RESEARCH ARTICLE

IMPACT OF SULPHUR AND BORON ADDITION ON SOIL CHEMICAL PROPERTIES, ACTIVITY OF SOIL ENZYMES AND LENTIL PRODUCTION IN RED SOILS OF VINDHYAN REGION, UTTAR PRADESH

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Received-01.05.2021, Revised-18.05.2021, Accepted-30.05.2021

Abstract: In red soil, secondary nutrient deficiency, especially sulphur (S) and micronutrients (such as B), has resulted in low fertility. Due to the severe shortage of high-quality pulses, researchers have become increasingly interested in the availability of S and B in soils. Therefore, four levels of sulphur as gypsum ($CaSO_4.2H_2O$) and four levels of Boron as borax ($Na_2B_4O_7.10H_2O$) were applied to soil in different treatment combinations, along with recommended doses of NPK (40, 60, and 20 kg ha^{-1} N, P, and K, respectively) as urea, diammonium phosphate, and Muriate of potash. With a factorial completely randomised design, this experimental trial was performed in pots and repeated three times. The soil samples were collected and analysed after the harvest of the lentil crop to determine changes in soil pH, EC, organic carbon, availability of cationic DTPA - extractable micronutrient (Zn, Cu, Fe & Mn), urease and dehydrogenase activity. According to the findings, sulphur and boron application reduce soil pH and EC, increased organic carbon. Similarly, it also affects the available Cu and Mn but not significantly. Application of these treatments affects the Zn availability significantly both the years and available Fe in one season only. The lowest pH value (pH 5.74) was observed with the application of 45 kg S ha^{-1} with 3 kg B ha^{-1} and the lowest EC value (0.28 dSm^{-1}) was obtained different levels of boron fertilizers through borax along with RDF application. The soil organic carbon increased from 4.01 to 4.28 mg kg^{-1}. Soil application of sulphur and Boron along with RDF has significantly increased DTPA - extractable Zn (0.57 to 0.72 mg kg^{-1} and non-significantly decreased the soil available DTPA – extractable Cu (0.77 to 0.72 mg kg^{-1}) and increased in Fe (23.49 to 26.26 mg kg^{-1}) and Mn (5.38 to 5.67 mg kg^{-1}) status. The effect of or gypsum and boron on lentil yield found positive and it increased the grain yield 86.17 % as compared to the application of RDF of NPK only.Urease activity was increased from 35.08 to 52.57µg NH_4^+ $g^{-1}hr^{-1}$ and dehydrogenase activity from 113.39 to 141.87 µg TPF g^{-1} soil day^{-1}. The synergistic effect of S and B application along with RDF recorded in lentil yield also. Remarkably, 86.17 % increment was recorded in grain yield of lentil with combined application of S @ 45 kg ha^{-1} and B @ 2 kg ha^{-1}along with RDF (2.29 g $plant^{-1}$) as compared to treatment where only RDF applied (1.23 g $plant^{-1}$).The increasing doses of sulphur through gypsum improved result in crop growth and yield of lentil but a higher dose of boron through borax after 2 kg B ha^{-1} reduces the yield of the lentil crop.The study explains that the treatment combinations had a synergistic effect and it may be concluded that the combinations of sulphur + Boron with primary nutrients increased soil available micronutrient status, enzyme activity and yield of lentil.

Keywords: Gypsum, Borax, Physico-chemical properties, Micronutrients, Soil enzyme activity, Lentil yield

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