is known to be low, e.g. deficiency symptoms have been observed or soil and/or plant tissue analysis results are low, it may be best to apply zinc initially at a high rate, and then follow this up with ongoing lower annual maintenance applications (and/or foliar sprays).

Sugarcane, in which zinc is applied at 10 kg/ha to last a complete crop cycle (plant crop plus ratoons). Sugarcane is planted in wide rows, and each plant is quite large compared to many other crops.

Pre-Plant Applications, where zinc is applied at high rates that are intended to last several years before repeat applications are made, e.g. 10 kg/ha Zn. The zinc needs to be placed into the soil before planting or be incorporated (cultivated in) after application if it is broadcast on the soil surface.

Zinc is immobile in the soil. Without incorporation, the zinc can be left stranded at the soil surface and be positionally unavailable to the crop's roots.

Planting Fertilisers for Annual Row Crops. Depending on the row spacing, e.g. one metre, and the size/stature of the individual plants, Zinc Sulfate Monohydrate may be used at 1 – 2 kg/ha Zn in the planting fertilizer in many vegetable crops and maize.

Zinc Sulfate Monohydrate should not be used where zinc is applied annually in crops sown at narrow row spacings, e.g. winter cereals such as wheat and barley. Granulock Z should be used in these situations.

ZnTEC

Zinc (Zn) as zinc oxide 534 g/kg (53.4% w/w). ZnTEC is sprayed on straights and blends potentially increasing applied zinc evenly when pre-drilled, side-dressed and banded.

Sprayed in 2 increments – 0.3% Zn & 0.5% Zn

- 0.3% Zn requires 0.57% ZnTEC (2.6L)
- 0.5% Zn requires 0.94% ZnTEC (4.4L)

Cobalt

Cobalt (Co) deficiency is unlikely in plants but may occur in grazing animals.

Cobalt in Animals

Cobalt is a constituent of Vitamin B12, each molecule of the vitamin containing one atom of cobalt. In cattle and sheep, Vitamin B12 is synthesized by rumen microbes. A deficiency in dietary cobalt results in Vitamin B12 deficiency in the grazing animal.

Where cobalt concentrations if forage are low, cobalt can be administered directly to grazing animals. This (direct animal supplementation) is the preferred way to supplement cattle and sheep, as pasture topdressing is not always successful in preventing cobalt deficiency in grazing animals. Advice should be sought from a Veterinarian or Animal Nutritionist on appropriate products and methods of administration.

Humans have no such microorganisms and must rely on their diet to provide them with the vitamin B12 they need.

Cobalt in Plants

In plants, cobalt is only of importance in nitrogen fixation by legumes. The *Rhizobium* bacteria need cobalt to synthesize vitamin B12, like rumen bacteria. Cobalt does not appear to be necessary for the host plant, and in other crops.

Most soils supply sufficient cobalt for legume nodulation. Sandy soils are most likely to be low in cobalt. Recommended rates for cobalt on sandy soils vary but are typically in the range of 25 – 50 g/ha Co, repeat applications being made every 2 – 4 years.

SuPerfect Co 0.12% is used at a concentration of 12.5% in Incitec Pivot Scrub Mixes for legume pastures on sandy soils, giving a cobalt concentration in the end product of 0.015% Co. When applied at 250 kg/ha, Scrub Mixes containing 0.015% Co supply 35 - 40 g/ha Co. SuPerfect Co 0.12% Concentrate can be added to Custom Blends for use in legume pasture on sandy soils where considered necessary. SuPerfect Co 0.12% is only available as a blend ingredient in southern Australia (Vis, SA, Tas). It is not stocked in NSW and Qld.

WARNING

This Agritopic is for guidance only. Seel local advice on appropriate fertiliser programs.

The use of fertilisers is not the only factor involved in producing a top yielding crop or pasture. Local soil, climatic and other conditions should also be taken into account, as these could affect crop or pasture responses to applied fertiliser.

Because conditions of use, suitability of product and application conditions are beyond our control, Incitec Pivot Fertilisers hereby expressly disclaim any liability to any person, property or thing in respect of any of the consequences of anything done or omitted to be done by any person in reliance, whether wholly or in part, upon the whole or any part of the contents of these Guidance Notes.

For more detailed advice on primary, secondary and micronutrients, including their use in foliar sprays, refer to the relevant Incitec Pivot Agritopic, and that on “Foliar Fertilisers”.

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