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Effect of Nutrient Management strategies on Performance of wheat (*Triticum aestivum L.)* in North West Zone

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ABSTRACT
A field experiment was conducted during 2015-16 and 2016-17 at Crop Research Centre of SardarVallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.).The experimental field was well drained, sandy loam in texture (46.2 % sand, 18.4 % silt and 17.4 % clay) and slightly alkaline in reaction (pH 7.8), It was low in organic carbon (0.58%), available nitrogen (222kg/ha), medium in available phosphorus (16.5 kg/ha) and high in potassium (249 kg/ha) with an electrical conductivity 0.23 dSm^{-1}(1:2, soil: water suspensionat 25C^{o}) and bulk density of 1.50 Mg/m3, respectively. The treatments comprised of all possible combinations of the two factors viz.,nutrient management strategies (6) as main plot factor and sources of nutrient (03) as sub plot factor, along with Farmer practice (control). Experimental results revealed that nutrient management strategies and sources of nutrient as whole adopted in treatment mean produced maximum growth parameters viz., plant height and number of tiller yield attributes such as spike length and spikelets spike^{-1}, yields viz., grain, straw and biological yield and nutrient content like nitrogen, phosphorous, potassium, sulphur and zinc content in grain and strawin comparison to control mean during both the years. Similarly customized fertilizer had recorded significantly highest growth parameters, yield and yield attributes, sulphur and zinc content as well as compared to all other treatments, whereas maximum NPK content was recorded under target yield (5 t ha^{-1}) plots during both the years. Moreover, 75% inorg+25%FYM+Azot+PSB had showed a similar trends to noticed maximum values of all above parameters over 75 % inorg+25%FYM and 100 % inorganicduring both the years.
Keywords: *Nutrient management strategies Sources of nutrient,Farmer practice (control), Growth, Yields and Nutrient content*

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INTRODUCTION

Wheat is the staple food of 40 percent human population across the globe and second most important cereal after rice. India is the second largest wheat producing country after China with an area of 29.64 million hectares, production of 92.46 million tones and average productivity of 3.12 t ha^{-1}. There has been impressive increase in wheat production from 42 lakh tones in 1961-62 to 289.76 lakh tones in 2010-11 (538 % increases).The country has to produce 105 Mt by 2025, demanding an average growth rate of 4% per annum [1].

It is widely recognized that neither use of organic manures alone nor chemical fertilizers can achieve the sustainability of the yield under the modern intensive farming. Contrary to detrimental effects of inorganic fertilizers, organic manures are available indigenously which improve soil health resulting in enhanced crop yield. However, the use of organic manures alone might not meet the plant requirement due to presence of relatively low levels of nutrients. Therefore, in order to make the soil well supplied with all the plant nutrients in the readily available form and to maintain good soil health, it is necessary to use organic manures in conjunction with inorganic fertilizers to obtain optimum yields [2]. Results have also shown that integrated nutrients management increases the yield and nutrient uptake [3].The efficiency of nutrient use may be raised by the combined use of organic and inorganic fertilizers. Organic fertilizers not only act as the source of nutrients, but also provide micronutrients and modify soil-physical behaviour as well as increased the efficiency of applied nutrients.

Nitrogen management requires special attention in its use so that the large losses can be minimized and the efficiency maximized. Site-specific nutrient management (SSNM) has been found especially useful to achieve the goals of improved productivity and higher N use efficiency (NUE). Moreover, leaf color charts and chlorophyll meters assist in the prediction of crop N needs for rice and wheat, leading to greater N-fertilizer efficiency at various yield levels. Remote sensing tools are also used to predict crop N demands precisely. At the same time, traditional techniques like balanced fertilization, integrated N management (INM), split application and nutrient budgeting, among others, are also used to supplement recent N management techniques to attain higher productivity and NUE, and reduce environmental pollution through the leakage of fertilizer N.This will definitely enhance the productivity of rice and wheat crops by improving soil fertility and ameliorating adverse soil physical conditions [4].However, under present investigation efforts were made to explore the feasibility of growing wheat under different nutrient management strategies. Therefore, the present study was carried out to investigate theeffect of nutrient management strategies on performance of wheat vis-à-vis sustainability of wheat.

