EFFECT OF JATROPHA CAKE AND ITS COMBINATION WITH FERTILIZER ON RICE PRODUCTIVITY

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Abstract: The present investigation was carried out during *kharif* season of 2006-07 at the Instruction Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experiment was laid out in randomized block design (RBD) and replicated thrice with ten treatments consist of Jatropha cake and chemical fertilizer doses and there combinations to evaluate effect on rice productivity. The applications of 100% NPK + 2 t ha^{-1} cake or 100% NPK + 1 t ha^{-1} cake were beneficial in increasing the growth, yield attributing characters dry matter production, uptake of major (nitrogen, phosphorus and potash) and micronutrients (iron, copper zinc and manganese) and yield of rice crop. The Jatropha cake additions with recommended dose of chemical fertilizer also improved the soil organic carbon, soil available major (nitrogen, phosphorus and potash) and micronutrients (iron, copper zinc and manganese), thus sustainable soil health can be maintained by long term use of the cake in crop production.

Keywords: Rice, Jatropha cake, Fertilizer, yield, productivity

INTRODUCTION

High cost of fertilizer and low purchasing capacity of the small and marginal peasants of the country, restrict the use of costly fertilizer input. Under such conditions the sustainable agriculture provides an ideal solution not only to tackle the problem of agriculture production but also to conserve and protect the natural resources.

Integrated nutrient management is the only way for sustainable agriculture. The integrated nutrient management includes the intelligent use of organic, inorganic and bio-fertilizer to harvest optimum yields over a time and maintain soil health. The bio-organic and organic manure are now again getting global importance to meet the nutrient need of crops since, the efficiency of applied mineral nutrients to the crop is markedly influenced in presence of low input available source viz. various organic manure.

Rice is the major cereal cultivated in Chhattisgarh and occupied more than 81 percent of cropped area, where the total rice area is 4.6 m ha, irrigated area cover 0.7 m ha, upland 1.3 m ha and rain fed low land cover 2.6 m ha. Sustainable production of rice can be assured through integration of organic and inorganic source of plant nutrients.. Injudicious use of inorganic fertilizer has becomming unsafe to human beings and our soil health. In the long term experiment conducted on alfisols, it was observed that higher yield level could be maintained when organic and inorganic nutrients were combined and applied to crops.

The de-oiled cakes can be used as a high grade organic fertilizer. Cultivators apply both edible and non edible oil cakes to the soil as manure. Edible oil cakes are more profitable as cattle feeds and non edible cakes should be used as manure. Availability of non edible oil cakes is around 1.8-2.0 lakh ton per annum (Radhakrishna, 2007). Non edible cakes such as neem, mahua, karanj, castor etc. are used as organic fertilizer. The manurial values of the cakes depends on its nutrient content mainly N, P, K and micronutrient. The percentage of nitrogen varied from (2.5) in mahua to (7.9) in de-corticated safflower cakes. The P_2O_5 content in oil cakes various from 0.8-3.0 per cent and K_2O from 1.2-2.2 per cent. Oil cakes though insoluble in water are quick-acting to the plant in about a week or ten days after application. The quantity of organic matter that gets added in normal application of oil cakes is too small to cause improvement in physical properties of soil. Cakes are more effective in moist soil in wet weather than in dry soil and in dry weather.

MATERIAL AND METHOD

The study was conducted in Instruction Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India for the year 2006-07. Randomized block design with three replications and ten treatments *i.e.* Control, 1 t ha^{-1} cake, 2t ha^{-1}, 50% NPK through fertilizer, 100% NPK through fertilizer (100: 60: 40) , 1 t ha^{-1} cake + 50 % NPK through fertilizer, 2 t ha^{-1} cake + 50% NPK through fertilizer, 50% NPK + 50% N through cake, 100% NPK + 1 t ha^{-1} cake and 100% NPK + 2t ha^{-1} imposed in experiment. The 'Indira-9' paddy cultivar was the test crop. The crop was sown at a spacing of 20 x10cm. The crop received one third N and full dose of P_2O_5 and K_2O as basal application and remaining N were applied at tillering and panicle initiation stages in two equal doses respectively. Nitrogen was applied through urea, phosphorus through diammonium phosphate (DAP) and potassium through muriate of potash. Five to seven centimeters deep good quality water was maintained in the field. All the plots were weeded thrice, once before first top dressing and again before second top dressing and last weeding 11 day after second weeding. Panicles were counted from 4 random locations in each plot and for filled grains/panicle, 20 panicles of each plot were separated and then average filled grains/panicle were calculated, whereas weight of 1000 filled grains was taken as test weight.

Soil samples (0~0.15 m depth) were collected. Samples were dried and passed through 2 mm sieve and analyzed for physicochemical characteristics as described by Jackson The experimental soil was neutral in reaction, low in organic carbon, and low in available nitrogen, medium in available phosphorus and high in potassium.

RESULT AND DISCUSSION

Effect of Jatropha cake and its combination with fertilizer on rice yield and yield attributing characters

Grain yield

The data on grain yield of rice as shown in Table 1 clearly indicates that the yield was significantly affected by the different treatment imposed. All the treatment gave significantly higher yield over control. Application of T_{10} (100%NPK + 2 t ha^{-1} cake) recorded highest yield followed by T_9 (100% NPK+1t ha^{-1} cake) and T_5 (100% NPK through fertilizer). These three treatments gave significantly higher yield over rest of the treatments. Similar results were reported by Dudhat *et al.* (1996).

