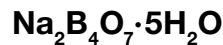


Granular borate for bulk blended fertilisers

14,6% B Typical



Disodium Tetraborate Pentahydrate

Background

Boron is one of seven micronutrients essential to all plant growth. Its role was recognised first in the 1920s and since that time, boron deficiency has been recognised in a wide range of crops.

Correcting boron deficiency

Boron deficiency can be remedied by the correct application of a borate containing material in solid or liquid fertilisers, to the seedbed in annual crops or under the foliar canopy of perennial crops. Perennial and annual crops can also be sprayed with boron containing solutions. These are normally tank mixed with other micronutrients or with agrochemical products.

The latter method of application may be preferable since at peak requirement times the boron needs of the growing plant can frequently exceed its ability to obtain its needs through the roots. Mixing with other sprays as part of a programme enables the grower to time this availability and save application cost.

Detecting boron deficiency

Boron deficiency shows in clearly defined ways in certain crops. Generally, by the time visible symptoms are seen, yields will already have been adversely affected. The best way to establish need is either through soil testing or through tissue analysis. In this way, boron supplementation can form part of a 'balanced nutrition' approach to crop fertilisation.

Predicting boron deficiency

Certain crops world-wide are known to be more susceptible to lack of boron than others. These are shown in the tables.

Susceptible

Alfalfa (Lucerne)	Coffee	Olive
Apple	Cotton	Pine
Broccoli	Eucalyptus	Red Beet
Carnation	Grape	Rutabaga
Cauliflower	Groundnut	Sugar beet
Carrot	Mangold	Sunflower
Celery	Oil Palm	Swede
Chrysanthemum	Oilseed rape	Turnip

Moderately susceptible

Banana	Cocoa	Pear
Brussels sprout	Coconut	Poppy
Cabbage	Flax Linseed	Potato
Chinese cabbage	Hop	Tea
Citrus	Maize Corn	Tobacco
Clover	Papaya	Tomato

There are several factors which need to be taken into account when boron deficiency may be suspected:

- High rainfall
- Recent liming (pH over 6.6)
- Previous cropping
- Boron removal by previous crops
- No boron nutrition
- Sandy soils
- High organic matter

Additional reading

Boron Deficiency—Its Prevention and Cure,
by V.M. Shorrocks (available from Borax on request.)

Mineral Nutrition of Higher Plants,
by Horst Marschner, Academic Press.

Boron and its Role in Crop Production,
by Umesh C. Gupta. CRC Press.

Advantages of *Granubor* Natur

A natural product

Granubor Natur is produced solely from sodium tetraborate pentahydrate which is itself refined from tincal ore using only physical means: crushing, steam, water, settling and crystallization. *Granubor* Natur contains no impurities or added ingredients, filters or coatings.

A sodium borate

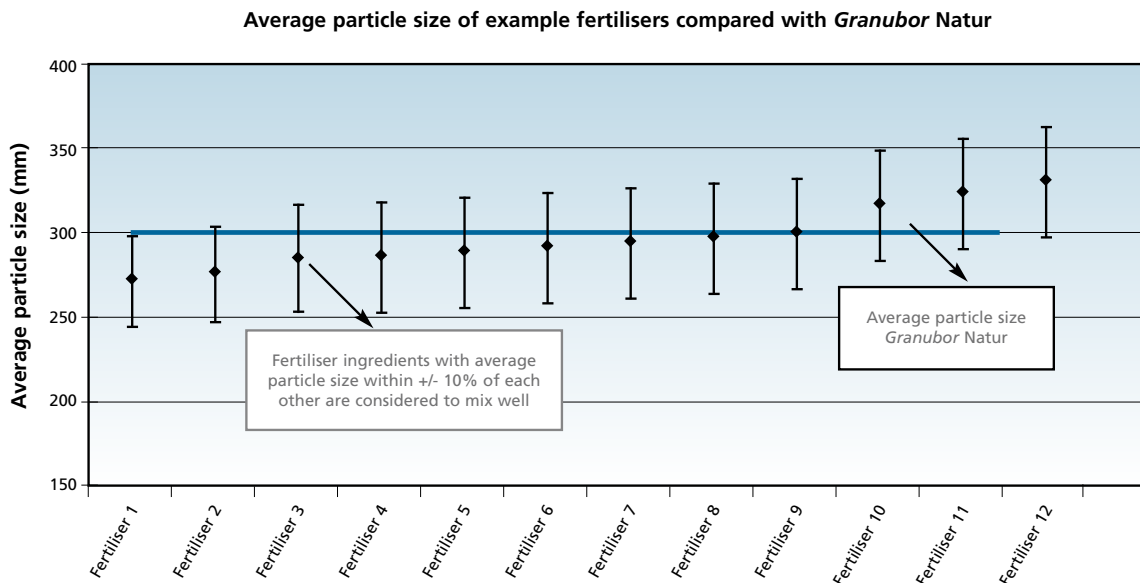
Granubor Natur is a sodium borate, totally soluble and the most appropriate form to provide boron in a soil solution in a timely manner for annual and perennial crops.