MATERIALS AND METHODS

Site description

A field experiment was conducted during 2015-16 and 2016-17 at Crop Research Centre of SardarVallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.), located at a latitude of 29^0 40' North and longitude of 77^0 42' East with an elevation of 237 metres above mean sea level. The climate of this region is subtropical and semi-arid and climate characterized with summers and extremely cold winters. The mean maximum temperature of this region is about 43^0C to 45^0C is not uncommon during summer while very low temperature (4-10^0C) accompanied by frost may be experienced in December-January. About 80 to 90% of rainfall received during July to September and few showers are also a common feature during the month of December to January and in late spring season

The experimental field was well drained, sandy loam in texture (46.2 % sand, 18.4 % silt and 17.4 % clay) and slightly alkaline in reaction (pH 7.8), It was low in organic carbon (0.58%), available nitrogen (222kg/ha), medium in available phosphorus (16.5 kg/ha) and high in potassium (249 kg/ha) with an electrical conductivity 0.23dSm^{-1}(1:2, soil: water suspensionat 25C^o) and bulk density of 1.50 Mg/m3, respectively. The treatments comprised of all possible combinations of the two factors viz.,nutrient management strategies (6) as main plot factor and sources of nutrient (03) as sub plot factor, along with Farmer practice (control).

Wheat (PBW-550) with the spacing (rows) of 20 cm was grown with recommended agronomic package of practices in 19 m^{-2} plot size. The seeds were placed manually in the furrows with a seed rate of 100 kg ha^{-1} sown on 14 November 2015 while harvested on 20 April 2016 during first year and 18 November 2016 while harvested on 24 April 2017 during second year of experimentation. In experiment, 75:75:60 (kg ha^{-1}) nitrogen, phosphorus and potassium, respectively was applied under recommended NPK, recommended NPK followed by LCC and recommended NPK followed by SPAD plot as a basal. While, in targeted yield plot (4 & 5 t ha^{-1})nitrogen, phosphorus and potassium was applied based on the organic and inorganic equation in NCR of Delhi. The NPK to 4 t ha^{-1} 99.2: 46.4: 30.2 kg ha^{-1} for inorganic, while 54.9: 36.5: 5.4 kg ha^{-1} for organic, respectively was recommended. Moreover, in case of 4 t ha^{-1} 152.3: 80.9: 57.2 kg ha^{-1} for inorganic, whereas 84.0: 65.7: 19.1 kg ha^{-1} for organic, respectively was recommended. Further, 120:60:40 (kg ha^{-1}) nitrogen, phosphorus and potassium, respectively was used under application of constituents of customized fertilizer (CF) on soil test value along with sulphur and zinc as per the CF formula. As per the soil test range, 150: 60: 60: 30: 0.5 kg ha^{-1} N:P:K:S:Zn was recommended. Half dose of N and full dose of P, K, S and Zn were applied as basal at the time of seeding through traditional seed drill. Remaining half N was top dressed in two equal split doses; first split before 1st post-sowing irrigation at crown root initiation stage and the second split before 3rd irrigation at pre-flowering stage, except LCC and SPAD plot where three times top dressing were carried out as per the threshold values of SPAD (15 kg ha^{-1}) and LCC (20 kg ha^{-1}).Basal application of fertilizer was made at 5 cm depth in furrows opened 2-3 cm by the side of seed furrow.

Targeted yield (4.0 and 5.0 t ha^{-1}) had relevant by making use of data on the yield of wheat, total uptake of N, P and K, initial soil test values for available N, P and K and doses of fertilizer N, P_2O_5 and K_2O applied, the basic parameters *viz.*, nutrient requirement (NR), contribution of nutrients from soil (Cs), fertilizer (Cf) and farmyard manure (Cfym) were calculated as outlined by Ramamoorthy *et al*. [5].

$$\text{Nutrient requirement (NR)} = \frac{\text{Total uptake of nutrient (kg)}}{\text{Grain yield (100kg)}}$$

The values were reported as Kg of nutrient (N, P and K) required to produce 100 kg of wheat grain. per cent contribution of nutrient from soil (C_s) or soil efficiency

$$= \frac{\text{Total nutrient uptake in control plots (kg/ha)} \times 100}{\text{STV of nutrient in control plots (kg/ha)}}$$

