Test soil and plant tissue before adding zinc

By Nicole Baxter

A nutrition specialist is encouraging growers in south-western Australia to consider adding zinc to their crops. Dr Robert Norton, of the International Plant Nutrition Institute, told growers and advisors at the 2014 New South Wales GRDC Grains Research Update, at Tamworth, that a deficiency was generally likely where the DTFA soil test result was less than 0.3 milligrams per kilogram of soil. However, taken alone, he said, soil test values were not a reliable predictor of a likely zinc response in crops.

To guide diagnosis, he encouraged the use of tissue tests by sampling the youngest expanded blade of wheat. A crop is likely to give a yield response to extra zinc, he explained, when the youngest leaf tissue concentration of zinc in wheat was less than 1.4 milligrams per kilogram.

He said that typically, the zinc supply can be low in many soil types, but zinc deficient soils:
- have a pH of more than 7.5;
- have a high sand content;
- are cold, wet and compacted;
- occur in some red and acidic soils;
- have low lime recently applied;
- have high phosphorus levels;
- are low in organic matter; and
- have been recently eroded or land-leveled.

DEFICIENCY SYMPTOMS

Dr Norton said zinc deficiencies tended to occur early in the growing season when soils were cold and wet. In these conditions, root growth is slowed compared with rapid dry growth, and the slow growing root system is unable to take up enough zinc to supply the shoot. Root damage and low zinc uptake can also occur with some root diseases or residual herbicides.

"Plants sometimes appear to grow this deficiency," he said. "But often the damage to the shoot has been done and yields can be significantly reduced.

DEFICIENCY DIAGNOSIS

To detect a deficiency using soil tests, Dr Norton said plants should be tested using the DTFA soil testing method) are generally less than 0.5 milligrams per kilogram, but the results were strongly influenced by soil pH, soil texture and soil organic carbon.

While soil tests provide a guide, Dr Norton said research literature supported the use of tissue tests as a more reliable diagnostic tool.

"It is critical to take the correct tissue at the correct time because uptake and redistribution differs with time and tissues," he said.

"Zinc has low mobility so the usual tissues to sample are the youngest fully expanded leaves (also known as the youngest expanded blade or YEB)."

Dr Norton explained that younger, more rapidly growing tissues were more responsive to changes in zinc supply so are better indicators of deficiency than older leaves or whole plants. He said the timing of sampling was also critical. Early sampling allows action to be taken to correct the deficiency. As the plant matures, zinc is redistributed and diluted and critical levels decline with plant age.

Dr Norton said tests strips were also useful to check if there was a zinc deficiency in the soil.

ADDRESSING A DEFICIENCY

If soil and tissue tests indicate a zinc response is likely, Dr Norton said there were several options available to address the deficiency. He said roots move to zinc, which means the distribution of drilled zinc needed to be even. If using a granular product, he said it was important to use a product that had a reliable particle size and an even concentration of zinc in each granule.

"Soil mixing or cultivation can dilute the zinc concentration, but can help plants access zinc," he said. It placed too shallow, zinc can be stranded in dry soil."

Dr Norton said crops differed in their response to zinc. As a consequence, his view is that it is more important to apply zinc ahead or onto responsive crops.

In general, he explained, research had shown that basals was more efficient than cereals at accessing soil zinc, while lupins, faba beans and chickpeas have lower demands than wheat, and lentils have a higher demand.

In contrast, he said, maize and sorghum had higher zinc demands than wheat or barley. So zinc supplements are not needed for all crops. "A crop rotation, address the zinc demand in the cereal phase rather than in the pulse or oilseed phase," he said.

While foliar zinc can be used for rescue operations, Dr Norton explained that it has little residual value. In comparison, soil-applied zinc (with micronutrient) has a residual value of two to five crops, depending on soil texture and pH.

APPLICATION TIME

In Dr Norton's opinion, the best time to apply zinc is at seeding, mixed or blended with fluid or granular fertilisers.

"Using zinc fortified seed can also reduce the need for added zinc. Under a moderate deficiency, crops are able to take up and respond to foliar zinc before stem elongation," he said.

"Later applications up to flowering can increase grain zinc content but will do little in terms of yield response. Using soil-applied zinc ahead of the most responsive crops seems a good strategy that balances cost and risk."

GRDC Research Code PFM5001
More information: Dr Robert Norton, 0428 877 118, rnorton@iupni.com

TAILORED SYSTEMS TO CHASE YIELD POTENTIAL

By Clarice Collins

CSIRO researchers led by Dr Zvi Hochman have explored the potential for northern grain growers to increase wheat yields by 1.2 tonnes per hectare using best practice embodying current technologies and varieties suited to individual farming systems.

Speaking at the GRDC Grains Research Update in Coober Pedy, New South Wales, Dr Hochman said the key to achieving such a yield lift was using best practice in crop production—water-limited yields, instead of actual yields.

"Water-limited yields are the yield potential determined by a given rainfall resource," Dr Hochman said. "Between 1996 and 2018 the average what yield across the northern grains region was 1.75t/ha, which is less than half the region’s potential water-limited yield of 5.3t/ha.

"If we accept that growers can sustainably achieve a relative yield of 80 per cent, then this study suggests that growers in the northern grains region could achieve yields of 2.82t/ha."

"So there is scope to close the exploitable yield gap and increase average yields by 1.2 kg/ha."

To help bridge the yield gap, Dr Hochman advocated tailoring best practice to individual farming systems, with a focus on using the ‘best adapted crop varieties and best cropping and land management practices for a given environment’.

He also urged growers to benchmark productivity against their agricultural local area (SLA).

With the exploitable yield gap varying from one SLA to the next, and from season to season, CSIRO researchers are developing a website showing ‘yield gap maps’ for farm locations as part of a GRDC-funded project.

As well as highlighting seasonal changes to water-limited yields across the northern grains region, the online maps are set to provide benchmarks for actual yields, water-limited yields, yield gaps and relative yields.

GRDC Research Code CAG14132
More information: Dr Zvi Hochman, CSIRO, 07 3333 5712, zvi.hochman@csiro.au