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Effects of variety and integrated nutrient management practices on yield and productivity of rice (*Oryza sativa* L.)-rapeseed (*Brassica campestris* L.) cropping sequence

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ABSTRACT

The effect of variety and integrated nutrient management in rice-rapeseed cropping sequence was studied. Both the varieties, Vandana and IR 6008-32 were at par with respect to grain and straw yields. The nutrient management practices had a significant effect on developmental phases of upland rice. The crop flowered and matured early due to application of recommended dose of fertilizer (RBD) + Single super phosphate incubated with FYM (1:2) + 5 t FYM ha^{-1} with highest grain (2.60 t ha^{-1}) and straw (6.90 t ha^{-1}) yields. The soil fertility status with respect to pH, organic carbon and total nitrogen were affected significantly by different nutrient management practices in rice. It had a significant effect on the performance of succeeding rapeseed crop (Var. TS-38). Highest seed (0.64 t ha^{-1}) and stover yield (1.32 t ha^{-1}) was recorded with application of 50% RDF + 5 t FYM ha^{-1}, which was at par with application of RDF + SSP incubated with FYM+ 5 t FYM ha^{-1}. Number of primary branches plant^{-1} and number of siliqua plant^{-1} were significantly affected by above treatments.

Key words: *Upland rice, rapeseed, nutrient management, soil fertility*

Upland rice is mainly grown in acid upland soils in Uttarakhand and north-eastern India, red lateritic soils of western Orissa, alluvial plains of coastal Orissa and eastern Uttar Pradesh (Singh, 2002). The productivity under the rainfed upland ecosystem is low (1 t ha-1) in most parts of India due to poor management practices as well as environmental factors. The north-eastern region accounts 10.48% of total rice area and 6.46% of the total rice production in the country (Pattanayak *et al*., 2006). While Arunachal Pradesh accounts 3.4% of rice area of north-eastern region and contributes around 2.3% of total rice production of this region with a productivity of nearly 1.0 t ha^{-1}. The abundant well distributed rainfall (more than 2000 mm per annum) in the state allows a second crop of oilseed crop like rapeseed in the residual soil moisture and nutrient. The farmers of the state use very low dose of chemical fertilizers (3.0 kg ha^{-1}) and FYM in rice production. There is lot of scope to increase the production and productivity of upland rice – rapeseed cropping sequence. Through better management practices like suitable variety, method of sowing, application of manures and fertilizers. Keeping the above facts in view, the present investigation was carried out to study the effect of variety and integrated nutrient management practices on the yield and productivity of upland rice with residual effect on succeeding rapeseed crop.

MATERIALS AND METHODS

A field experiment was conducted at research farm of the ICAR Research Complex for NEH Region, Arunachal Pradesh during the 2004-05 and 2005-06 in the red lateritic soils at an altitude of 660 m MSL with two upland rice varieties (Vandana and IR 6008-32) in the main plot and five nutrient management practices [control , recommended dose of fertilizer (RDF), 50% RDF + 5 t FYM ha^{-1}, 50% RDF + Green Manures and RDF + SSP incubated with FYM (1:2) + 5 t FYM ha^{-1}] in the sub-plot. Sunnhemp (*Crotalaria juncea* L.) as green manure was grown in contour strips between

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rice rows and recycled after one month. Phosphorus from single super phosphate was mixed with farmyard manure at 1:2 (oven-dry-weight) and the mixture was incubated for 72 hours in plastic bags under shade. The recommended dose of fertilizer was 80:60:60 kg, N, P_2O_5 and K_2O ha^{-1}. The soil of experimental site was clay loam having pH 5.03, organic carbon 0.62%, available N 340.0 kg ha^{-1}, available P 7.9 kg ha^{-1} and available K 105.5 kg ha^{-1}. Observations on grain, straw yield and other characters were recorded at harvest. The soil samples under each treatment were analysed by standard methods (Jackson, 1973) in respect of pH, organic carbon and total nitrogen (Muhr *et al*., 1965). After harvesting of upland rice, soil samples were collected from each plot separately for analyses and rapeseed variety TS-38 was sown in each plot to study the effect of nutrient management practices on the succeeding crop. Observations on seed, stover and yield attributing characters were recorded at harvest.

RESULTS AND DISCUSSION

Rice, variety Vandana matured earlier (113 days) than IR 6008-32 (125 days), though both the varieties were at par with respect to grain and straw yields (Table 1). The nutrient management practices had a significant effect on developmental phases of upland rice. Singh and Singh (2003) observed that growth and yield of rainfed upland rice can be substantially improved by the application of incubated P with locally available farmyard manure. The crop flowered and matured early due to application of recommended dose of fertilizer and SSP incubated with FYM (1:2) and recorded the highest grain (2.6 t ha^{-1}) and straw (6.9 t ha^{-1}) yields. Behera and Ram (2004) recorded similar results due to improved soil physical conditions through FYM addition.