Per cent contribution of concerned nutrient from fertilizer (C_f) or fertilizer efficiency

$$= \frac{\text{(Total uptake of nutrients in treated plots)} - \text{(STV of nutrient in treated plots} \times \text{Cs/100)}}{\text{Amount of nutrient added as fertilizer (kg/ha)}} \times 100$$

Per cent contribution of concerned nutrient from farm yard manure (C_{fym}) or farmyard manure efficiency

$$= \frac{\text{(Total uptake of nutrients in FYM treated plots)} - \text{(STV of nutrients in FYM treated plots} \times \text{Cs/100)}}{\text{Amount of nutrients added as FYM (kg/ha)}} \times 100$$

Nutrient recommendation equation for wheat in NCR of Delhi

FN = 5.31 T – 0.51SN

FP_2O_5 = 3.45 T – 5.55 SP

FK_2O = 2.75 T – 0.32 SK

Moreover, for integrated purpose the equation are given below

FN= 3.85T-0.41SN-1.64 FYM

Where,

T= Targeted yield

SN= Soil nitrogen

SP=Soil phosphorus

SK=Soil potassium

Source: http://stcr.gov.in/HTML/html/Bulletins/Delhi_bulletin.htm

Basic parameter

Observations on various growth parameters viz. plant height and number of tillersat harvest. Yield attributes was recorded by selecting 10 plants from 19 m^2 and yields was estimated by the produce obtained from net plot area, treatment wise during both the year.

Plant sampling and analysis The plants measured for growth and yield were used for analyzing the N, P, K, S and Zn content in grains and straw. The grain and straw samples were dried at 70 °C in a hot air oven. The dried samples were ground in a stainless steel Thomas Model 4 Wiley ® Mill. The N content in grains and straw was determined by digesting the samples in sulfuric acid (H_2SO_4), followed by analysis of total N by the Kjeldahl method by Page[6] using a Kjeltec™ 8000 auto analyzer (FOSS Company, Denmark). The P content in grains and straw was determined by the vanadomolybdo-phosphoric yellow colour method and the K content both in grains and straw was analyzed in di-acid (HNO_3 and $HClO_4$) digests by the flame photometeric method. Further S content was determine by Turbidimetric method while Zn content by atomic absorption spectrophotometer.

Statistical analysis

The data obtained were subjected to statistical analysis as outlined by Gomez and Gomez [7]. The treatment differences were tested by using “F” test and critical differences (at 5 per cent probability).

RESULT AND DISCUSSION

Growth parameters

The data presented in Table 1 revealed that nutrient management strategies and sources of nutrient as whole adopted in treatment mean produced taller plants and more number of tiller in comparison to control mean, though the differences were significant to number of tillers only during both the year. Customized fertilizer had produced significantly taller plants and more number of tiller than those grown with other nutrient management strategies during both the years. NPK 100% had produces significantly more growth parameters as against target yield (4 t ha^{-1}), but less than the treatments where SPAD-502 or LCC was used, though the difference was not significant among SPAD-502 and LCC based treatments during both the years. This may be due to proper nutrient supply at the active growth stages. Further, such an increase in growth might have been attributed to increased supply of essential elements mainly N, P, K, S, Zn. All these essential elements are known to have specific metabolic functions in various physiological processes like photosynthesis, respiration and transpiration etc, by being constituent of various metabolites or as co-factor or catalyst in enzymatic processes. Enhanced supply of nitrogen is associated with an increase in concentration of growth promoting hormones particularly auxins and cytokinins. Phosphorus does have a role in energy transfer reaction and thereby further assimilation of primary metabolites into various products of significance like protein, nucleic acids, amino acids etc. Potassium plays a vital role in osmotic relation and stomatal function of the plants and consequently the cell turgidity, the driving force behind cell elongation, a fundamental process of plant growth. Similar observations were also made by Bhaduri and Gautam[8]

Application of 75 % inorg+25%FYM+Azot+PSB had taller plants and highest tillers than that with 75 % inorg+25%FYM and 100 % inorganic. The difference was however significant to number of tiller only during both the years.This may be due to better effect of organic sources on the adequate nutrients supply for longer period, which will affects crop growth and photosynthetic activity. Similar results were found by Sepat *et al.* [9]

