



A STUDY ON CUSTOMIZED FERTILIZER'S ON PADDY

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ABSTRACT

The present investigation was undertaken with the objectives to evaluate the performance of a customized fertilizer (CF). An experiment was conducted in Krishi Vigyan Kendra, (Sardar Vallabhbhai Patel University of Agriculture & Technology) Ujhani, Badaun, Uttar Pradesh state to evaluate the effect of a customized fertilizer's (CF) with grades 7.5:30:7.5:1.5:1.5:00 (N:P:K:S:Zn:Mg) other treatments involved different CF from MRDCF through 6:18:6:5.3:.035:00, 8:15:15:01:0.25:0.15, 8:15:15:01:0.50:0.15, 8:15:15:01:0.25:00, 8:15:10:01:0.25:00 and 8:15:18:01:0.25:00 on yield and yield attributes of Paddy crop (var.PD-12). The treatments involved considered a manufacturer recommended dose of CF (MRDCF) providing basal as standard dose. An additional comparison treatment involved use of CF as per state recommendations/Farmer's Practices for N and P. The CF effect evaluated through observations on Plant height, No. of tillers per meter row, No. of effective tillers, Spike length, Spike weight, No. of grains per spike, 1000-grain test weight, grain and straw yield, benefit-cost ratio, net returns, etc. indicated that using Customized fertilizer T4 gave the best results.

Key Words : Customized fertilizer, Yield attributes, Paddy

Customized fertilizer is more than simply a fertilizer - it is a concept around the plant nutrition. Such fertilizers are backed by sound scientific plant nutrition principles and research. For developing a customized fertilizer a team of dedicated scientists focusing on specifics of crops and soil conditions is required. These specialists know how to get the best out of a plant, to ensure that the plant realizes its natural growth potential and yield attributes. To put it quite simply, customized fertilizer blends provide the best nutritional package for premium quality plant growth. The customized fertilizer is designed to contain nutrients (both macro and micro) forms, contents, and their proportions, which are highly area,

soil and crop specific. In other words customized fertilizer is a multi-nutrient carriers precisely tailored to meet specific basal nutritional needs of the 'crop'. The technology used in manufacture of such fertilizers make them high quality so that all granules fertilizers are highly uniform in physical form and chemical composition. For ensuring homogeneous supply of nutrients to all plants it is necessary that these fertilizers are band placed at the time of sowing.

A rice-wheat sequence that yields 6t ha⁻¹ of rice (unmilled) and 4t ha⁻¹ of wheat consumes 300kg of N, 30kg P, and 300kg ha⁻¹ of potassium (Bijay-Singh *et al.*, 2004). Besides, it leads to concomitant depletion

of various secondary and micronutrients. The rice-wheat system has started showing fatigue signs and lack of response to increasing levels of fertilizers has been attributed among many factors to macro- and micro-nutrient imbalances resulting from exhaustive feeding and imbalanced replenishment of nutrients through inappropriate fertilizer applications. Application of many fertilizer sources resulting from soil-test based recommendations during one agronomic operation (at the time of sowing), is constrained by high labour costs and uneven application (if mixed) owing to segregation. These hurdles to site-specific soil test based fertilizer applications can be overcome by producing crop-specific and site-specific mixed fertilizer grades, called customized fertilizers. Paddy is the predominant *Kharif* season crop of northwestern and central India. Due to its prolonged association with wheat, the rice-wheat cropping sequence has started exhibiting deficiency of various secondary and micronutrients, namely, sulphur, manganese, and zinc. As a result, the northwest region

has been witnessing increased sale of various nutrient cocktails. These cocktails do not provide site-specific, need-based, and economical solutions to various plant nutrition related problems. There is a need for fertilizers that can provide for application of micronutrients like Zn (Ramkala *et al.*, 2008). Keeping this in view, this experiment was laid during *Kharif* 2009 to evaluate the performance of a customized fertilizer grade prepared specifically for western Uttar Pradesh for paddy crop by a fertilizer manufacturer.

