



## Granubor®

15% B

Guaranteed Analysis: Boron (B) 15%



Sodium Tetraborate Pentahydrate

### Boron, an essential plant nutrient

Boron is one of seven micronutrients essential to all plant growth. Its role was recognized first in the 1920s and since that time, boron deficiency has been recognized 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 fertilizers, to the seedbed in annual crops or under the foliar canopy of perennial crops.

### Blended fertilizers

One very common and practical field method is to blend a suitable boron granule containing the base fertilizer or top dressing. The blend is then applied to the crop in the normal way. *Granubor®* is particularly suitable for this purpose.

### 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 fertilization.

### Predicting boron deficiency

Certain crops worldwide are known to be more susceptible to boron deficiency than others. These are shown in the tables.

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

Susceptible to B deficiency		
Alfalfa (Lucerne)	Coffee	Peanuts
Apple	Cotton	Pine
Broccoli	Eucalyptus	Red beet
Carnation	Grape	Rutabaga
Cauliflower	Mangold	Sugar beet
Carrot	Oil palm	Sunflower
Celery	Oilseed rape	Swede
Chrysanthemum	Olive	Turnip

Moderately susceptible to B deficiency		
Banana	Cocoa	Pear
Brussels sprout	Coconut	Poppy
Cabbage	Flax linseed	Potato
Chinese cabbage	Hop	Tea
Citrus	Maize Corn	Tobacco
Clover	Papaya	Tomato

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### Additional reading

*Boron Deficiency—Its Prevention and Cure*, by V.M. Shorrocks (available from U.S. 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

#### A natural product

*Granubor* 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* contains no impurities or added ingredients, fillers, or coatings.

#### A sodium borate

*Granubor* 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 fertilizers

A number of factors affect quality of mixing of fertilizers ingredients when they are blended together such as particle size, weight/density

and surface characteristics. By far the most important one 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* has an average particle size of around 2.8 mm, making it compatible with most fertilizers with a minimum of segregation in bagging, transport and application.

#### Perfect for blending – particle size distribution

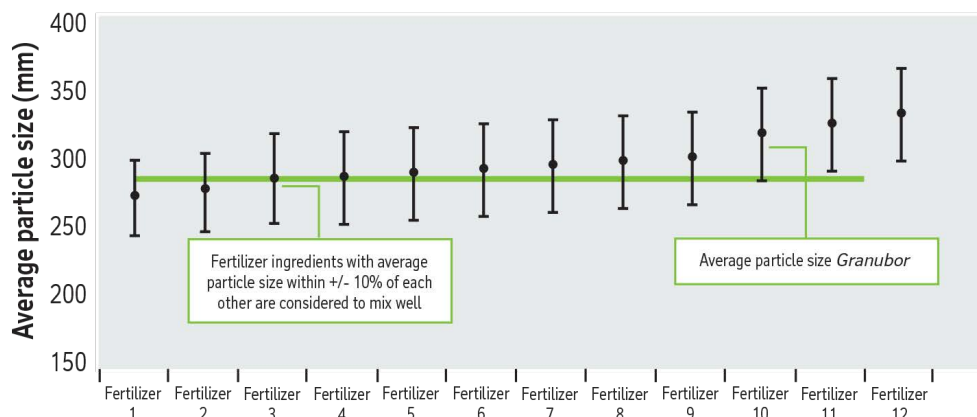
The particle size distribution is also important in terms of compatibility. *Granubor* is screened between -4 and +14 mesh with very little outside these values, and has a uniform particle size distribution similar to commonly used blends of prilled and granulated fertilizers. The graph below shows the typical product “fit” with two typical blends.

While the mean particle size is important, so are the variation particle sizes within the product or the particle spread. Particle spread can be visualized in the graphs below in which *Granubor* is shown against the two fertilizer blends.

