SOIL HEALTH AND CROP PRODUCTIVITY IN ALFISOLS WITH INTEGRATED PLANT NUTRIENT SUPPLY SYSTEM

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Abstract

Integrated use of organic manures, with inorganic fertiliser N, were evaluated for soil health and yield in maize soybean cropping system through field experiments for two years in Alfisols of Hyderabad, India. Maize and Soybean were test crops. The experiment was laid out in RBD with six treatments consisting of substitution of 50% level of recommended dose of N (RDN) through each of vermicompost (VC), poultry manure (PM), biogas slurry (BGS) and farmyard manure (FYM) along with recommended dose of nitrogen (120 kg/ha) and control. Application of organic manure in conjunction with inorganic fertiliser N significantly improved the soil physical properties, nutrient status of soil. Grain and stover/haulm yields of maize and soybean crops. The improvement in soil health and yields of crops among different treatments was in the order: VC> PM> BGS> FYM> RDF> Control.

Key words: Soil health, organic manures, maize, soybean, cropping system and IPNS.

In recent years, with the sole aim to increase food pro- duction using high yielding varieties, there has been an excessive use of inorganic? fertilisers. This has created an imbalance among macro- and micro-nutrients, resulting in nutrient deficiencies leading to loss of soil health and unsustainable crop yields. Hence, proper blending of inorganic fertilisers with eco-friendly, organic manures are essential for improving soil health and maximising sustainable crop production. The present study aimed? to compare the effect of straingth inorganic fert- ilisers with organic/inorganic blends.

Materials and methods

Field experiments were conducted over two years (1994-95 and 1995-96) at Hyderabad, India, using maize (DHM-105) and soybean (cv. Hardee) as test crops. The Alfisols soil used in the study had the following characteristics: bulk density (BD) 1.55 Mg/m^3, soil porosity (SP) 32.85%, water-stable aggregates >0.25 mm 19.28%, water-holding capacity (WHC) 23.84%, infiltration rate (IR) 4.32 cm/h, hydraulic conductivity (HC) 2.25 cm/h, pH 7.8, organic carbon (OC) 0.5%, available N 202 kg/ha, P_2O_5, 8.5 kg/ha, K_2O 296.5 kg/ha, Fe 6.96 mg/kg, Cu 0.58 mg/kg, Mn 9.20 mg/kg and Zn 0.91 mg/kg. The experiment was laid out in a randomised block design with six treatments consisting of 50% substitution of recommended N rate (120 kg/ha) through FYM, VC, PM and BGS along with recommended N rate through fertiliser (RDN) and control. The treatments were imposed for the maize crop only and the recommended fertilisers (40:50:40 NPK kg/ha) were applied to soybean crop. A uniform dose of P and K 60 kg/ha each was applied to maize crop as basal dressing for all the treatments except control. N was applied in the form of urea, P_2O_5 as single superphosphate and K_2O as muriate of potash. Soil samples collected just before start of the experiment, and after two years, were analysed for different soil physical properties, organic carbon, available macro-nutrients and micro-nutrient con- tent using standard procedures.

Results and discussion

Substitution of 50% of recommended N rate with organic manures significantly improved the soil physical properties *viz.,* SP, WSA, WHC, IR and HC while BD decreased. There was no change in soil pH and EC (Table 1). Vermicompost (VC), which was on par with poultry manure (PM), recorded the best soil physical properties in comparison with plots treated with BGS, farmyard manure (FYM), recommended N rate (RDN) and the control. The highest SP maintained by VC treated plots may be due to stimulative action on native earthworms, resulting in a build up of the worm population, thereby increasing soil macro

pores through burrowing action. The improvement in WSA in plots treat-ed with manures may be due to binding action of organic matter added to soil by manures, as this effect was evident in plots treated with urea where aggregation was still poor. Similar results were observed by Biswas *et. al.*, (2). The increased WHC, IR, HC and decreased BD under manure treated plots may be due to the better degree of aggregation and porosity compared to the RDN and control plots. The OC, available macro-nutrients (N, P and K) and? micro-nutrients (Fe, Cu, Mn, and Zn) increased significantly where 50% of the N was provided by manures (Table 2). The increase of OC, nutrient availability among different treatments was in the order: 50N+50VC >50N+50PM > 50N +50BGS >50N+50FYM > RDN > control. The higher availability of nutrients in soil treated with manures in combination with inorganic fertilisers may be due to the direct addition of nutrients after mineralisation of manures (1) as well as to reduced fixation of nutrients like Fe, Cu, Mn and Zn.

The grain and stover/haulm yields of maize and soy-bean were positively influenced and were in the follow-ing order: 50N +50VC > 50N+50PM >50N+50BGS 50N+50FYM> RDN> control (Table 2). However, the grain yields under treatments 50N+50VC and 50N +50PM were on par and differed significantly with other treatments. Similar increased yields under VC treated plots were reported by Krishnamoorthy and Vajranaba-iah (3) who attributed the yield increases to the presence of plant growth hormones that have beneficial effects on all yield parameters. Better yields under manure treated plots, compared to RDN and control, may be attributed to the better soil physical conditions and increased availability of nutrients, which enhanced the nutrient absorption resulting in better yields.

Conclusion

Based on the study, it can be concluded that the combined use of VC at 50% level of N with 50% N through inorganic fertiliser is suitable for maintaining good soil health and for obtaining optimum yields in maize- soybean cropping system.

References

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