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Research article

EFFECT OF LONG TERM FERTILIZATION ON PH, EC AND EXCHANGEABLE CA AND MG IN VERTISOLS UNDER SORGHUM-WHEAT CROPPING SEQUENCE

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ABSTRACT: The experiment was under taken during the year 2007-08 to study the effect of long term fertilization and manuring on exchangeable Ca and Mg. The soil is calcareous slightly alkaline in reaction, low in OC and available N very low in available P and high in available K. The experiment comprised of twelve treatments including NPK levels with and without FYM, sulphur and zinc replicated four times in randomised block design. The manure and fertilizers were given to sorghum crop every year and only fertilizers were applied to wheat crop. The soil samples from all the treatments were collected from 0-20 cm depth. Highest and significant exchangeable Ca and Mg were noticed in the treatment 100% NPK + 10 t FYM $ha^{-1.}$

Key words: Long term fertilization, exchangeable Ca and Mg

INTRODUCTION

Over the years, testing for exchangeable Ca and Mg has been found to give reasonably good estimates of the amounts of these elements potentially available to plants. Currently, almost all soil testing laboratories. Magnesium is a component of several primary and secondary minerals in the soil, which are essentially insoluble, for agricultural considerations. These materials are the original sources of the soluble or available forms of Mg. Magnesium is also present in relatively soluble forms, and is found in ionic form (Mg^{+2}) adhered to the soil colloidal complex. The ionic form is considered to be available to crops. Exchangeable Ca and Mg increases with the application of FYM (Bellakki and Badanur, 1997).

MATERIALS AND METHODS

The long term fertilizer experiment was initiated during *kharif* 1988 on the Research Farm of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola in Maharashtra ($22^0$42' N and $77^0$02' E, 307.42 m above mean sea level). The soil is Vertisol with alkaline pH (8.1), high cation exchange capacity (48 c mol (p^+) kg^{-1}), medium soil organic carbon (4.6 g kg^{-1}), total nitrogen (0.044 %), low available phosphorus (8.4 kg ha^{-1}) and high available potassium (358 kg ha^{-1}). The present investigation was undertaken during 2007-08 after 19^{th} cropping cycle of this long term experiment. The experiment consisted of twelve treatments *viz*., T_1- 50 % NPK, T_2- 100 % NPK, T_3- 150 % NPK , T_4- 100 % NPK(S free), T_5- 100 % NPK + 2.5 kg Zn ha^{-1}, T_6-100 NP, T_7- 100 % N, T_8- 100 % NPK+ FYM @10 t ha^{-1}, T_9-100 % NPK (S free) + 37.5 kg S ha^{-1}, T_{10}- FYM @ 10 t ha^{-1}, T_{11}- 75 % NPK and T_{12}-Control. The experiment is laid out in randomized block design and replicated four times. The experiment is being conducted on same site and same randomization. The nutrients were applied through the fertilizers like urea, single super phosphate, muariate of potash, diammonium phosphate (T_4 and T_9). Sulphur is applied through gypsum (T_9 only) for sorghum crop and zinc is applied through zinc sulphate once in two years for wheat crop only (T_5 only).

The farmyard manure was applied every year one month before sowing of sorghum crop. The recommended fertilizer doses were applied as 100:50:40 and 120:60:60 kg N, P_2O_5 and K_2O ha^{-1} to sorghum and wheat crops, respectively. During the year of study, sorghum (CSH-9) was sown during first week of July and harvested in second week of November and wheat (AKW-1071) was sown during second fortnight of November and harvested in first week of April. The grain and straw yields of each crop were recorded and plot wise soil samples (0-20 cm) collected after harvest of wheat which was analyzed for pH, electrical conductivity, and exchangeable Ca and Mg. Exchangeable Ca and Mg were estimated by using EDTA method in the neutral normal ammonium acetate extract as described by Hesse (1971).

RESULTS AND DISCUSSION

A rational fertilizer use programme for the optimal growth of crops in rotation involves estimation of amount of fertilizers to be applied, which in turn depends upon an amount of nutrient available to the plants from previously applied fertilizers and amount inherently available from the soil.

