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CORRELATION OF SOIL'S PHYSICO-CHEMICAL ATTRIBUTES WITH INTEGRATED NUTRIENT MANAGEMENT UNDER RAINFED CONDITION

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ABSTRACT
The purpose of this work was is to evaluate the correlation of soil's physico-chemical attributes with integrated nutrient management under rainfed condition. The experiment was conducted in a randomized complete block design (RCBD) with 14 treatments *i.e.* treatments consist of control (T_1), (T_2) NPKS (20:17:20:20 kg/ha), (T_3) 50% NPKS, (T_4) FYM @ 5 t/ha, (T_5) vermicompost @ 2 t/ha, (T_6) NPKS (20:17:20:20 kg/ha) + FYM @ 5t/ha, (T_7) NPKS (20:17:20:20 kg/ha) +vermicompost @ 2 t/ha, (T8) 50% NPKS +FYM @ 5 t/ha, (T_9) 50% NPKS + vermicompost @ 2 t/ha, (T10) *Rhizobium* culture +PSB, (T_{11}) NPKS (20:17 ; 20:20 kg/ha) + *Rhizobium* culture + PSB, (T12) 50% NPKS +*Rhizobium* culture + PSB, (T_{13}) FYM @ 5 t/ha + *Rhizobium* culture + PSB and (T_{14}) vermicompost @ 2 t/ha + *Rhizobium* culture +PSB. In T7 plot increased value of NPK was N = 286 kg/ha, P = 24.40 kg/ha, K = 472 kg/ha as compared to non-treated soil. However before sowing soil NPK was 200 kg/ha, 15 kg/ha, 440 kg/ha respectively, organic carbon = 0.42%, pH = 7.5 and EC = 0.3 dS/m which was far less than the nutrient obtained in soil after harvest. After the analysis of nutrient status in post harvest soil it can be concluded that integrated nutrient management in soil by combined application of chemical fertilizer +VC (T7 Plot) are best for soil fertility for longer period. Based on the results of this study it is clear that with the use of INM we can minimize the quality of fertilizers and recycle farm waste, therefore results in safer environment and sustainable soil fertility.

KEY WORDS: Bio-fertilizers, Correlation, Physico-chemical parameter, Rainfed condition, Vermicompost.

INTRODUCTION

The Soil is unconsolidated material occupying the earth's surface, which provides a solid, yet penetrable foundation for plant growth; it enables to become firmly anchored and serves as a reservoir for the water and minerals needed by plants. The soil is an example of a major ecosystem, containing a large number of different kinds of animals, bacteria and plants that compose an inter-related biologic complex. The soil structure effect the root growth and ultimately affect the growth of the plant species (Munkholm *et al*., 2002; Hu *et al*., 2006; Meersa *et al*., 2007; Iqbal and Shafiq, 2007; Ibanga *et al*., 2008; Ozkan *et al*., 2008; Maher *et al*., 2008; Nuseyinova *et al*., 2009). It is the soil, which sustain life on the earth. Rainfed farming is the practice of growing crops, entirely depending on rainfall as source of moisture where the mean annual rainfall is around 750 mm. The quantity of rainfall should be adequate or sufficient to meet the crop demand. The results of a large number of experiments on manure and fertilizers conducted across the country revealed that neither chemical fertilizer nor organic sources alone can sustain the soil productivity under high intensive cropping systems (Singh and Yadav, 1992). The integrated nutrient management (INM) has assumed greater significance in the recent past. Work on INM, as a whole is very less. Besides, the prohibitive cost of chemical fertilizers often compels to use organic and bio-fertilizers. Therefore, INM involving inorganic, biological and organic sources has potential to improve soil fertility on sustainable basis, since it supplies almost all the nutrients besides increasing nutrient use efficiency and improving physico-chemical properties of soil. The application of bio-fertilizer mixed with FYM saved 50 % recommended dose of chemical fertilizer. (Rajkhowa *et al.*, 2003, Rajput and Pandey 2004 and Rajput and Kushwah, 2005).

MATERIALS & METHODS

A Field experiment was conducted at RAK college of Agriculture at Sehore during Rabi season 2009-10 and 2010-11 to evaluate the response of integrated nutrient management on soil fertility and health. Lentil variety JL-3 was selected for this investigation. The experiment was laid out in Randomized Complete Block Design having 14 treatments of nutrient management with 3 replications. The treatments consist of control (T_1), (T_2) NPKS (20:17:20:20 kg/ha), (T_3) 50% NPKS, (T_4) FYM @ 5 t/ha, (T_5) vermicompost @ 2 t/ha, (T_6) NPKS (20:17:20:20 kg/ha) + FYM @ 5t/ha, (T_7) NPKS (20:17:20:20 kg/ha) +vermicompost @ 2 t/ha, (T8) 50% NPKS +FYM @ 5 t/ha, (T_9) 50% NPKS + vermicompost @ 2 t/ha, (T10) *Rhizobium* culture +PSB, (T_{11}) NPKS (20:17 ; 20:20 kg/ha) + *Rhizobium* culture + PSB, (T12) 50% NPKS +*Rhizobium* culture + PSB, (T_{13}) FYM @ 5 t/ha + *Rhizobium* culture + PSB and (T_{14}) vermicompost @ 2 t/ha + *Rhizobium* culture +PSB.

