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Performance of different nitrogenous complex fertilizers for paddy (*Oryza sativa* Linn.) in Entisol

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Abstract
A field experiment was conducted during the *kharif* season of 2016 at Post Graduate farm, College of Agriculture, Kolhapur. The experiment was laid out in Randomized block design consisted of seven treatments *viz.*, T1: absolute control, T2: Urea +SSP+MOP, T3: 18:46:0 (DAP), T4: 20:20:0, T5: 10:26:26, T6: 1919:19, T7: 15:15:15 which were replicated by three times. The result revealed that among the different NP complex fertilizers DAP recorded higher no. of tillers, plant height, thousand grains weight, chlorophyll content, grain and stover yield and B:C ratio. There was no significant difference in available N, P, and K content after harvest of crop in soil indicating no residual effect of different nitrogenous complex fertilizers.

Keywords: Kharif rice, NP complex fertilizers

Introduction
In India rice is the most important and extensively grown cereal crop which constituents the principle food for about two third population of India (Anonymous, 2006) [1]. Fertilizers plays vital role in increasing agriculture production. Now-a-days several complex fertilizers with varying composition are available in the market. The balance use of fertilizer is envitable for sustaining the yield of the rice. Considering the per unit nutrient cost of straight fertilizers as and when required by the farmer and to increase the efficiency of applied fertilizer, use of complex fertilizers is envitable. Many NP complex fertilizers (Ammonium phosphate, Diammonim phosphate and Nitrophosphate) are available in the market, but their efficacy for upland rice of the region is not well understood. In of view this, the present research work has carried out to evaluate the efficacy of different NP complex fertilizers for paddy.

Material and methods
A field experiment was laid out in randomized block design on silty clay soils of Agriculture College, Kolhapur having (pH (12.5) - 8.14 EC (dS m^{-1}) - 0.36, Organic carbon-0.88(%), Calcium, carbonate (%)- 5.25 (available N (Kg ha^{-1}) – 177.18, available P (Kg ha^{-1}) –23.74, available K (Kg ha^{-1}) – 265.1, ammonical nitrogen (ppm) – 2.43. There were seven treatments T1: absolute control, T2 : Urea +SSP+MOP, T3: 18:46:0 (DAP), T4 : 20:20:0, T5: 10:26:26, T6: 1919:19,T7: 15:15:15. The basal dose of fertilizers @ 40:50:50 N, P_2O_5 : K_2O kg ha^{-1} were applied at the time of sowing through different nitrogenous complex fertilizers. The basal dose of N was compensated through urea and potash was compensated through muriate of potash. The remaining dose of N (60 kg ha^{-1}) was splited in two i.e. 40 per cent at tillering stage (65 DAS) and 20 per cent at panicle initiation stage (95 DAS) was applied through urea. The treatments were replicated three times with net plot size 4.20 m x 2.40 m with spacing 20 cm x 15 cm. By randomisation five hills were selected from each plot for recording biometric observation. The grain and stover yield were recorded at harvest. After harvest of crop, soil samples were collected and analysed for pH, EC, organic carbon, available N, P and K by adopting standard procedure.

Result and Discussion

Growth and yield of paddy: The data pertaining to growth and yield of paddy is presented in Table-1. The total number of tillers per hill highest in DAP treatment. Similar trend was observed in plant height, thousand grains weight. There was no significant difference on chlorophyll content at tillering stage of paddy. The treatment DAP recorded significantly highest grain (41.26 q ha^{-1}) and stover (52.77 q ha^{-1}) of paddy but it was at par with T4 (20:20:0), T7 (15:15:15) and T5 (10:26:26). The superior performance of DAP might be attributed due to higher amount of ammonical nitrogen than other complex fertilizers. These results were in confirmative with those reported by Rao *et al.* (1970) [5], Gurmani *et al.* (1984) [2].

Table 1: Effect of different nitrogenous complex fertilizers on growth, yield attributing characters and yield of paddy

Treatment	Total number Of tillers per hill	Total chlorophyll Content (mg g^{-1})	Plant height (cm)	Thousand grains wt. (g)	Grain yield (q ha^{-1})	Stover yield (q ha^{-1})
T_1 (Control)	13.33	0.58	54.00	16.33	14.43	17.38
T_2(Urea+SSP+ MOP)	16.00	0.60	63.33	18.58	30.21	36.93
T_3 (18:46:0)	20.00	0.62	75.33	23.03	41.26	52.77
T_4 (20:20:0)	19.33	0.62	69.00	20.90	38.36	48.21
T_5 (10:26:26)	17.33	0.61	65.33	20.26	35.70	45.73
T_6 (19:19:19)	17.00	0.61	64.00	19.33	30.44	38.79
T_7 (15:15:15)	18.33	0.61	67.66	20.66	37.78	47.78
S.E ±	1.05	0.01	2.64	0.75	1.93	2.61
C.D.(P=0.O5)	3.24	NS	8.13	2.34	5.96	8.05

Uptake of nutrients

N uptake

Data pertaining to the effect of different treatments on nutrient uptake of nitrogen (N) at tillering, panicle initiation and harvesting stage (table 2) indicated that treatments DAP recorded significantly highest nitrogen uptake (48.10 and 62.47 kg ha-1) at tillering and panicle initiation stage, respectively. At harvest increased nitrogen uptake increased significantly might be due to increase in availability of both NH_4 and NO_3-nitrogen from complex fertilizers. These results were in confirmative with those reported by Tamgale *et al.* (2006) [6].

