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A STUDY OF CUSTOMIZED FERTILIZER ON WHEAT

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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 Vallabbhai Patel University of Agriculture & Technology)Ujhani,Badaun,Uttar Pradesh state to evaluate the effect of a customized fertilizer's (CF) with grades 8:20:30:3:5:0.5 (N: P: K: S: Zn) other treatments involved different CF from MRDCF through 6:11:15:1.5:0.25 and 10:18:25:3:00.on yield and yield attributes of wheat crop (var. HD2733). 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 T2 gave the best results.

Key Words: **Customized fertilizer, Yield attributes, Wheat**

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. Wheat is the predominant rabi season crop of northwestern and central India. Due to its prolonged association with rice, 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 rabi 2009-10 to evaluate the performance of a customized fertilizer grade prepared specifically for western Uttar Pradesh for wheat crop by a fertilizer manufacturer.

Material 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 8:20:30:3:5:0.5, 6:11:15:1.5:0.25 and 10:18:25:3:00 (N-P-K-S-Zn). The experiment was conducted in rabi 2009-10 season at sites, Krishi Vigyan Kendra, Ujhani, Badaun (S.V.P.University of Ag.& Tech.,Meerut) u.p. India. **District Badaun comes under Mid Western Plain Zone of U.P. The temperature ranges from 4.5 ^{0}C to 45.4 ^{0}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 1. 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).

Table 1. Some basic properties of soil at Parauli (Badaun)sites.

	Property	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 2. Various treatments of customized fertilizer used in wheat crop

Treatment	CF composition	Basal	N	First	Second	Total N	Total P	Total K	Total S	Total Zn
		CF (kg/ha)	contribution to basal N (kg/ha)	Top Dressed N (kg/ha^{-1})	Top Dressed N (kg/ha^{-1})	Added (kg/ha^{-1})	Added (kg/ha-1)	Added (kg/ha-1)	Added (kg/ha-1)	Added (kg/ha-1)
T1	08:20:30:03:0.5	300	24.00	45.00	45.00	114.00	60.00	90.00	9.00	1.50
T2	06:11:15:1.5:0.25	550	32.70	43.15	43.15	119.00	60.00	81.75	8.18	1.36
T3	10:18:25:03:00	350	33.30	45.35	45.35	124.00	60.00	83.25	9.50	0.00
T4	Farmer's Practices	125	23.40	48.30	48.30	120.00	60.00	30.00	0.00	0.00

*MRDCF: Manufacturer-recommended dose of customized fertilizer

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 (T3). T4 incidentally provided Recommended dose/Farmer's Prectice. Each treatment had five replicates. Besides basal application, treatments involving graded doses of CF (T2 through T3) 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) through urea a day before first irrigation in keeping with the State university recommendation. Wheat crop (variety HD2733), was sown on 10 November 2009 at Parauli site. All recommended agronomic practices were followed to raise the crop. Below normal temperatures prevalent during April 2011 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: -

Table 3: 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
T1	08:20:30:03:0.5	88.9	56	53	8.3	2.40	47
T2	06:11:15:1.5:0.25	87.2	59	55	9.3	2.48	49
T3	10:18:25:03:00	89.4	61	56	9.1	2.47	50
T4	Farmer's Practices	84.7	50	47	8.1	2.37	45
LSD(0.05)		3.1	7	8	1.05	0.10	3

Plant height. Customized fertilizer application resulted in increased plant height (Table 3), but Customized fertilizer level T3(89.4) and T1(87.9) of the benchmark, T4 Recommended dose level maintained plant height around a mean of 84.7cm. 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 3). Customized fertilizer application resulted in increased number of tillers . Customized fertilizer T3 level is having maximum the number of effective tillers considerably (56). Further, using CF as per recommended dose (T4) produced less number of effective tillers as did the T3 treatment application.

Spike length. Customized fertilizer application led to increase in spike length (Table3). Treatment increase the head length significantly. Furthermore, treatment T2 in general, showed higher response of spike length than T3 and T1. This varied response can be ascribed to the difference in fertility status of consequent response to CF in comparison to T4 under normally fertilized conditions, spike length hovered around a mean of 8.1cm.

Spike weight. Customized fertilizer application increased spike weight over T4 treatment (Table 3). However, treatment T2 is showed higher response of spike length than T3 and T1and add to the spike weight significantly. under normally fertilized conditions T4, spike weight hovered around a mean of 2.37g.

No. of grains/spike. Customized fertilizer application added to the grain count in all CF treatment (Table 3) CF treatment T3 is having maximum number of grain count and then T2 ,T1 accordingly. On an average, under customized fertilizer level maintained a 49-grain/spike level.

Table 4: 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
T1	08:20:30:03:0.5	34.02	48.3	73.7	0.395
T2	06:11:15:1.5:0.25	33.84	50.4	81.3	0.382
T3	10:18:25:03:00	32.40	48.9	68.6	0.416
T4	Farmer's Practices	31.20	42.3	72.1	0.369
LSD(0.05)		1.04	6.72	7.03	0.016

1000-grain test weight. Thousand-grain test weight yield attribute behaved the way other yield attributes did (Table 4). CF applications beyond T4 recommended dose help to increase 1000-grain weight. CF treatment T2 is having maximum 1000-grain weight and then T1,T3 accordingly. On an average, under customized fertilizer level maintained a 33.20 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 (T4) lead to a significant increase in grain yield (Table 4). CF treatment T2 is having maximum Grain yield and then T3,T1 accordingly. On an average, under customized fertilizer treatments maintained a 49.20qt/ha level.

Straw yield. Effect of CF application on straw yield resembles its effect on grain yield (Table 4). However, different CF treatment went on adding to straw yield significantly. CF levels beyond

recommended dose (T4) lead to a significant increase in straw yield (Table 4). CF treatment T2 is having maximum straw yield and then T1,T3 accordingly. On an average, under customized fertilizer treatments maintained a 74.53qt/ha level.

Harvest index. Ratio of grain yield to total biomass yield decreased with different CF treatment from T3 to T1 through T2 (Table 4). CF levels beyond recommended dose (T4) lead to a significant increase in harvest index (Table 4). CF treatment T3 is having harvest index (0.416)and then T1(0.395) , T2(0.382) accordingly. On an average, under customized fertilizer treatments maintained a 0.390 level. Also, different CF treatments are significantly affect the average harvest index of 0.390 achieved in all the treatments.

Table 5: 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
T1	08:20:30:03:0.5	12503	47639	3.81
T2	06:11:15:1.5:0.25	12001	48958	4.08
T3	10:18:25:03:00	12282	48146	3.92
T4	Farmer's Practices	13790	42198	3.06
LSD(0.05)		NS	5973	0.86

Net Returns: A perusal of net returns yielded by various CF treatments (Table 5) indicated that T2 treatment gave the highest net returns(48958) and then T3(48146),T1(47639) 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 T2 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 T2(4.08). Data on yield and yield attributes and economic parameters primarily suggest that using the CF T2. 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 T2 can be clearly ascribed to the differences in soil fertility status.

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