In present study the soil was analyzed before sowing and after harvesting the crop. Soil was collected from the field before sowing, weighed and air dried and analyzed for pH, EC, NPK and OC. After harvesting, soil sample was taken from each plot respectively and then analyzed for pH and NPK by using standard methods (Jackson, 1958, 1967, 1973), Subhiah and Asija (1956). Data were statistically analyzed by procedure described by Fisher, 1958.

RESULTS & DISCUSSION

Soil samples were analyzed before sowing and after harvesting of crop to visualize the amount of NPK remaining in the soil and that all nutrients were significantly affected by treatments. NPK were found maximum under combined application of organic and inorganic nutrients (T7 Plot). The maximum value of nitrogen, phosphorus and potassium in T_7 plot was 286.00 kg/ha, 24.40 kg/ha and 472 kg/ha and minimum value was 184.33 kg/ha, 8.70 kg/ha and 284 kg/ha in control. The values were comparatively less when pre treated with organic or inorganic fertilizers alone. In combination of organic and inorganic fertilizers this NPK contained in soil shoots up. The pH of soil did not differ significantly in different treatments, it varies from 7.50 to7.67. Higher availability of NPK under combined application of nutrients may be due to improved physical, chemical and biological properties on account of organic matter addition, as earlier observed by Patra *et al.*, (2000); Anwar *et al.* (2005), Chand *et al.* (2011) and Kumar *et al.* (2011).

TABLE 1: Physico-chemical properties of experimental soil before treatment

S. No.	Particulars	Content 2009-10
1	Organic carbon (%)	0.42
2	Available nitrogen (N kg/ha)	200
3	Available phosphorus (P_2O_5 kg/ha)	15.0
4	Available potassium (K_2O kg/ha)	440
5	Soil pH	7.5
6	E.C. dS/m	0.3

TABLE 2: Physico-chemical properties of experimental soil after crop harvest as influenced by different INM treatment

Treatment		Available nutrients balance in soil (kg/ha)			
		pH	N	P	K
Control (no fertilizers)	T_1	7.50	184.33	8.70	284.00
NPKS (20:17:20:20 kg/ha)	T_2	7.57	248.00	16.40	418.00
50% NPKS	T_3	7.53	240.00	14.27	411.00
FYM @ 5 t/ha	T_4	7.53	231.00	15.30	415.00
VC @ 2 t/ha	T_5	7.50	235.00	18.30	419.00
NPKS (20:17:20:20 kg/ha) + FYM @ 5 t/ha	T_6	7.60	274.00	23.80	448.00
NPKS (20:17:20:20 kg/ha) + VC @ 2 t/ha	T_7	7.57	286.00	24.40	472.00
50% NPKS + FYM @ 5 t/ha	T_8	7.50	261.00	18.50	455.00
50% NPKS + VC @ 2 t/ha	T_9	7.67	266.00	17.30	450.00
RZ culture + PSB	T_{10}	7.57	252.00	11.30	421.00
NPKS (20:17:20:20 kg/ha) + *RZ* culture + PSB	T_{11}	7.67	255.00	15.20	448.00
50% NPKS + *RZ* culture + PSB	T_{12}	7.63	250.00	14.00	421.00
FYM @ 5 t/ha + *RZ* culture + PSB	T_{13}	7.57	251.00	13.40	415.00
VC @ 2 t/ha + *RZ* culture + PSB	T_{14}	7.57	248.00	12.30	418.00
S. E.m ±		0.08	7.86	1.07	10.51
C.D. (at 5%)		0.25	22.85	3.11	30.55

CONCLUSION

After the analysis of nutrient status in post harvest soil it can be concluded that INM in soil by combined application of NPKS (20:17:20:20 kg/ha) + VC @ 2t/ha (T7 Plot) are best for soil fertility for longer periods. INM will increase soil organic matter status, which act as a reservoir for nutrients and hence improve soil physico-chemical attributes for plant's growth under rainfed condition. This study indicates that combined application of manure and fertilizer help to increase crop productivity and maintaining soil fertility and soil quality.

Present investigations will be useful to farmers; agronomist, researchers and environmentalists as it will provide information in maintaining long term soil fertility; sustained higher productivity of crop and lessen the harm caused to the soil by the use of chemical fertilizers.

