

INCORPORATION OF A SOLID INDUSTRIAL MANGANESE WASTE INTO THE SOIL IMPROVES YIELD OF CROPS

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EXTENDED ABSTRACT

The potential use, as soil-improving agent, of an industrial solid waste that contains MnO₂ was studied in two-year field trials. This waste was the by-product of an industry that produces raw material for dry cells and it is neutralized with lime. Chemical analysis indicated that it has pH 7.9 and contains total Mn 14.12%, high levels of Al, K, Ca, Fe, but lower of heavy metals such as Cu, Zn, Co, Cr, Ni, As, Cd and Sn. The amounts added to the soil, one year before the beginning of this study, were 0, 40, 50 and 60 t/stremma (=1000 m²). The experimental plants used were corn, sunflower, cotton, processing tomato, table-tomato, eggplant, pepper, alfalfa, sugar beet and durum wheat. The plot size was 2 m² and all the plots were separated by 0.5 m paths. There were six replications for each treatment. The results showed that the addition of high quantities of the by-product (50 and 60 t/stremma) to the soil, improved the yield of the crops as follows: The highest may fresh weight was achieved at the level of 60 t/str. Compared to the control, the total biomass per plot was improved 4.4 times and the corn yield 9.0 times. This higher corn yield was due to the increased corn weight per ear (9.0 times) and due to the improved 1000-grain weight (it was doubled). The highest sunflower fresh weight was achieved at the level of 50 t/str., whereby the total fresh weight was improved 7.2 times and the seed production was increased up to 5.0 times. This high production was due to the higher seed production per head (4.9 times) and due to the improved 1000 seed weight (2.7 times). At the level of 50 t/str. the total fresh weight of cotton was increased by 8.0 times, the fibre production (including seeds) by 2.0 times and the number of bolls of the plants per plot by 5.7 times. There were no significant differences between treatments in the 1000 seed weight. At the level of 60 t/str. the total biomass of processing tomato was increased by 2.0 times, the tomato yield per plot by 3.4 times, the number of fruits by 2.0 times and the average fruit weight by 2.4 times, compared to that of control. The yield of table-tomato increased by 1.3 times for biomass, by 1.6 times for fruit yield, by 2.8 times for number of fruits per experimental plot and by 1.4 times for average fruit weight. The respective increases in eggplant were 4.0, 3.8, 3.7 and 2.6 and in pepper 3.0, 6.0, 4.4 and 5.8. The highest alfalfa fresh weight was achieved at the level of 40 t/str. (mean of two cuts), it was increased by 1.4 times compared to that of control. The yield of the durum wheat increased at the levels 50 and 60 t/str. 2.4 times and by the sugar beet the total biomass (leaves and bulbs separately) increased more than 10 times. The concentration of nutrients and heavy metals in the plant tissue was normal. In some crops Mn and Fe concentration was high but not in toxic levels for the plants.

Key words: industrial waste, manganese dioxide, soil improvement, Mn-fertilization