Straw yield

The results of straw yield of paddy as shown in Table 1 indicates that T_{10} (100% NPK + 2 t ha^{-1} cake) recorded significantly higher straw yield over rest of the treatments except T_9 (100% NPK + 1 t ha^{-1} cake) and T_5 (100% NPK through fertilizer).

Total number of tillers

The data on total number of tillers per square meter of paddy as shown in Table 2 and revealed that these were significantly affected by the various treatments. The highest number of total tillers was observed in T_{10} (100% NPK + 2 t ha^{-1} cake) Bokhtiar *et al.* (2001).

Effective tiller

The data on effective tillers m^{-2} of paddy as shown in Table 2 indicated that the highest number of effective tillers was observed in T_{10} (100% NPK + 2 t ha^{-1} cake) followed by T_9 (100% NPK + 1 t ha^{-1} cake) and T_5 (100% NPK through fertilizer). Similar results were found by Jadhav *et al.,* (1983) and Subhendu *et al.,* (2005).

Average plant height

The data given in Table 2 and on average plant height revealed that plant height was influenced significantly due to varying treatments applied to rice crop. The highest plant height was recorded due to combine application of cakes + full dose of NPK fertilizer i.e. T_{10} (100% NPK + 2 t ha^{-1} cake).

Thousand grain weight

Significant differences were observed with the application of various treatments in respect to thousand grain weight (Table 2). Numerically highest test weight was noticed with T_{10} (100% NPK + 2 t ha^{-1} cake) followed by T_9 (100% NPK + 1 t ha^{-1} cake) and T_5 (100% NPK through fertilizer).

Table 1: Effect of Jatropha cake and fertilizer doses on grain and straw yield.

Treatments	Yield (q ha^{-1})	
	Grain	**Straw**
T_1 : Control	29.22	68.99
T_2 : 1 t ha^{-1} cake	33.22	73.16
T_3 : 2 t ha^{-1} cake	35.67	77.50
T_4 : 50% NPK through fertilizer	37.29	78.33
T_5 : 100% NPK through fertilizer	45.57	100.16
T_6 : 1 t ha^{-1} cake + 50% NPK through fertilizer	39.81	93.41
T_7 : 2 t ha^{-1} cake + 50% NPK through fertilizer	42.58	96.16
T_8 : 50% NPK + 50% N through cake	40.95	83.08
T_9 : 100% NPK + 1 t ha^{-1} cake	46.71	106.41
T_{10} : 100% NPK + 2 t ha^{-1} cake	47.53	114.16
SEm±	**1.27**	**4.84**
CD (5%)	**3.78**	**14.41**

Table 2: Effect of jatropha cake and fertilizer dose on rice productivity characters

Treatments	Total tillers (m^{-2})	Effective tillers (m^{-2})	Plant height (cm)	1000 grain weight (g)
T_1 : Control	312.66	285.33	92.03	20.43
T_2 : 1 t ha^{-1} cake	344.66	312.00	92.73	22.26
T_3 : 2 t ha^{-1} cake	364.00	329.32	93.60	22.83
T_4 : 50% NPK through fertilizer	368.66	333.32	92.83	21.20
T_5 : 100% NPK through fertilizer	429.32	378.00	95.16	26.03
T_6 : 1 t ha^{-1} cake + 50% NPK through fertilizer	382.66	353.32	94.06	24.93
T_7 : 2 t ha^{-1} cake + 50% NPK through fertilizer	389.32	358.00	94.36	25.40
T_8 : 50% NPK + 50% N through cake	366.00	339.32	93.13	22.50
T_9 : 100% NPK + 1 t ha^{-1} cake	447.32	394.00	96.33	27.23
T_{10} : 100% NPK + 2 t ha^{-1} cake	468.00	410.66	97.16	28.86
SEm±	**17.95**	**16.99**	**0.562**	**0.395**
CD (5%)	**53.33**	**50.47**	**1.67**	**1.17**

CONCLUSION

The findings of the experiments in brief are summarized as below.

Applications of Jatropha cake, chemical fertilizer and their integrations to the soil significantly increased soil organic carbon content, while no effect on soil electrical conductivity and pH was observed.

The application of 100% NPK + 2 t ha^{-1} cake showed significantly highest plant height, total and effective tillers over control and was also similar with 100% NPK + 1t ha^{-1} cake. Effect of different treatments on test weight was also significant over control and was the highest with 100% NPK + 2 t ha^{-1} cake.

The significantly higher grain yield and straw yield was recorded with application of 100% NPK + 2 t ha^{-1} cake over control, but found similar with 100% NPK + 1t ha^{-1} cake and 100% NPK through fertilizer applications.

The results discussed earlier in form the summary given above, it is concluded that the Jatropha cake addition with chemical fertilizer improved the physico- chemical properties and nutrients status of the soil, thus sustainable soil health can be maintained by long term use of the cake in crop production. The applications of 100% NPK + 2 t ha^{-1} or 100% NPK + 1 t ha^{-1} were beneficial in increasing the rice productivity.

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