Yield attributes

Control mean irrespective of nutrient management strategies and sources of nutrient (Table 1) borne spike of significantly less length as compared to treatment mean during both the years (Table 4.4 and Fig. 4.3). Mean spike length was 10.46 cm treatment mean as against 9.4 cm in control mean with order change of 11.2 %. Alike trend was also noticed in spikelets spike^{-1}during both the years.Spike length and spikelets spike^{-1} had recorded to be highest with customized fertilizer, which was significantly superior against rest of the treatment. Target yield (4 t ha^{-1}) was inferior and resulted in shortest spike length and spikelets spike^{-1} as compared to all other treatments. PK+50 % N->SPAD-502 was recorded significantly minimum spike length and spikelets spike^{-1} against target yield (5 t ha^{-1}), while maximum as compared to PK+50 % N->LCC and NPK 100%. NPK 100% did shown on par with LCC based treatment, whereas, SPAD-502 was remained on par with LCC and superior against NPK 100%.Micronutrient (Zn) are required in small amounts but their effects on plant metabolism by working synergistically with other essential nutrients in normal functioning of system are significant and often visible [10, 11].

The data on spike length presented Table 1 indicated a positive effect of 75 % inorg+25%FYM+Azot+PSB on spike length and spikelets spike^{-1}when compared with 75 % inorg+25%FYM and 100 % inorganic. However, the difference was not significant during both the year.

Yields

The yield of a crop is function of crop stand and performance of individual plant that are largely governed by successful completion of the vegetative phase. In wheat, crop stand and test weight are the key yield components (Table 2).Control mean irrespective of nutrient management strategies and sources of nutrient resulted in considerable reduction in grain, straw and biological yield as compared to treatment mean. The plot which treated with customized fertilizer gave significantly higher grain, straw and biological yield over rest of the treatment during both the year, though no other nutrient management strategies was as good as customized fertilizer. Differences among PK+50 % N->SPAD-502, PK+50 % N -> LCC and NPK 100% were however non-significant. The lowest grain, straw and biological yield was recorded significantly with target yield (4 t ha^{-1}) during both the years as compared to all other treatments.It was mainly due to the fact that under favorable soil conditions, the plant accumulates and translocation photosynthetic from source to the sink more efficiently which inturn increased all the growth and yield attributes too. Similar report was also made by Singh and Ram [12].

The data on yield presented in Table 2 indicated that 75% inorg+25%FYM+Azot+PSB had more advantageous to obtained higher grain, straw and biological yield in comparison to 75 % inorg+25%FYM and 100 % inorganic. However, the difference among them was not significant during both the years of experimentation.

Nutrient content

Data on nutrient content presented in Table 3 & 4 revealed that higher values of nitrogen, phosphorous, potassium, sulphur and zinc content in grain and straw had noticed in treatment mean than in control mean, the differences were however non-significant between them.

Nitrogen phosphorous and potassium content in grain and straw were significant highest in target yield (5 t ha^{-1}) plots during both the years over target yield (4 t ha^{-1}). Whereas, sulphur and zinc content in grain and straw was remained significantly higher with the used of customized fertilizer as compared to all other treatments during both the years. Differences among PK+50 % N->SPAD-502, PK+50 % N -> LCC and NPK 100% were however non-significant to nitrogen phosphorous, potassium, sulphur and zinc content in grain and straw during both the year. Target yield (4 t ha^{-1}) was inferior over all other treatments during both the year. The higher content was mainly due to higher available of nutrient which result higher nutrient absorption. The results confirm the findings of Shivay *et al.* [13]and Gupta and Sharma [14].

The data on nutrient content in grain and straw given in Table 3 & 4 disclosed that 75% inorg+25%FYM+Azot+PSB had slightly raised nitrogen, phosphorous, potassium, sulphur and zinc content in grain and straw as comparison to 75 % inorg+25%FYM and 100 % inorganic during both the years. However the differences were significant to sulphur content in straw during both the years.The results confirm the findings of Kumar and Thenua[15].

