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Perspectives on integrated nutrient management in soil properties of rice crop

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Abstract
The present investigation entitled "Production potential of scented rice under different organic nutrient management" was conducted during the year 2012 at Krishi Nagar, Research Farm, JNKVV, Jabalpur (M.P.). This study has been started since the year 2003-04 under AICRP on Integrated Farming System. It is obvious from the results that pH of soil did not deviate after completion of ninth crop-cycle under a rice-based cropping system. The treatments were applied in rice crop under rice-based cropping systems. In all 7 treatments consisted with T_1 :- 50% NPK through fertilizers + 50% N through FYM, T_2 :- 1/3 N through each of FYM, vermicompost (VC) and neem cake (NC), T_3 :- T_2 +Agronomic practices of weed control, T_4 :- T_2 + BGA+ Rock phosphate + PSB, T_5 :- T_2 + Azospirillium +PSB, T_6 :- 100% NPK through fertilizers + Zn as per soil test values (STV) and T_7 :- T_2 + Green manuring of sunhemp under randomized block design. The EC, OC, N and P contents remarkably improved due to the effects organic nutrient management over their initial status, but inorganic treated plot did not change these soil parameters over their parental status. Organic treated plots to rice crop for 3 consecutive years under a fixed rice based cropping system attributed to enhance the EC, OC and N contents of soil and maintained the sustainability on long run basis.

Keywords: Soil Health, EC, pH, OC, Sustainability and Integrated Nutrient Management

Introduction
Rice (*Oryza sativa L.*) is one of the most important staple food crops, which supplies major source of calories for about 45 per cent of world population, particularly to the people of Asian countries. Asia produces and consumes 90 per cent of world's rice. Among the rice growing countries, India ranks first in area followed by China and Bangladesh. Rice is a major cereal crop of India occupied an area of 42.56 million ha with the production of 95.33 million tons and productivity 2240 kg/ha in M.P. (Anonymous 2010) [1].

Sustainability in crop yield and soil health could be achieved by the application of mineral fertilizers along with organic manures. Benefits of organic manures like farm yard manure, neem cake, green manures, poultry manure and vermicompost are well known but the availability is reducing day by day. These organic manures are not only good sources of nutrients but also improve the physical condition of the soil. Apart from containing NPK these also contain small amounts of trace elements especially boron, copper, iron, sulphur, zinc and with fair quantity of growth promoting substances.

Kymore Plateau and Satpura hills zone comes under rice growing tract. Cultivation of rice–wheat and rice-gram are not economical due to higher cost of cultivation. The resource poor farmer unable to afford desirable agro inputs for management of labour, nutrients, weed and water. Therefore, integrated nutrient management *i.e.* organic manure and inorganics are used simultaneously is probably the most effective method to maintain healthy sustainable soil system while increase crop productivity. Under organic farming package, there is possibility to grow scented rice due to high demand of organic production. Scented rice is economically viable and sustainable on long run basis.

Methodology
The experiment was conducted at Krishi Nagar, Research Farm, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP). The present investigation is a part of continuous field experimentation under All India Coordinated Research Project on Integrated Farming System (AICRP-IFS), which has been started since 2003-04. Thus it was the ninth year of the

experimentation with the same treatments on the same site of field without changing the layout plan. Hence, initial status pertaining to physico– chemical properties of the soil in experimental field was taken from the annual report of the project. The average annual rainfall of the tract is about 1350 mm which is mostly received during the rainy season. Soils are loamy sand with pH 7.2, 0.45 dS/m EC, 0.66% organic carbon, 215.0 kg ha^{-1} N, 8.2 kg ha^{-1} P_2O_5 and 370 kg ha^{-1} K_2O during initial stage of experiment 2003-04. Experiment was laid out in a randomized block design with three replications comprising seven different treatment combinations *i.e.* T_1 - 50% NPK through fertilizers + 50% N through FYM, T_2 - 1/3 N through each of FYM, Vermicompost and Neem cake, T_3 - T_2 + Agronomic practices of weed control, T_4 - T_2 + BGA + Rock Phosphate + PSB, T_5 - T_2 + Azospirillum + PSB, T_6 - 100% NPK through fertilizer + Zn as per soil test values, T_7 - T_2 + Green manuring with Sunhemp. Sugandha - 5 variety of rice was sown in nursery bed at the rate of 30 kg/ha on 30 June in rows 20 cm apart. The recommended dose of fertilizer for rice was 120 kg ha^{-1} N, 60 kg ha^{-1} P_2O_5 and 40 kg ha^{-1} K_2O.