Table 2: Effect of different nitrogenous complex fertilizers on uptake of nitrogen by paddy at different growth stages

Treatment	Uptake of nitrogen by paddy (kg ha^{-1})		
	Tillering (65 DAS)	Panicle Inititation (95 DAS)	At harvest (145 DAS)
T_1 (Control)	12.06	16.55	19.98
T_2 (Urea+SSP MOP)	35.99	42.96	49.75
T_3 (18:46:0)	48.10	62.47	69.84
T_4 (20:20:0)	42.22	55.41	61.97
T_5 (10:26:26)	37.68	51.99	60.32
T_6 (19:19:19)	35.08	48.16	49.25
T_7 (15:15:15)	41.51	54.13	61.02
S.E ±	0.94	1.73	2.83
C.D.(P=0.0.5)	2.91	5.11	8.74

P uptake

Data on the effect of different nitrogenous complex fertilizers on uptake of phosphorus (P) at tillering, panicle initiation and harvesting stage (table 3) indicated that treatments DAP recorded significantly highest phosphorus uptake (7.39 and 15.04 kg ha-1) at tillering and panicle initiation stage, respectively. At harvest P uptake increased significantly might be due to increase in availability of phosphorus through different sources of complex fertilizers over control. Murumkar *et al.* (2015) [4] and Tamgale *et al.* (2006) [6] also reported highest availability of phosphorus from the complex fertilizers containing more proportion of water soluble phosphorus.

Table 3: Effect of different nitrogenous complex fertilizers on uptake of phosphorus by paddy at different growth stages

Treatment	Uptake of phosphorus by paddy (kg ha^{-1})		
	Tillering (65 DAS)	Panicle initiation (95 DAS)	At harvest (145 DAS)
T_1 (Control)	2.47	4.67	6.71
T_2 (Urea+SSP+ MOP)	5.36	10.78	16.19
T_3 (18:46:0)	7.39	15.04	23.58
T_4 (20:20:0)	6.51	13.42	21.15
T_5 (10:26:26)	5.71	13.24	19.73
T_6 (19:19:19)	5.43	10.72	16.86
T_7 (15:15:15)	6.27	13.30	21.05
S.E ±	0.24	0.53	1.00
C.D.(P=0.0.5)	0.75	1.64	3.10

K uptake

The Data pertaining to the effect of different nitrogenous complex fertilizers on uptake of potassium (K) at tillering, panicle initiation and harvest stage (table 4) indicated that treatments DAP recorded significantly highest potassium uptake (49.69 and 83.24 kg ha-1) at tillering and panicle initiation stage respectively. At harvest uptake increased significantly might be due to synergistic effect of nitrogen uptake on potassium uptake which might have significantly increased the potassium uptake. Similar synergistic effect of nitrogen uptake of paddy on potassium uptake have been reported by Tamgale *et al.* (2006) [6] and Murumkar *et al.* (2015) [4].

Table 4: Effect of different nitrogenous complex fertilizers on uptake of potasium by paddy at different growth stages

Treatment	Uptake of potassium by paddy (kg ha^{-1})		
	Tillering (65 DAS)	Panicle inititation (95 DAS)	At harvest (145 DAS)
T_1 (Control)	12.96	22.95	26.92
T_2 (Urea+SSP MOP)	36.61	60.68	64.69
T_3 (18:46:0)	49.69	83.24	93.07
T_4 (20:20:0)	43.03	78.69	86.23
T_5 (10:26:26)	37.54	73.73	78.85
T_6 (19:19:19)	35.62	61.61	67.15
T_7 (15:15:15)	41.12	77.85	83.22
S.E ±	0.44	1.20	3.98
C.D.(P=0.0.5)	1.37	3.72	12.28

Gross monetary returns, cost of cultivation and B:C ratio: The data on the effect of different nitrogenous complex fertilizers on gross monetary returns, cost of cultivation, net monetary returns and B:C ratio is presented in (Table 5). The significantly highest B:C ratio (2.87) was recorded in T_3 (DAP). Considering the availability and B:C ratio may proved as good source for increasing the growth, yield attributing characters and yield of paddy. The increased in B:C ratio of paddy due to application of different nitrogenous complex fertilizers increased growth and yield of paddy might be due to many advantages of complex fertilizers over straight fertilizers. The differential response of complex fertilizers is attributed to its content and proportion of different forms of nitrogen (NH_4 and NO_3) and phosphorus (Water and Citrate soluble) insoluble form. Similar higher B:C ratio of complex fertilizers over straight fertilizers for paddy. Same result is confirmative Menhi Lal (1977) [3].

Table 5: Gross monetary returns, cost of cultivation, net monetary returns and B:C ratio as influenced by application different nitrogenous complex fertilizers

Treatment	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Gross monetary returns '(000)' (Rs. ha^{-1})	Cost of cultivation '(000)' (Rs. ha^{-1})	Net monetary returns '(000)' (Rs. ha^{-1})	B:C Ratio
T_1 (Control)	14.33	17.38	50.81	47.11	3.70	1.08
T_2 (Urea+SSP+MOP)	30.21	36.93	112.62	52.23	60.39	2.16
T_3 (18:46:0)	41.26	52.77	145.57	50.71	94.86	2.87
T_4 (20:20:0)	38.36	48.21	135.26	50.58	84.70	2.68
T_5 (10:26:26)	35.70	45.73	125.98	52.35	73.63	2.41
T_6 (19:19:19)	30.44	38.79	107.34	51.55	55.84	2.08
T_7 (15:15:15)	37.78	47.78	142.78	52.13	90.65	2.74
S.E ±	1.93	2.61	6.70	-	6.70	-
C.D. (P=0.05)	5.96	8.05	20.65	-	20.65	-

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