MATERIALS AND METHODS

The experiment was laid out in completely randomized design to evaluate the performance of a customized fertilizer (CF) product provided by Tata Fertilizers and Chemicals Limited, Babrala. The grades of CF was 7.5:30:7.5:1.5:1.5:00 (N: P: K: S: Zn:@) other treatments involved different CF from MRDCF through 6:18:6:5.3:0.35:0.00, 8:15:15:01:0.25:0.15, 8:15:15:1:0.5:0.15, 8:15:15:1:0.25:0.00, 8:15:10:

Table A : Some basic properties of soil at experimental field Parauli (Badaun) sites

Sr. No.	Property	Experimental field Parauli (Badaun)
1.	Texture	sandy loam
2.	pH(1:2 soil:water ratio)	7.6
3.	EC (dS m ⁻¹)	0.09
4.	Organic matter	0.276
5.	Available P (kg ha ⁻¹)	27.3
6.	Available K (kg ha ⁻¹)	258.1

Table B : Various treatments of customized fertilizer used in Paddy crop

Treatment	CF composition	Basal	CF contribution to basal N	First top dressed	Second top dressed	Total N	Total P	Total K	Total S	Total Zn	Total Mg
		CF (kg/ha)	(kg/ha ⁻¹)	(kg/ha ⁻¹)	(kg/ha ⁻¹)	Added (kg/ha ⁻¹)	Added (kg/ha ⁻¹)	Added (kg/ha ⁻¹)	Added (kg/ha ⁻¹)	Added (kg/ha ⁻¹)	Added (kg/ha ⁻¹)
T ₁	7.5:30:7.5:1.5:1.5:00	375	28.12	45.00	35.00	120.00	112.50	28.12	5.62	5.62	0.00
T ₂	6:18:6:5.3:0.35:00	375	22.50	45.00	35.00	120.00	67.50	24.37	19.87	1.31	0.00
T ₃	8:15:15:01:0.25:0.15	500	40.00	45.00	35.00	120.00	75.00	75.00	5.00	1.25	0.75
T ₄	8:15:15:01:0.50:0.15	500	40.00	45.00	35.00	120.00	75.00	75.00	5.00	2.50	0.75
T ₅	8:15:15:01:0.25:00	500	40.00	45.00	35.00	120.00	75.00	75.00	5.00	1.25	0.00
T ₆	8:15:10:01:0.25:00	500	40.00	45.00	35.00	120.00	75.00	50.00	5.00	1.25	0.00
T ₇	8:15:18:01:0.25:00	500	40.00	45.00	35.00	120.00	75.00	90.00	5.00	1.25	0.00
T ₈	Farmer's Practice	120,60,40	25.00	45.00	50.00	120.00	60.00	40.00	0.0	0.00	0.00

*MRDCF: Manufacturer-recommended dose of customized fertilizer

1:0.25:00 and 8:15:18:01:0.25:00. The experiment was conducted at sites: S.V.P. University of Ag. & Tech., Krishi Vigyan Kendra, Ujhani, Badaun, U.P., India District Badaun comes under Mid Western Plain Zone of U.P. The temperature ranges from 4.5 °C to 45.4 °C. The soils of the region are mostly alluvial and soils are neutral to moderately alkaline and medium in organic content. Rainfall in this region is received during mid June to mid October with annual rainfall is 882 mm. Basic soil properties of sites are given in Table A. Soil organic carbon was determined as per the method proposed by Walkley and Black (1934), available P by the method given by Olsen *et al.* (1954), and available K was determined by extracting the soil with 1N neutral ammonium acetate (Pratt, 1982).

Keeping in view the protocol given by the manufacturer, the treatment with a CF dose providing a basal dose. Hence, this CF dose level was considered as 100% of the manufacturer-recommended dose of basal dose. The other treatments were designed around it by varying this basal CF dose by a level of T1 starting from (T2) through (T7). T8 incidentally provided Recommended dose/Farmer's Practice. Each treatment had five replicates. Besides basal application, treatments involving graded doses of CF (T1 through T7) involved top-dressing N through two equated installments of urea with first and second irrigations. Amount of top-dressed N was calculated by maintaining a basal N to top-dressed N ratio. However, in the treatment involving