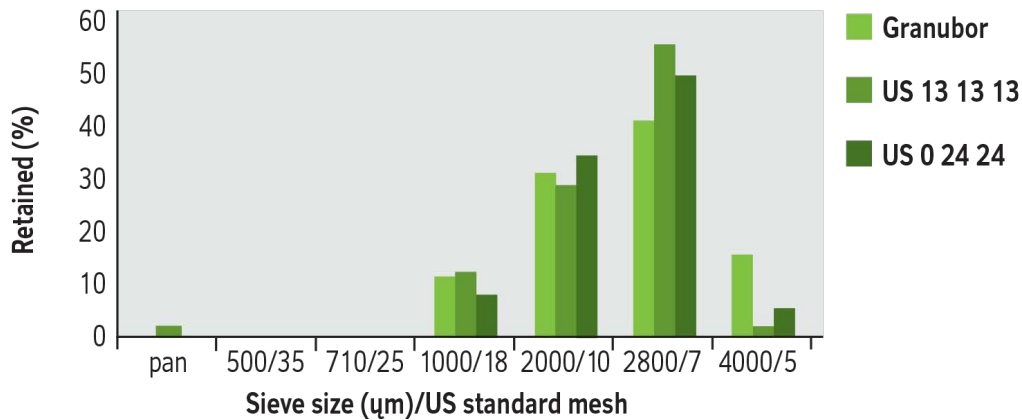
*Granubor* closely approximates the particle size spread of two example blends. Some competitors do not.

The figure below shows how the average particle size of *Granubor* compares with 12 example fertilizers:

**Average particle size of example fertilizers compared with *Granubor***



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Typical particle size*		
SGN	UI	Va
280	50	20

Sieve specification	
U.S. Standard Sieve No.	% Retained Guarantee
-4 + 14	≥95.0

\*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 will resist breakage in normal transport and handling and during spreading.

Typical particle strength	
9 lbs/granule	Force required to crush particles with an average diameter of 2.4 mm.

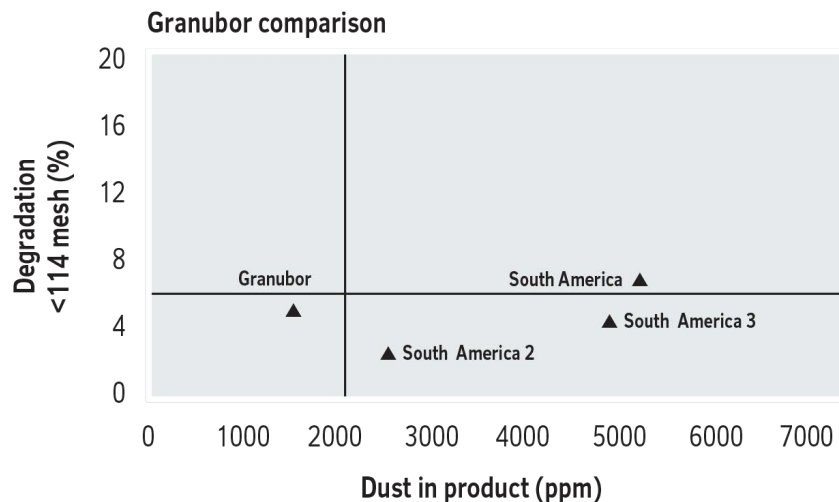
Bulk density		
kg/m <sup>3</sup>	lb/cu ft	Angle of repose
942.5	58.84 loose / 60 tight	30°

### Conditioning or coating to prevent attrition and dust

The attrition (breakage) of particles producing fines and powder can be most important in handling and transport.

Typical flow rate	
<i>Granubor can be pneumatically transported, tipped and conveyed.</i>	
11 lbs/min	Measurement according to fertilizer industry standard EN 1235:1995.

*Granubor* is specially surface treated with borate to reduce the possibility of degradation and dust content. In the graph at the right *Granubor* and some competitors have been compared in terms these parameters. Results in the lower left quadrant are most acceptable.



## Main uses

- Incorporation of boron into blended fertilizers to provide an application ready mixture. *Granubor* is a white granular boron material produced to meet the stringent requirements of the bulk blended fertilizer industry.
- Direct soil application by farmers where its physical form may present advantages in application, eg case of spreading under and around tree and plantation crops.
- *Granubor* 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.

## The *Granubor* brand

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



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