Table 1: Effect of nutrient management strategies and sources of nutrient on growth and yield attributes of wheat

Treatments	Plant height (cm)		Number of tiller meter^{-1} row length		Spike length (cm)		Spikelets spike^{-1}	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
Control V/S Rest								
Control Mean	78.0	81.0	84.0	88.0	9.20	9.60	17.87	18.30
Treatment Mean	80.1	83.1	101.5	105.6	10.28	10.64	19.49	19.82
S.Em.±	1.4	0.6	5.8	5.7	0.46	0.46	0.77	0.76
CD *(P=0.05)*	NS	NS	16.7	16.2	NS	NS	NS	NS
Nutrient management strategies								
NPK 100%	78.7	81.7	94.7	98.6	9.67	10.03	18.57	18.67
PK+50 % N->SPAD-502	80.4	83.7	106.3	109.7	10.43	10.83	19.67	20.13
PK+50 % N -> LCC	79.5	82.5	101.3	104.3	10.07	10.47	18.97	19.37
Target yield (4 t/ha)	77.6	80.6	77.4	83.3	8.77	9.10	17.00	17.50
Target yield (5 t/ha)	81.5	84.4	112.0	117.0	11.07	11.30	21.23	21.53
Custom Fertiliser	82.8	85.7	117.3	121.0	11.70	12.10	21.52	21.70
S.Em.±	0.8	1.0	1.3	1.4	0.13	0.14	0.25	0.25
C.D. (P=0.05)	2.6	3.2	4.1	4.2	0.42	0.43	0.77	0.79
Sources of nutrient								
100 % inorg	79.6	82.4	98.0	103.1	10.05	10.42	19.30	19.45
75 % inorg+25%FYM	80.2	83.3	102.1	106.0	10.33	10.67	19.49	19.92
75 % inorg+25%FYM+Azot+PSB	80.5	83.7	104.0	107.8	10.47	10.83	19.68	20.08
S.Em.±	0.9	1.3	1.6	1.7	0.17	0.17	0.31	0.32
C.D. (P=0.05)	NS	NS	4.7	4.9	NS	NS	NS	NS

Table 2: Effect of nutrient management strategies and sources of nutrient on growth, starw, and biological yield

Treatments	Grain yield (t ha^{-1})		Straw yield (t ha^{-1})		Biological yield (t ha^{-1})	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
Control V/S Rest						
Control Mean	4.43	4.52	5.62	5.74	10.05	10.26
Treatment Mean	4.79	4.86	6.25	6.35	11.03	11.21
S.Em.±	0.17	0.26	0.17	0.26	0.43	0.42
CD *(P=0.05)*	NS	NS	NS	NS	NS	NS
Nutrient management strategies						
NPK 100%	4.58	4.67	6.02	6.15	10.59	10.81
PK+50 % N->SPAD-502	4.79	4.87	6.43	6.52	11.22	11.38
PK+50 % N -> LCC	4.70	4.75	6.26	6.35	10.95	11.10
Target yield (4 t/ha)	4.29	4.39	5.21	5.35	9.50	9.74
Target yield (5 t/ha)	5.17	5.23	6.71	6.79	11.88	12.02
Custom Fertiliser	5.19	5.24	6.85	6.97	12.04	12.20
S.Em.±	0.06	0.06	0.08	0.08	0.14	0.14
C.D. (P=0.05)	0.19	0.19	0.25	0.25	0.44	0.44
Sources of nutrient						
100 % inorg	4.68	4.78	6.16	6.26	10.84	11.03
75 % inorg+25%FYM	4.82	4.88	6.25	6.36	11.06	11.23
75 % inorg+25%FYM+Azot+PSB	4.86	4.92	6.33	6.45	11.19	11.36
S.Em.±	0.07	0.08	0.10	0.10	0.18	0.18
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS

Table 3: Effect of nutrient management strategies and sources of nutrient on nitrogen, phosphorus and potassium content in grain and straw