Table 1: Soil reaction (pH) and EC of soil as influenced by long term fertilization

Treatments	pH	EC (dS m^{-1})
T_1 - 50%NPK	7.94	0.28
T_2 - 100%NPK	7.85	0.31
T_3 - 150%NPK	7.78	0.34
T_4 - 100%NPK S free	7.85	0.29
T_5 - 100%NPK + 2.5 kg Zn ha^{-1}	7.83	0.32
T_6 - 100%NP	7.87	0.31
T_7 - 100%N	7.88	0.31
T_8 - 100%NPK +10 t FYM ha^{-1}	7.75	0.34
T_9 - 100%NPK + 37.5 kg S ha^{-1}	7.82	0.33
T_{10} - FYM only 10 t ha^{-1}	7.82	0.28
T_{11} - 75% NPK	7.86	0.29
T_{12} - Control	7.98	0.27
SE(m)±	0.07	0.01
CD at 5%	-	0.04

Soil reaction (pH)

In the present investigation the soil pH was assessed under various fertilizer treatments. The pH of soil was not influenced statistically by various treatments. The data presented in Table 1, indicated that the continuous use of manures and fertilizer, slightly lowered the pH. Increase in fertilizer doses decreased the pH. Sharma et al. (2007) also reported non significant results in soil pH after 31 years of experimentation. The addition of organics in the form of FYM @ 10 t ha^{-1} in the treatment of T_8 and T_{10} reduced the pH. This could be ascribed to the release of organic acids during the process of decomposition of the organic compounds. The results are in line with the findings reported by Sinha et al. (1997).

Electrical conductivity

Data as regards the long term effect of various fertilizer treatments on electrical conductivity is presented in Table 1. The significant change in electrical conductivity may be attributed to the long term addition of NPK fertilizers. Electrical conductivity varied from 0.27 to 0.34 dS m^{-1} in treatments. Conspectus, the data pertaining to electrical conductivity indicated that electrical conductivity was noticed highest in the treatment of super optimal dose of inorganic fertilizers (T_3) as compared to the INM and FYM only treatments. This may be attributed to the fertilizer that application of chemical fertilizers only over the long period leads to slight increase in the soluble salts in the soil. The findings are in consonance with the results reported by Sharma et al. (2007). Even continuous use of FYM showed higher values for electrical conductivity than control, which may probably be due to solubilising effect of organic acids on various compounds in soil. Sharma and Gupta (1998) observed that there is no consistent trend by pH and EC due to different treatments. However these values were recorded low compared to initial status of soil. It may be due to addition of several plant acids in soil during decomposition of crop residues in the field (Newaj and Yadav, 1994).

Exchangeable Ca and Mg

The effect of various treatments on exchangeable Ca and Mg was significant (Table 2). Significantly highest exchangeable Ca and Mg [44.23 and 8.90 c mol (p^+) kg^{-1}] were recorded in the treatment 100% NPK + 10 t FYM (T_8) followed by 150% NPK treatment. Lowest exchangeable Ca and Mg content were recorded in control. The application of 10 t FYM ha^{-1} recorded significantly higher exchangeable Ca and Mg over 100% NPK treatment and as well as control these findings are also reported by Bellaki et al. (1998).

Graded levels of NPK application (50% to 150%) increased the exchangeable Ca and Mg. The results are in conformity with findings reported by Chander et al. (2007). There was 16.5 and 26.1 per cent build up in exchangeable Ca and Mg respectively in the treatment 100% NPK + 10 t FYM over control.

Table 2: Long term influence of various treatments on exchangeable Ca and Mg under sorghum-wheat cropping sequence

Treatments	Ca [c mol (p^+) kg^{-1}]	Mg [c mol (p^+) kg^{-1}]
T_1 - 50%NPK	38.73	7.40
T_2 - 100%NPK	40.00	7.75
T_3 - 150%NPK	43.30	7.93
T_4 - 100%NPK S free	39.08	7.73
T_5 - 100%NPK + 2.5 kg Zn ha^{-1}	39.60	7.80
T_6 - 100%NP	39.88	7.60
T_7 - 100%N	39.18	7.43
T_8 - 100%NPK +10 t FYM ha^{-1}	44.23	8.93
T_9 - 100%NPK + 37.5 kg S ha^{-1}	40.43	8.00
T_{10} - FYM only 10 t ha^{-1}	42.30	8.13
T_{11} - 75% NPK	39.30	7.55
T_{12} - Control	37.98	7.08
SE(m)±	0.07	0.03
CD at 5%	0.20	0.08

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