BORON DEFICIENCY IS WIDESPREAD IN THE HIGHLANDS

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WHAT DOES BORON DO?

Boron (B) is a nutrient (plant food) that plants need to grow properly. Only a very small amount is needed. When a plant has too little of a certain plant food, we say it has a deficiency. Too much boron in the soil can easily harm plant growth. In plants, boron helps the growing point of the shoot and root to develop properly. Also it helps cell walls to form, flowers to be fertilised and fruit to develop.

Root crops, vegetables and tree crops are more likely than grain legumes and members of the grass family to show symptoms (signs) of boron deficiency. This is because grain legumes and grasses do not need so much boron for proper growth.

BORON DEFICIENCIES IN P.N.G.

Boron deficiency was first reported in P.N.G. by staff of the Office of Forests who found it on pine trees.

Boron deficiency is very common in the highlands. It is very bad in the Southern Highlands in places like Ialibu, Kagua, Mendi, Upper Mendi, and Nipa. It is fairly bad in parts of Enga and Western Highlands, and not so bad in Simbu, Eastern Highlands and the Wau-Bulolo area. Boron deficiency is also reported near Port Moresby, in the Markham Valley and on the Lelet Plateau of New Ireland.

SYMPTOMS

When there is not enough of a plant food in the soil, plants show symptoms which mean that the plant does not have enough of that particular plant food. The symptoms depend on the plant food needed and also on the particular crop. Symptoms which show boron deficiency are:

1. Growing tips or buds die, with bushy growth near the tip. The internodes (length of the stem between leaves) are short.

2. Leaves are often misshapen and wrinkled, thick and brittle, but are not usually yellow in colour.

3. Water soaked, 'dead' spots or holes in root crops and in the pith (centre) of stems.

4. Fruit small and poorly formed often with corky lumps and lesions (marks).

5. Low seed production because of poor fertilisation.

Boron deficiencies are more likely to occur during or after a drought. This is because plants get most of their boron needs from organic matter in the topsoil. In a drought the soil dries out, so the roots go down deeper in the soil to

get water and plant food. There is less organic matter there and so the plant may not get enough boron.

Symptoms on some highland crops are as follows:

Yar (*Casuarina oligodon*)
Growth is stunted and plants look rounded and bushy. Internodes are short. The growing tips die. When boron fertiliser is applied, the main shoot grows tall as in a healthy plant. Boron deficiency is easy to see in casuarina and is widespread in the highlands.

Sweet potato
Hard brown spots form inside the tubers. This ruins their eating quality. We have only seen this in the Southern Highlands on poor soils.

Cabbage, cauliflower and broccoli
The stem of the plant is hollow. This has been reported from the Wapenamanda (Enga) and Laloki (Port Moresby) areas.

Coffee
The growing tip of the stem dies and branches growing below the tip develop. This gives a fan effect and the top of the plant becomes bushy. Also the internodes are short. Leaves have a 'leathery' feel to them.

Pine trees (*Pinus caribaea* and *Pinus patula*)
The terminal (top) shoot dies. Plants are short and have very many dead shoots. New shoots grow from buds and from the tip (apex). Office of Forests staff have found boron deficiency occurs in pine trees wherever they have been planted in Papua New Guinea. Usually pine trees will not grow to maturity unless the seedlings are given a little boron fertiliser.

Cape gooseberry (*Physalis peruviana*)
Plants suffering from boron

Casuarina showing boron deficiency symptoms. It is stunted and has a rounded, bushy appearance

These Cape Gooseberry plants had symptoms of boron deficiency. Those on the left were treated with a little borax fertiliser and have recovered. The ones on the right have not been treated. They are stunted, the tips are dead and very few fruit are being produced.

deficiency do not grow strongly. The tips of the growing stem die back, and in severe cases eventually the entire plant can die. Leaves are less green and smaller than on healthy plants. In an experiment at Aiyura, plants treated with boron fertiliser produced 52 grams of berries per metre-row per week. Untreated plants produced 33 g/metre-row/week. So the boron fertiliser increased the fruit yield by over 50%.

Pawpaw
The youngest leaves bend downwards and the leaf tips and leaf margins (edges) die back, The leaves are hard and tough to feel. The fruit develop bumps on them.

Black raspberry *(Rubus lasiocarpus)*
Many sick branches develop on the canes. The fruits are hard, small, and not juicy.

Hibiscus
The growing point of the shrub dies and side shoots grow up to replace it. The plant is stunted and in severe cases, it will not grow at all. Symptoms on decorative hibiscus hedges at Aiyura have been cured by using boron fertiliser.

HOW TO PREVENT AND CURE BORON DEFICIENCY

Organic matter in soil gives boron to the growing plant. So a good way to prevent boron deficiency occurring is to add a lot of organic matter to the soil before planting or as a mulch to a perennial crop. To increase the organic matter in the soil, you can use compost, (made either where you are going to plant the crop, or in a separate heap) or coffee pulp, rotten cocoa pods, or animal manure.

Coffee pulp or rotten cocoa pods applied at 30 t/ha provide about 0.12-0.14 kg of boron per ha. This is about one eighth the amount of boron that plants need to grow well. Of course, these organic fertilisers also give lots of other plant foods. At 30 t/ha, coffee pulp also

gives 80 kg of nitrogen, 6 kg of phosphorus, and 150 kg of potassium as well as other plant foods.

Another way to prevent or cure boron deficiency is to apply boron fertiliser. Borax is the fertiliser most used in P.N.G. Another way is to use a mixed fertiliser that contains boron, such as coffee mix. Borax containing 11% boron should be applied at 10-20 kg borax per ha. This is a very low rate. Where symptoms are very severe, such as in the Southern Highlands, borax could be tried experimentally at rates as high as 50 kg/ha. It is important that not too much boron fertiliser is put on because even rates as low as 20 kg borax per ha can be too much, causing toxicity (poisoning). If a plant has too much boron (toxicity) a yellow colour appears on the tip or edges of the leaves. Later this part of the leaf dies.

Photographs: B. Calcinai

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FURTHER READING

Shorrocks, V.M. (1974). *Boron Deficiency - Its Prevention and Cure*. Borax Consolidated Limited. (Obtainable free from Borax Consolidated Limited, Borax House, Carlisle Place, London SWIP IHT, United Kingdom).