REFERENCES

Anwar, M., Patra, D.D., Chand, S., Kumar, Alpesh, Naqvi, A.A. and Khanuja, S.P.S. (2005) Effect of organic manures and inorganic fertilizers on growth, herb and oil yield, nutrient accumulation and oil quantity of French Basil communication in soil science and plant analysis. vol. 36: 1737- 1746.

Chand, Sukhmal, Pandey, Ankit, Anwar, Mohammed and Patra, D.D. (2011) Influence of integrated supply of vermicompost, bio-fertilizers and inorganic fertilizers on productivity and quality of rose scented Geranium

(*Pelargonium* Sp.) Indian J. of natural products and resources. Vol. 2 (3): 375-382

Fisher, R.A., (1958) Skeleton Analysis of Variance Book "Design of Experiment".

Hu, T., X.L.I., Dong, J., Rong, B. , Shen, Z., Cchow, J. and Watson, J.G. (2006) Morphology and elemental composition of dust fall particles inside emperor Qin's Tera- cota warriors and horses museum. China. Particuology.,4 (6): 346-351.

Ibanga, J.I., Umoh, B.N. and Iren, B.D. (2008) Effects of cement dust on soil chemical properties the cabar environment, Southeastern Nigeria. Soil Science and plant analysis, 39:51-558.

Iqbal, M., Zafa, M. and Abdin, M. Z. (2000) Studies on anatomical physiological and biochemical response of trees to coal smoke pollution around a thermal power plant. Project report submitted by Department of Botany, Faculty of Science, Zamia Hamdard University, Hamdard nagar, New Delhi to Ministry of Environment and forest Government of India.

Jackson, M.L., (1958, 1967,1973) Soil chemical analysis prentice hall, India Pvt. Ltd. New Delhi 1-497.

Khan, Hakim., Ahmad, Farhad, Ahmad, S.Q., Sherin M. and Bari, Abdul (2006) Effect of phosphorus fertilizer on grain yield of Lentil. Sarhad J. Agric. 22 (3): 433-436.

Kumar Mohan, A.B., Narase, N.C. Gowda Raviraja, Shetty, G. and Kartik, N.M. (2011) Effect of organic manures and inorganic fertilizers on available NPK, microbial density of the soil and nutrient uptake of Brinjal. Research journal of Agriculture Science 2011, (2) 2:304-307.

Maher, B.A., Moore, C. and Matzka, J. (2008) Spatial variation in vehicle derived metal pollution identified by magnatic and elemental analysis of road side tree leaves. Atmos. Environ., 42:364-373.

Munkholm, L.J., Schjonning, P. and Elmholt, S. (2002) Soil structure dynamics: Effects of management and water content. Paper presented at advances in soil structure research workshop, Prince Edward Island, Canada.

Ozkan, M.H., Gurkan, R., Ozkan, A. and Akeary, M. (2008) Determination of Mn and Pb in road side soil samples of FAAS with ultrasound assisted teaching. Journal of Analytical chemistry, 60:469-474.

Patra, DD., Anwar, M. and Chand, S. (2000) Integrated nutrient management and waste recycling for restoring soil fertility and productivity in Japanese Mint (*Menth arvensis*) and Mustard (*Brassica juncea*) sequence in Uttar Pradesh, India. Agric. Ecosys. and Environment. 80:267-275.

Rajkhowa, D.J., Sakia, M. and Rajkhowa, K.M. (2003) Effect of vermicompost and levels of fertilizer on Green Gram. Legume Research, 26 (1): 63 – 65.

Rajput, R.L. and Pandey, R.N. (2004) Effect of method of application of bio-fertilizer on yield of Pea (*Pisium sativum*). Legume Research, 25 (1) :75 –76.

Rajput, R.L. and Kushwah, S. S. (2005) Effect of integrated nutrient management on yield of Pea (*Pisium sativum*). Legume Research, 28 (3): 231 – 232.

Saravanapandian, P. (1998) Effect of fertilizer phosphorous, FYM and incubation period on available P in different soil types of Ranga Reddy district of Andhra, Madras Agricultural Journal. 85 (10/12): 511-513.

Singh, G.B. and Yadav, D.V. (1992) Integrated nutrient supply system in sugarcane and sugarcane based cropping system. Fertilizer News, (37): 15-22.

Subbiah, B.V. and Asija, G.L. (1956) A rapid procedure for the estimation of available nitrogen in soil. Curr. Sci. 25: 259-260.

ABBREVIATIONS

C.D. - Critical Difference, EC - Electrical conductivity, FYM - Farm Yard Manure, INM - Integrated Nutrient Management, NPKS - Nitrogen Phosphorus, Potassium, Sulfur, PSB - Phosphate soluble bacteria, RZ - *Rhizobium*, S.E.m - Standard error mean, VC – Vermicompost.