The soil samples were taken after the harvesting of rice from each plot at 0-30 cm depth with the help of soil-auger. After this, all samples were dried plot wise separately. Then dried samples were powdered with the help of mortar and pistal. Finally, soil sample of each plot was subjected to their analysis for pH, EC, OC and N, P and K contents as per the standard procedures.

Adequate research facilities viz. irrigation water, seeds, fertilizers, equipment's and laborers etc. were available on the research farm to conduct the field research observation smoothly.

Nutrient (NPK) contents of organic manures

The major nutrient (NPK) contents of different organic manures tested under the present investigation are given in the table 1 as below:

Table 1: Major nutrient contents of different organic manures

Organic manure	Nutrient contents (%)		
	N	P_2O_5	K_2O
FYM	0.51	0.25	0.50
Vermicompost	1.20	0.90	0.84
Neem oil cake	4.52	1.12	1.40
Blue green algae	0.68	0.13	0.49

Result and Discussion

Effect of different treatments on pH, EC, OC, N, P and K content of soil

It is evident from the said data (table 2), that pH of soil did not deviate much due to the effect of various treatments over their parental status after the completion of 9 crop-cycles. But EC, OC, N and P contents of soil considerably improved due to the effect of various nutrient management over their parental status. The treatments associated with application of organic manures partially or completely viz., T_1, T_2, T_3, T_4, T_5, T_6 and T_7 had higher values pertaining to EC, OC, N and P contents of soil over their initial values. K content was almost unchanged under all treatments after completion of 9 crop-cycles.

The EC, OC, N and P contents showed remarkable improvement due to the effects organic nutrient management over their initial status, but inorganic treated plot did not change these soil parameters over their initial status. Organic treated plots continuously to both crops for nine years under a fixed rice-based system attributed to enhance the OC and N contents of soil agreeing with the findings of Murali and Shetty (2000) [2], Singh *et al*. (2005) [5] and Jha *et al*. (2004) [3].

The K status remained unchanged over their initial status after completion of ninth crop-cycle under all treatments including organic nutrient management (Murali and Shetty, 2000; Singh *et al*., 2004) [2, 4] has also mentioned that balanced nutrition to crop through organic as well as inorganic sources found helpful to maintain the K content of soil. The data pertaining to changes in soil properties viz., pH, OC, EC and available N, P and K contents due to the effect of varying treatments after completion of 9th crop-cycle over their initial status are given below.

Table 2: Changes in soil properties due to different treatments upto end of 2012 over their initial status

Tr. No.	Treatments	pH	EC (dS/m)	OC (g/kg)	Available nutreints		
					N	P	K
	* Initial soil status	7.2	0.45	0.66	215	8.2	370
T_1	50% NPK through fertilizer + 50% N through FYM	7.2	0.49	0.67	225	9.1	369
T_2	1/3 N through each of FYM,VC and NEOC	7.2	0.47	0.68	221	9.3	371
T_3	T_2 + Agronomy practices of weed control	7.3	0.47	0.69	220	9.2	370
T_4	T_2 +BGA +Rock Phosphate + PSB	7.3	0.48	0.69	230	9.1	372
T_5	T_2 + Azosprillum + PSB	7.2	0.47	0.68	224	8.9	370
T_6	100% NPK through fertilizer + Zn as per soil test	7.2	0.49	0.68	221	8.9	371
T_7	T_2 + Green manuring of Sunhemp in summer	7.3	0.46	0.68	219	9.0	369

Conclusion

Based on the above facts, finding could be concluded as under:

Organic nutrient management in rice crop under rice-based cropping system improved the EC, OC, N and P contents and stabilized the K contents of soil over their initial status after completion of ninth crop-cycle in a sustainable manner.

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