agreement with state recommended dose of N and P through CF N was top-dressed once @ 60kg N ha-1 (basal N: top-dressed N ratio 1:1) in keeping with the State university recommendation. paddy crop (variety PD-12), was sown on 30/07/2009 at Parauli site. All recommended agronomic practices were followed to raise the crop. Below normal temperatures prevalent during 02/11/2009 delayed the maturity considerably at Parauli site. Straw and grain yield parameters were recorded at maturity. Other observations included number of effective tillers per plant or per meter row, plant height at maturity, spike length, number of grains per spike, grain test weight, etc. For plant height, plants selected at random were tagged and height was measured in centimeters from ground level to the base of the ear head. Effective tillers in one meter row length were counted from randomly selected rows in each plot. Grains per spike were assessed by randomly selecting ten ear heads from each plot. The experimental data was examined statistically using analysis of variance by employing CS-11 programme (Cheema, 1990).

RESULTS AND DISCUSSION

The experimental results of the present investigation to evaluate the performance of a customized fertilizer (CF) have been described under the following headings:

Plant height :

Customized fertilizer application resulted in

Table 1: Plant height, number of tillers, No. of effective tillers, Spike length, Spike weight, No. of grains per spike as affected by various CF

Treatment	CF composition	Plant height	No. of tillers m ⁻¹ row	No. of effective tillers m ⁻¹ row	Spike length (cm)	Spike weight (gm)	No. of grains per spike
T ₁	7.5:30:7.5:1.5:1.5:00	85.8	89	76	13.6	2.54	43
T ₂	6:18:6:5.3:.035:00	87.3	91	78	13.3	2.35	42
T ₃	8:15:15:01:0.25:0.15	84.5	88	73	12.8	2.44	45
T ₄	8:15:15:01:0.50:0.15	84.4	90	77	13.7	2.88	47
T ₅	8:15:15:01:0.25:00	82.9	84	73	11.9	2.21	44
T ₆	8:15:10:01:0.25:00	85.7	87	74	12.7	2.12	42
T ₇	8:15:18:01:0.25:00	84.8	89	71	13.4	2.32	44
T ₈	Farmer's Practice	85.6	83	68	11.2	2.08	41
	LSD(0.05)	2.9	6	7	1.01	0.10	3

increased plant height (Table 1), but Customized fertilizer level T₂ (87.3) and T₁ (85.8) of the benchmark, T₆ Recommended dose level maintained plant height around a mean of 85.7cm. Average plant height at CF application as per recommendations did not differ significantly from other CF levels in its vicinity.

Data showed that splitting top-dressed N dose in two instalments, first at crown root initiation stage and second at first node stage, resulted in greater, though statistically insignificant, plant height than that gained in topdressing N in one dose at CRI stage. The higher plant height with split top dressed N has been reported extensively (Bhardwaj *et al.*, 2010, Oscarson *et al.*, 1995). It might have resulted from increased production of photosynthates by prolonged availability of fertilizer N (Bhardwaj *et al.*, 2010).

Effective tillers :

On an average, effective tillers formed about 85-96 per cent of total tillers (Table 1). Customized fertilizer

application resulted in increased number of tillers . Customized fertilizer T₂ level is having maximum the number of effective tillers considerably (78). Further, using CF as per recommended dose (T₄) produced less number of effective tillers as did the T₂ treatment application.

Spike length :

Customized fertilizer application led to increase in spike length (Table3). Treatment increase the head length significantly. Furthermore, treatment T₄ in general, showed higher response of spike length than T₁ and T₇. This varied response can be ascribed to the difference in fertility status of consequent response to CF in comparison to T₈ under normally fertilized conditions, spike length hovered around a mean of 11.2cm.

