

Methods and sources of applied manganese on converted low-manganese paddy field for soybeans¹

Ching-Hsi Lin²

summary

Manganese deficiency symptoms in soybeans (*Glycine max*) have been observed on high pH, light textured, drained paddy fields (Schist alluvial soils) at Yu-Ii, Hualien. Field experiments were conducted in the summer of 1985 and the spring of 1986 to evaluate the effectiveness of manganese sources for soil and foliar application on alleviating soybean manganese deficiency and to study the possibility of iron or/and zinc deficiencies other than manganese which may also contribute to growth and yield imitations.

Determinate and broad-leaf cultivar "Hualien No.1" soybeans were grown for summer and spring crops on shallow sandy loam soils with rich calcium, high pH 7.3, low DTPA-extractable Mn levels from 0.8 to 1.3 $\mu\text{g/g}$, or 0.1N HCl-extractable Mn levels from 63 to 65 $\mu\text{g/g}$.

Soil pH decreased from 7.4 to 7.1 in 1985 and 7.5 to 6.7 in 1986 as a result of sulphur powder (2 t/ha) broadcast and band applications. It indicated that band application had better acidifying and green up effects on soils and plants than broadcast one.

Visual manganese deficiency symptoms were common and severe in check plots, and seldom occurred in plots treated with manganese sulfate, but almost no symptoms were observed in plots treated with manganese sulfate + sulphur powder (band application) or foliar manganese application. Plant analysis showed Mn levels in leaves were increased when manganese fertilizers were applied in soils or foliar sprays, The blade concentrations of Mn in recently matured leaves sampled at R6 growth stage were 15 and 16 $\mu\text{g/g}$ in untreated plots, 30 and 32 $\mu\text{g/g}$ in manganese sulfated added plots, 45 $\mu\text{g/g}$ in manganese sulfate + band application of sulphur powder treated plots. Range in 50 to 970 $\mu\text{g/g}$ in foliar sprayed plots was obtained. The correlation coefficient between extractable Mn and blade Mn was 0.72(r^2) with DTPA and 0.71(r^2) with 0.1 N HCL.

Soybean seed yields were greatly increased by soil or foliar application of Mn. Seed yield increases were contributed by increases in pod number per plant, pod weight and seed weight. Seed yields were much higher from the plots that received foliar spray of Mn, especially for Maneb and Trimazone, than soil application of Mn.

Foliar applications of 0.5% manganese sulfate, Metalosate-Mn (liquid amino acid chelate) X 3500, 80% oaneb X 400, 0.5% manganese sulfate + zinc sulfate, and 85% Trimazone X 700 increased seed yields over control for summer and spring crops by 37, 33, 66, 39, 94, and 82, 34, 211, 100, 209%, respectively, while soil application of manganese sulfate 300 kg/ha(broadcast for summer, band for spring crop) only increased 18.24 % and 15.92 % , respectively. These

experiments indicate that foliar application is a better method than soil application and it is the most effective and economical method for alleviation Mn deficiency in soybeans by foliar sprays of 80% Maneb or 85% Trimazole which are also fungicides with controlling disease capability.

Foliar application of Zn had no effect on yield, but Fe had some effect in summer crop due to occurrence of Fe-deficiency.

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- ². Soil chemist and chief, Division of Crop Environment.