Integrated nutrient management practices in upland rice had a significant effect on the performance of succeeding rapeseed crop too. Das and Ram (2006) reported that combined use of optimal fertilizers and FYM maintained the fertility status of soil in a long term manuring and fertilization trial. Highest seed (6.41 t ha^{-1}) and stover yield (1.36 t ha^{-1}) was recorded with application of 50% RDF + 5 t FYM ha^{-1}, which was at par with application of RDF + SSP incubated with FYM + 5 t FYM ha^{-1}(Table 2). Higher available nutrient status of soil was observed when organics were combined with inorganics compared to inorganic fertilizer alone. This appreciable build up, in the available nutrient contents of the soil major be due to mineralization of organic sources and solubilization of nutrients from the native source during decomposition. Number of primary branches/plant and number of siliqua/plant were significantly affected by above treatments.

The soil fertility status with respect to pH, organic C and total N were affected significantly by the different nutrient management in rice (Table 3). Soil pH was improved with application of RDF + SSP incubated with FYM (1:2) + 5 t FYM ha^{-1} which was at par with 50% RDF + 5 t FYM ha^{-1}. There was an increased content of organic C in soil after rice in which

Table 1. Effect of variety and nutrient management practices on developmental phases and yield of upland rice

Treatments	Days to 50% flowering	Days to maturity	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
Varieties				
Vandana	90	113	20.22	51.40
IR6008-32	99	125	21.59	51.40
CD (P=0.05)	2.07	0.50	NS	NS
Nutrient Management Practices				
Control	97	122	16.82	43.25
RDF	94	116	23.05	49.58
50% RDF + 5 t FYM ha^{-1}	94	121	19.98	51.96
50% RDF + Green Manures	95	120	18.67	42.71
RDF + SSP incubated with FYM (1:2) + 5 t FYM ha^{-1}	93	117	26.00	69.00
CD (P=0.05)	0.77	0.39	3.36	13.60

RDF: Recommended dose of fertilizers

Table 2. Effect of variety and nutrient management practices of upland rice on succeeding rapeseed (Pooled data of two years)

Treatments	Seed yield (t ha^{-1})	Stover yield (t ha^{-1})	No. of primary branches plant^{-1}	No. of siliqua plant^{-1}	1000 seed wt. (g)
Varieties					
Vandana	4.99	9.89	4.80	61.07	3.36
IR6008-32	4.99	10.71	5.40	73.93	3.36
CD (P0.05)	NS	NS	NS	NS	NS
Nutrient Management Practices					
Control	4.43	9.62	4.67	55.83	3.30
RDF	4.49	8.15	4.33	57.50	3.39
50% RDF + 5 t FYM ha^{-1}	6.41	13.16	5.83	80.00	3.38
50% RDF + Green Manures	4.01	7.96	4.67	66.17	3.36
RDF + SSP incubated with FYM (1:2) + 5 t FYM ha^{-1}	5.61	12.63	6.00	78.00	3.37
CD (P=0.05)	1.48	3.18	0.79	19.35	NS

RDF: Recommended dose of fertilizers

Table 3. Effect of variety and nutrient management practices on soil fertility status after rice in rice-rapeseed cropping sequence (Pooled data of two years)

Treatments	Soil pH		OC (%)		Total N (%)	
Varieties	I	AR	I	AR	I	AR
Vandana	5.03	5.20	0.62	0.62	0.065	0.071
IR6008-32	5.03	5.12	0.62	0.64	0.065	0.074
SEm ±	-	0.97	-	0.08	-	0.050
CD (0.05)	-	NS	-	NS	-	NS
Nutrient Management Practices						
Control	5.03	4.77	0.62	0.51	0.065	0.072
RDF	5.03	4.85	0.62	0.52	0.065	0.076
50% RDF + 5 t FYM ha^{-1}	5.03	5.35	0.62	0.77	0.065	0.081
50% RDF + Green Manures	5.03	5.25	0.62	0.64	0.065	0.082
RDF + SSP incubated with FYM (1:2) + 5 t FYM ha^{-1}	5.03	5.58	0.62	0.72	0.065	0.079
CD (P=0.05)	-	0.27	-	0.11	-	0.006

*I – Initial, AR – after rice

50% RDF + 5 t FYM ha^{-1} was applied followed by RDF + SSP incubated with FYM (1:2) + 5 t FYM ha^{-1}. Similar results were also obtained with respect to total nitrogen. Results from long-term fertility experiments clearly showed the advantage of addition of farm yard manure along with chemical fertilizer on crop yield (Prasad, 2002), this practice also increased organic matter content in soil.

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