

Trace-element Nutrition for healthier broadacre crops and people

A study into the management and importance that trace element nutrition has for the growth of crops, farmer profitability and crop produce's mineral content for human health.

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This study initially focussed upon the role of trace elements in broadacre farming, the definition of broadacre for this report is the expansive production of crops such as cereals (wheat, barley, oats) and oilseeds (canola, soybeans). As the study broadened and progressed the focus was expanded to the global issues of produce quality and human nutrition. The principals of crop nutrition across most plant types remain constant and are not exclusive to cereals and oilseed crops, plants need adequate nutrition to perform to their optimum. This is also true for animals, humans and all other organisms on the planet. In the agricultural system if there is a mineral nutrition deficiency this has consequences for not only the current crop but also upstream in the production chain for the farmer's income and all the way downstream in the production/value chain to the consumer who eats a food product. This is why Trace Elements's (TE) are important to agriculture and to humanity.

There are lessons in the study of TE's for farmers, food processors, consumers and legislators. The issues around food affect everyone and depending upon your role in the chain between the producer and the consumer the issues in this paper are significant.

My background as an agricultural scientist and work as an agronomic advisor made me very interested in the role of trace elements to make plants achieve their true genetic potential. Now as a full-time farmer my interest is keener than ever as the growth of my crops affects me directly. In agriculture we only have control over certain parts of our system and it is easy to become defeated by the apparent lack of control over the outcome from our system. There is no point dwelling on the effects of weather, prices, strikes etc, we usually do not have direct control over these things as producers. **We do have control** however of more parts of our production systems than we ever had before. The technologies of irrigation, precision farming, weather radar, efficient large scale machinery, futures contracts for grain pricing and a choice of an amazing array of inputs to make our crops grow better are just a few examples. In this report I focus on a part of the system we have control of, TE nutrition.

The aim of this report is to educate the reader as to the importance of TE's, how to apply them, and generate discussion around the use of them more widely within agriculture and the food industry. Trace elements are required to improve farmer's profitability, consumer health and humanity. For the study I travelled for 6 months during 2009 to 4 continents during three trips attending conferences, interviewing farmer's and their advisers observing first hand the best strategies and techniques farmers use to improve the quality and quantity of the produce from their farming system.

The key findings of my report are that farmer's have the potential to increase their productivity and profitability by using trace elements. Consumers should be demanding an adequate level of mineral nutrition in the food they eat and farmer's should be encouraging this and getting more value for food that **is** enhanced with minerals. Organic produce contains no actual additional mineral nutrition benefit over non-organic produce (Alan D Dangour, 2009) and yet it commands more money from consumers. Farmer's should be rewarded for food that is enhanced with mineral TE's while growing and more nutritious rather than an organic food which is sold by marketing spin with no added nutrition. Food processors should use raw food ingredients that have been enhanced with minerals naturally by farmers using fertilisers on their crops. This would reduce the instance of food contamination with toxic levels at the processing stage such as the melamine scare in milk in China in recent times.

Melamine was used in China to make milk appear higher in protein and is normally used in plastic products, killed at least four children and sickened 53,000 in mainland China (AAP, 2010). Minerals are best added to plants rather than at the food processing stage to ensure the minerals are in plant products in forms that are able to be absorbed by humans and animals. Farmer's need to assess their crop production in each paddock on their farm separately from other farmers in their area and critical levels for TE deficiency need to be determined for their system. Farmer's may think their levels of fertilisation are adequate based on published critical levels of leaf tissue analysis or soil testing. The critical level for each farm needs to be determined by the farmer which gives them the greatest profitability. Each field, crop type and variety has a slightly varying requirement for nutrition as no biological system is identical, to achieve an average optimum an overview of the system is required and is best done by the farmer with the right information.

Many people in the developing world suffer from TE deficiency at a chronic and severe level. Some third world populations are worse off because they not only suffer a deficiency, they also suffer toxicities from another contaminant such as arsenic and cadmium which are taken up by plants such as rice when TE's like Zinc and Iron are not available due to soil deficiencies. I recommend that farmer's assess their crops and livestock for TE deficiencies that may be asymptomatic, costing yield, production, profit and product quality.

The broadacre farming industry is a stakeholder in the issue of TE biofortification of food. The Australian and global agricultural industry needs to embrace trace element nutrition as a quality parameter for differentiation just as it did more than 50 years ago with product differentiation based on protein. More value will be derived from this for the producer and the whole value chain. Policy makers need to see the value of having elevated and adequate levels of trace elements in food to combat the issues of heart disease, cancer and other preventable diseases based in part on inadequate TE nutrition. Australia may be able to create more benefit in its aid efforts to countries suffering food production shortfall's by assisting with food aid that has elevated levels of nutrition to assist health goals rather than just throwing money at problems of this type.

It is recommended that the Australian grains industry set up a standard for food products that are enhanced or enriched with minerals (biofortified) for improved human health outcomes. The Australian grains industry needs to set up an Identity Preserved (IP) value chain for grain which has been produced under an accredited Quality Assured (QA) system with TE's applied at critical stages of crop growth to elevate the nutrition of the end product **safely**. The elevated TE food product has to be profitable for producers to grow it and consumers will need to see the value for their health and the grains industry will need to accept this parameter in their standards.

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