Include key minerals for enhanced soya production

KIMLEIGH CHEMICALS SA (PTY) LTD

By Dr FG Adriaanse, for Kimleigh Chemicals SA (Pty) Ltd

Copper (Cu) and molybdenum (Mo) are among those elements which have been well recognised as essential plant nutrients for soya production. However, up to now nickel (Ni) and cobalt (Co) have mostly not formed part of fertilisation programmes, even though Ni was documented to be an essential element in 1987 and Co in 1983.

Yet both these elements play vital roles in soya bean production. Ni is key for nitrogen metabolism of urea-like compounds and can benefit symbiosis of Rhizobia bacteria. Deficiency symptoms show as browning of leaf tips because of toxic levels of the urea-like compounds accumulating. Co facilitates nodule formation and N_2 fixation processes. It also increases growth yield, oil and protein contents in seeds.

Materials and methods

A field was identified close to the Vaal River, approximately 30km from Potchefstroom, which, according to soil and leaf analyses, indicated Cu and Mo deficiencies despite compost applications of 4,9t/ha. Ni and Co were not analysed in the soil and leaves since norms for these elements have not been well documented. Band-placed fertiliser applications at planting were 13,6kg N/ha, 13,5kg P/ha, 7,8kg S/ha, 192g Zn/ha, 105g Cu/ha, 96g B/ha and 38g Mo/ha.

The micronutrients in the plant mixture were Kimleigh Mentrix formulations which were coated onto fertiliser granules. Zn and Cu were supplied as nano formulations. Deficiencies of Cu and Mo still showed up in the leaves despite significant applications at planting.

Eight foliar spray treatments and four replications were arranged in a randomised block design. Apart from a control treatment, one treatment consisted of Cu and Mo and another of Cu, Mo, Ni, and Co (*Figure 1*). Only Cu was supplied in nano-formulation in both products.

The trial was planted on 9 December 2021 and treatments sprayed on 24 February 2022 (R3 growth stage). Harvesting took place on 5 May 2022. Yields were corrected to 12,5% moisture.

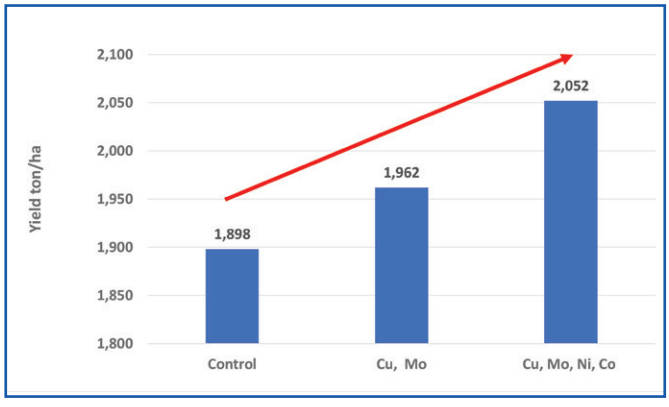
Results and discussion

Treatment effects on soya yield are illustrated in *Figure 1*. Treatment 1 increased yield by 0,064t/ha (3,4%) above the control, which was statistically not significant. The increase in income at R8 000/ton is R512/ha and the cost R276,80 resulting in an increase in profit of R235,20/ha. Treatment 2 increased yield by 0,154 ton/ha (8,1%) above the control which was statistically significant at P = 0,15. The increase in income at the same soya price is R1 232/ha and the cost R266,34/ha resulting in an increase in profit of R778,34/ha.

All micro-nutrients except Ni and Co were applied to all treatments in significant quantities as a fertiliser coating at planting. Since the topsoil pH (KCl) was 5, Mo would not have been readily available for uptake. Mo is the only micronutrient which becomes less available under acidic conditions. Mo applied at planting could also have leached to some extent. Cu in the fertiliser plant mixture was probably also fixed by the application of organic material.

Organic matter binds Cu more than any other micronutrient which also reduces availability to crops. For these reasons, at least some response to Cu and Mo foliar applications as shown in *Figure 1* was expected. A far better yield response to Treatment 2 compared to Treatment 1 can be ascribed to the addition of Ni and Co and/or a higher Mo rate in Treatment 2.

Figure 1: Kimleigh Metalin and Fertilin combinations of foliar applications.



Treatment 1: 101g Cu/ha + 38g Mo/ha. Treatment 2: 87g Cu/ha + 147g Mo/ha + 20g Ni/ha + 7g Co/ha. LSD (P = 0,15) = 0,138 ton/ha. CV = 6,9%.

Conclusions

A specific combination of Cu, Mo, Ni and Co resulted in an increase in soya yield which was 85% statistically reliable and economically justifiable, increasing profit by R778/ha. Cu applications at planting may be ineffective due to fixation by organic material.

Foliar applications of Mo are inevitable under acidic conditions and when leaching is expected. The synergistic effect of Ni and Co with other elements and the clearly defined roles of these elements in soya production should be realised and further investigated.

For more information, visit *www.kimleigh.com* or phone 018 293 1028.