Perfect for blending – compatibility with a wide range of fertilisers

A number of factors affect quality of mixing of fertilisers ingredients when they are blended together such as particle size, weight/density and surface characteristics. By far the most important is the average size of the granules and how similar this is to the average granule size of the other ingredients in the blend.

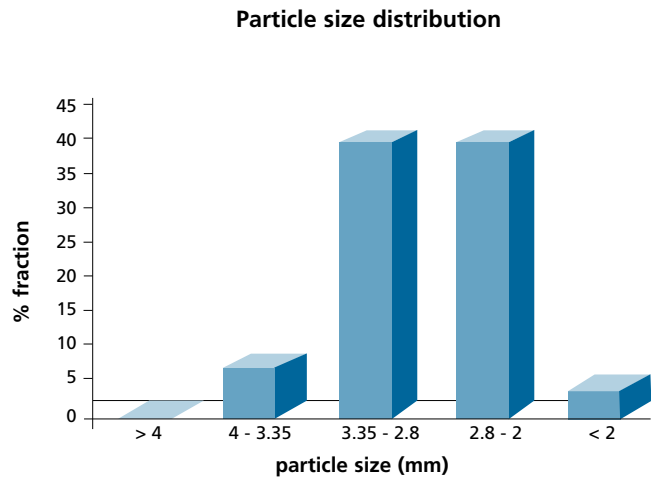
Granubor Natur has an average particle size of 3mm, making it compatible with most fertilisers with a minimum of segregation in transport and application.

The figure below shows how the average particle size of *Granubor* Natur compares with 12 example fertilisers from different countries:



Particle size distribution

The particle size distribution is also important in terms of compatibility. *Granubor* Natur is screened between 2mm and 4mm with very little outside these values, being very similar to the particle distribution of prilled and granulated fertilizers.



Typical particle size

SGN	UI	Va
300	50	20

Definitions:

SGN = $d_{50} \times 100$ (Materials having SGNs within 10% of other components' SGNs mix well.)

UI = $d_5/d_{90} \times 100$ (A measure of particle size spread. The higher the value, the tighter the distribution.)

Va = $(d_{84}-d_{16}) / 2 \times d_{50} \times 100$ (Variation Index. The higher the value, the greater the deviation from the d_{50} .)

In transport and storage

Crush resistance

Granubor Natur will resist breakage in normal transport and handling and during spreading.

Typical particle strength

>40 N*	Force required to crush particles with an average diameter of 2.4mm.
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*Newtons

Bulk density

kgm ⁻³	lb./cu. ft.	Angle of repose
900	60	30°

Typical flow rate

Granubor Natur can be pneumatically transported, tipped and conveyed.

Typical flow rate

5 kg/min	Measurement according to fertiliser industry standard EN 1235:1995
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Main uses

- Incorporation of boron into blended fertilisers to provide an application ready mixture
Granubor Natur is a white granular boron material produced to meet the stringent requirements of the bulk blended fertiliser industry.
- Direct application by farmers where its physical form may present advantages in application, e.g. ease of spreading under and around tree and plantation crops.
- *Granubor* Natur has been developed to improve the soil boron status when this is low or borderline (ie. less than 0.5ppm) hot water available boron level.

Rate of inclusion ready reckoner

Target % B in final fertiliser	<i>Granubor</i> Natur kg/tonne
0.10	6.8
0.25	17.0
0.50	39.0
1.00	68.0

To calculate the amount of *Granubor* Natur required, multiply the elemental boron by 6.8

The *Granubor* brand

Borax has been providing granular boron for soil applications since 1985. *Granubor* Natur is the result of further process research and an up-to-date understanding of the market needs.

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