Treatments	Nitrogen content (%)				Phosphorus content (%)				Potassium content (%)			
	Grain		Straw		Grain		Straw		Grain		Straw	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Control V/S Rest												
Control Mean	1.72	1.72	0.47	0.48	0.31	0.32	0.15	0.15	0.42	0.43	1.65	1.66
Treatment Mean	1.74	1.75	0.53	0.52	0.33	0.34	0.15	0.16	0.44	0.46	1.68	1.69
S.Em.±	0.03	0.04	0.03	0.02	0.01	0 .01	0.01	.01	.01	0.01	0.04	0.04
CD *(P=0.05)*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nutrient management strategies												
NPK 100%	1.74	1.74	0.56	0.50	0.34	0.34	0.15	0.16	0.45	0.46	1.68	1.69
PK+50 % N->SPAD-502	1.74	1.75	0.51	0.52	0.35	0.35	0.16	0.16	0.45	0.47	1.69	1.70
PK+50 % N -> LCC	1.74	1.74	0.53	0.52	0.35	0.35	0.16	0.16	0.45	0.47	1.69	1.70
Target yield (4 t/ha)	1.71	1.71	0.47	0.47	0.30	0.31	0.14	0.14	0.42	0.43	1.64	1.66
Target yield (5 t/ha)	1.78	1.77	0.59	0.55	0.36	0.36	0.17	0.17	0.46	0.48	1.70	1.71
Custom Fertiliser	1.76	1.78	0.54	0.56	0.32	0.33	0.15	0.15	0.43	0.44	1.67	1.68
S.Em.±	0.02	0.02	0.01	0.01	0.003	0.004	0.002	0.002	0.004	0.01	0.02	0.02
C.D. (P=0.05)	0.06	0.06	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	NS	NS
Sources of nutrient												
100 % inorg	1.74	1.74	0.50	0.51	0.33	0.33	0.15	0.15	0.43	0.45	1.67	1.68
75 % inorg+25%FYM	1.75	1.75	0.53	0.52	0.34	0.34	0.16	0.16	0.44	0.46	1.68	1.69
75 % inorg+25%FYM+Azot+PSB	1.75	1.75	0.57	0.53	0.34	0.35	0.16	0.16	0.45	0.46	1.68	1.70
S.Em.±	0.02	0.03	0.01	0.01	0.01	0.01	0.003	0.003	0.005	0.01	0.03	0.03
C.D. (P=0.05)	NS	NS	0.03	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table4: Effect of nutrient management strategies and sources of nutrient on sulphur and zinc content in grain and straw

Treatments	Sulphur content (%)				Zinc content (PPM)			
	Grain		Straw		Grain		Straw	
	15-16	16-17	15-16	16-17	15-16	16-17	15-16	16-17
Control V/S Rest								
Control Mean	0.10	0.11	0.28	0.36	64.10	65.20	11.31	12.10
Treatment Mean	0.11	0.13	0.37	0.42	73.09	74.39	13.43	13.88
S.Em.±	0.01	0.01	0.04	0.04	3.75	3.86	1.26	1.30
CD *(P=0.05)*	NS	NS	NS	NS	NS	NS	NS	NS
Nutrient management strategies								
NPK 100%	0.11	0.13	0.30	0.35	67.06	68.04	11.52	11.80
PK+50 % N->SPAD-502	0.10	0.11	0.36	0.40	74.22	75.31	12.94	13.48
PK+50 % N -> LCC	0.10	0.11	0.35	0.40	71.26	72.32	11.87	12.28
Target yield (4 t/ha)	0.08	0.10	0.24	0.31	60.89	62.31	10.76	11.16
Target yield (5 t/ha)	0.11	0.13	0.41	0.46	78.79	79.80	13.95	14.30
Custom Fertiliser	0.14	0.16	0.53	0.59	86.31	88.57	19.54	20.23
S.Em.±	0.002	0.002	0.01	0.01	0.90	0.92	0.16	0.16
C.D. (P=0.05)	0.01	0.01	0.02	0.02	2.85	2.89	0.50	0.51
Sources of nutrient								
100 % inorg	0.10	0.12	0.35	0.40	71.76	72.84	13.00	13.51
75 % inorg+25%FYM	0.11	0.13	0.37	0.42	73.07	74.58	13.48	13.90
75 % inorg+25%FYM+Azot+PSB	0.11	0.13	0.38	0.44	74.44	75.77	13.86	14.23
S.Em.±	0.002	0.002	0.01	0.01	1.18	1.20	0.22	0.22
C.D. (P=0.05)	NS	NS	0.02	0.02	NS	NS	NS	NS

CONCLUSION

Based on the above findings, customized fertilizer have been proved to performed better in sandy loam soil for achieved maximum yield and retained sustainability in the production system.

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