Background
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. 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 program 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 fertilization.

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.
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*, de V.M. Shorrocks (available upon request from U.S. Borax)


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

### Composition

Mixture of:
- Boric acid, $\text{H}_3\text{BO}_3$
- Borax pentahydrate, $\text{Na}_2\text{B}_4\text{O}_7\cdot\text{5H}_2\text{O}$ and sodium pentaborate, $\text{Na}_2\text{B}_10\text{O}_{16}\cdot10\text{H}_2\text{O}$

**Appearance**

White, free flowing granules

**Average bulk density**

700-720 kg/m$^3$

**pH buffering action**

Aqueous solutions of Solubor DF range from mildly alkaline at low concentrations to practically neutral as concentration increases.

**Packaging**

Solubor DF is available in 5, 12, and 25 kg polyethylene sacks.

### Chemical specification

<table>
<thead>
<tr>
<th></th>
<th>Typical</th>
<th>Guarantee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water soluble boron, B%</td>
<td>17.5</td>
<td>17.2 - 17.8</td>
</tr>
<tr>
<td>Equivalent B$_2$O$_3$% (Boric oxide)</td>
<td>56.4</td>
<td>55.4 - 57.3</td>
</tr>
<tr>
<td>Na$_2$O% (Sodium oxide)</td>
<td>10.0</td>
<td>9.5 - 10.5</td>
</tr>
</tbody>
</table>

### Sieve specification

<table>
<thead>
<tr>
<th>Mesh size mm</th>
<th>Percent retained guarantee</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30</td>
<td>2.0</td>
</tr>
</tbody>
</table>

### Percent Solubor DF by weight of solution vs. pH at 23°C

<table>
<thead>
<tr>
<th>Concentration</th>
<th>pH at 23°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>8.3</td>
</tr>
<tr>
<td>1.0</td>
<td>8.3</td>
</tr>
<tr>
<td>2.0</td>
<td>8.1</td>
</tr>
<tr>
<td>2.5</td>
<td>8.0</td>
</tr>
<tr>
<td>5.0</td>
<td>7.8</td>
</tr>
<tr>
<td>7.5</td>
<td>7.6</td>
</tr>
<tr>
<td>10.0</td>
<td>7.4</td>
</tr>
</tbody>
</table>
Main uses

- As a spray treatment to prevent the occurrence of boron deficiency in susceptible crops
- To provide boron through irrigation, fertigation or hydroponics where these systems are used

*Solubor* DF is used on numerous crops as a routine treatment or where a specific need has been identified. These include:

**Field crops:** Alfalfa/lucerne, cotton, corn/maize, oilseed rape, sugar beet, sunflower
**Tree crops:** Apples, citrus, coffee, olives, vines
**Vegetables:** Cabbage, carrots, cauliflower, celery, red beet

It is mainly used as a spray to the soil at planting or as a foliar spray in the young crop.

Advantages

**Free flowing microgranular formulation**

*Solubor* DF with a consistent particle size of 0.3 mm is a flowable product which for the first time enables a solid boron fertilizer to be poured into induction bowl systems.

Whether introduced to the sprayer from the top filler or induction bowl, *Solubor* DF can significantly reduce down time between loads.

**Non dusty**

A consistent granule size of 0.3 mm ensures significant reduction in dust.

**Easy to handle packaging**

The particle size and flowability permit *Solubor* DF to be packed in polyethylene sacks of 5, 12, and 25 kg sizes. The feedback from growers is that the 12 kg size is particularly convenient to handle from the pallet into the sprayer.

The polyethylene bags have the added advantage of weatherproof protection for the product.

**High solubility**

*Solubor* DF is formulated to give very high solubility levels and ensure speedy mixing. Dissolution rate is a function of concentration, agitation, and water temperature. Exercise caution when mixing high dose rates in low water volumes at low temperatures. The dissolution rate will depend on factors such as pouring rate and the equipment involved, ambient and water temperatures. The graph below showing dissolution at different temperatures, can be used as a guide.

**Compatibility**

*Solubor* DF is compatible with most agrochemicals and liquid fertilizers. It has been tested in conjunction with more than 250 products and compatibility lists are available from your distributor.
**Recommendations for use**

*Solubor* DF should be dissolved in water and applied as a spray to the soil or to the crop. It may be poured directly into the induction hopper or the spray tank filler. It is essential to use a generous supply of water and adequate flow through the induction hopper. Whether *Solubor* DF is fed into the hopper or directly into the tank, strong agitation must always be maintained throughout the mixing and spray operations.

Use as directed. Do not exceed recommended rates or a maximum dose rate of 4 kg boron (24 kg *Solubor* DF) per hectare per year.

For dose rates on crops other than those mentioned, please contact your distributor.

### Mixing instructions

1. Two-thirds fill tank
2. Start up agitation—open venturi-switch and flashing nozzles
3. Cut a slit on the corner of the bag
4. Pour *Solubor* DF at a rate to ensure continuous drainage of induction bowl
5. Top up tank to required level

### Application Rates

<table>
<thead>
<tr>
<th>Crop</th>
<th><em>Solubor</em> DF kg/ha</th>
<th>Volume water l/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar beet</td>
<td>6-18</td>
<td>200</td>
</tr>
<tr>
<td>Oilseed rape</td>
<td>6-14</td>
<td>200</td>
</tr>
<tr>
<td>Vegetable brassicas</td>
<td>6-12</td>
<td>–</td>
</tr>
<tr>
<td>Apple and pear</td>
<td>3 x 2.4</td>
<td>–</td>
</tr>
</tbody>
</table>

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