Spike weight :

Customized fertilizer application increased spike weight over T₈ treatment (Table 1). However, treatment

Table 2 : 1000-grain weight (test wt.), grain yield, straw yield and harvest index as affected by various CF

Treatment	CF composition	1000-grain weight (test wt.) (g)	Grain yield	Straw yield	Harvest index
T ₁	7.5:30:7.5:1.5:1.5:00	21.19	54.3	64.3	0.457
T ₂	6:18:6:5.3:.035:00	20.57	53.2	66.2	0.445
T ₃	8:15:15:01:0.25:0.15	21.20	58.9	65.6	0.473
T ₄	8:15:15:01:0.50:0.15	21.77	61.3	65.1	0.484
T ₅	8:15:15:01:0.25:00	21.36	58.2	63.1	0.479
T ₆	8:15:10:01:0.25:00	21.33	57.3	63.8	0.472
T ₇	8:15:18:01:0.25:00	21.24	57.1	64.1	0.471
T ₈	Farmer's Practice	16.15	52.9	60.4	0.466
LSD(0.05)		1.05	6.53	6.89	0.014

Table 3: Gross Cost, Net returns and B:C ratio as affected by various CF

Treatment	CF composition	Gross Cost	Net returns (Rs.ha ⁻¹)	B:C Ratio
T ₁	7.5:30:7.5:1.5:1.5:00	18570	51585	2.77
T ₂	6:18:6:5.3:.035:00	18570	50540	2.72
T ₃	8:15:15:01:0.25:0.15	19350	55955	2.89
T ₄	8:15:15:01:0.50:0.15	19350	58235	3.01
T ₅	8:15:15:01:0.25:00	19350	55290	2.85
T ₆	8:15:10:01:0.25:00	19350	54435	2.81
T ₇	8:15:18:01:0.25:00	19350	54245	2.80
T ₈	Farmer's Practice	20050	50255	2.50
LSD(0.05)		NS	5871	0.83

T4 is showed higher response of spike length than T1 and T3 and add to the spike weight significantly. under normally fertilized conditions T8, spike weight hovered around a mean of 2.08g.

No. of grains/spike :

Customized fertilizer application added to the grain count in all CF treatment (Table 1) CF treatment T4 is having maximum number of grain count and then T3, T5 accordingly. On an average, under customized fertilizer level maintained a 47-grain/spike level.

1000-grain test weight :

Thousand-grain test weight yield attribute behaved the way other yield attributes did (Table 2). CF applications beyond T8 recommended dose help to increase 1000-grain weight. CF treatment T4 is having maximum 1000-grain weight and then T5, T6 accordingly. On an average, under customized fertilizer level maintained a 21.77 gm 1000-grain weight level.

Grain yield :

Grain yield is a composite and interactive effect of above-discussed yield attributes. Accordingly, CF level beyond recommended dose (T8) lead to a significant increase in grain yield (Table 2). CF treatment T4 is having maximum Grain yield and then T3, T5 accordingly. On an average, under customized fertilizer treatments maintained a 61.30qt/ha level.

Straw yield :

Effect of CF application on straw yield resembles its effect on grain yield (Table 2). However, different CF treatment went on adding to straw yield significantly. CF levels beyond recommended dose (T8) lead to a significant increase in straw yield (Table 2). CF treatment T2 is having maximum straw yield and then T3, T1 accordingly. On an average, under customized fertilizer treatments maintained a 66.20qt/ha level.

Harvest index :

Ratio of grain yield to total biomass yield decreased with different CF treatment from T3 to T1 through T2

(Table 2). CF levels beyond recommended dose (T4) lead to a significant increase in harvest index (Table 2). CF treatment T4 is having harvest index (0.484) and then T5(0.479), T3(0.473) accordingly.

Net returns :

A perusal of net returns yield by various CF treatments (Table 5) indicated that T4 treatment gave the highest net returns(58235) and then T3(55955), T5(55290) accordingly. This trend can be associated with higher grain yields. CF treatments beyond (recommended dose) add significantly to the net returns.

Benefit-cost (B:C) Ratio :

A comparison between different CF treatments, the treatment T4 gave better B:C ratio than others treatments (Table 5). This difference did not result from grain yield difference but from higher straw yield across all the treatments. Thus, this superiority in B:C ratio is of significance only under efficient economic utilization of straw. Accounting for statistical significance, the highest B:C ratio was recorded by the use of CF as T4(3.01). Data on yield and yield attributes and economic parameters primarily suggest that using the CF T4. the dose considered standard by the manufacturer, leads to the best results. This is closely followed by the use of CF T3 of the manufacturer-recommended level. Higher overall response of various yield and yield attributes to increasing CF T4 can be clearly ascribed to the differences in soil fertility status.

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