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Effect of integrated nutrient management on tuber yield and soil properties of potato (*Solanum tuberosum* L.)

Neeraj Kumar Tiwari, Neeraj Kumar and Atik Ahamad
Department of Soil Science &Agriculture Chemistry, NDUA&T, Kumarganj Faizabad-224229
E-Mail: neerajt024@gmail.com

ABSTRACT

The field experiment was conducted during rabi season of 2012-13 to effect of integrated nutrient management on tuber yield and soil properties of potato (Solanum tuberosum L.) at Agronomy Research Farm at Narendra Deva University of Agriculture & Technology, Kumarganj Faizabad (U.P.) These experiment was conducted with three replications and seventeen treatments. The treatments consisted of three levels of Tata Geo Green 150, 60 and 100 kg ha^{-1} at the time of planting and same amount of TGG after three months of planting) in combination with three level of RDF (100, 75 and 50 % RDF). These results showed that maximum tuber yield (301.60q ha^{-1}) was recorded with treatment T_2 receiving Tata Geo Green (Enriched) @ 3.75 t ha^{-1} soil application + Recommended dose of chemical fertilizer which is significantly superior to over all the treatments except treatment T_1, T_3, T_5 and T_6. Various levels of TGG (Enriched) showed significant improvement in yield as well as nutrients availability as compared to 100% recommended dose of chemical fertilizers supplied through inorganic fertilizers alone. Improvements in tuber yield and nutrients status were relatively more under the treatments having TGG (Enriched) as compared to FYM. Application of various levels of TGG along with 75 and 50% RDF increased the tuber yield from 10.14% to 12.95% and 0.7% to 0.90% respectively over FYM with 25 and 50 % reduction of RDF respectively. The growth characters and yield attribute viz. plant height, number of shoots per plant at different growth stages, were significantly higher with the application of Tata Geo Green (Enriched) @ 3.75 t ha^{-1} as soil application + 100% recommended dose of chemical fertilizer in potato. Soil properties like, pH and EC were non significant over all the treatments while nutrients availability in soil (OC, Available N, P_2O_5 and K_2O) were significantly higher with the application of Tata Geo Green (Enriched) @ 5 t ha^{-1} as soil application + 100% recommended dose of chemical fertilizer) as compared to control.

Key words **:** TGG **(**Enriched**)** RDF, FYM, Potato

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INTRODUCTION

Potato is an important crop for solving food and nutritional security problems of growing population of India with its high potential for the growth and yield. Potato is the fourth most important food crop after rice, wheat and maize in the North-East plains of India. India is the second largest potato producing country in the world after China, with annual production of 42.48 million tonnes from area of 1.93 million hectare, while in Uttar Pradesh area, production and productivity of potato is 0.55 m ha, 13.57 m tonnes and 24.67 tonnes /ha, respectively (Anonymous, 2013). Potato production system based on the seed tubers has several disadvantages such as low multiplication rates, high storage and transportation costs as well as more pressure of pest and disease transmission risk due to vegetative propagation Dubey *et al*., 2010.

Organic manures and their extracts have been used to improve soil fertility and in combating pests and diseases. Organic manures and composts have also been found to have a direct anti disease effect by stimulating competing micro organisms and also by inducing resistance to plant diseases Ghorbani *et al*., 2006. However, there are other contradicting evidences indicating the reverse impact of using these sources Chauhan *et al*., 2000. Inadequate and imbalanced use of fertilizer especially nitrogen phosphorus and potassium are responsible for low productivity of potato in many parts of the country. Among the major nutrients potassium is one of the very important nutrient element for potato crop, as it regulates growth and vigor, improves quality and general health that ultimately hastens yield. Potassium also keeps potato away from various physiological disorder and infections. Organic matter improves the physico-

chemical and biological properties of the soil. Potato is a heavy feeder of nutrients having high requirement of NPK and other nutrients Chatterjee *et al*. 2010. The application of organic manures like farm yard manure and vermi-compost etc not only supply nutrients to the crop but also improved physico-chemical properties of soil and its water retention capacity. In a healthy soil, the biotic and a biotic component covering organic matter, including soil life, mineral particle, soil air and water exist in a stage of dynamic equilibrium and regulated the eco-system. Potato yield and production efficiency are directly related to fertilizer management practices to optimize yield and economic return, while minimizing adverse environmental effects. As potato is a highly input intensive crop, fertilization with inorganic sources of nutrients plays an important role for its higher production. But due to increased cost and detrimental effect on soil fertility and human health, supplementing the nutrients though organic sources like FYM and other organic manure has become necessary to sustain production, productivity and improve soil health Kumar *et al*. 2011. N, P, K and micronutrients are considered most important for quality and optimal potato yield. Integrated nutrient supply involving judicious use of fertilizers and organic sources of nutrients assumes greater significance in India because long-term sustainability of productivity in intensive cropping system, land degradation as well as environmental pollution can be minimized only though integration of inorganic and organic sources of nutrients.

Materials and methods

2.1 Experimental Site

The experiment was carried out during the *rabi* seasons in 2012-13 at Agronomy Research Farm of N.D.U.A. & T Kumarganj, Faizabad (U.P.). It lies at 26^0 47' N latitude, 82^0 12' E longitude and an altitude 113 m above the mean sea level. The experiment was laid out in randomized block design with four replications. The plot size was 4.50m x 5.0m. The soil of the experimental field was silty loam having pH 8.28, electrical conductivity 0.39 ds/m, organic carbon 0.41% and available NPK of 120.90, 14.72 and 246.00 kg/ha, respectively. The hybrid potato variety '*Kufri Lalima*' tubers were planted in fourth week of November and harvested in first week of April. The average duration of the crop was 120 days. The applied organic manure such as Tata Geo Green (TGG) and Farm Yard Manure (FYM) was given following.

Composition of TGG Enriched:		**Composition of FYM**
2-2.5 % Total N, 4% P2O5, 3% K2O , 3% Ca, 1% Mg, 1.25% Sulphure, 100 ppm Zn, 300 ppm % Mn and less than 25% moisture content.		0.42% N, 0.23 % P_2O_5 and 0.43 % K_2O

Half dose of nitrogen and full doses of phosphorus and potassium were applied as basal dressing through urea, single supper phosphate and muriate of potash, respectively. The remaining half dose of N was applied at earthling up (35 days after planting). The tubers were planted at 10 cm apart in the furrows of 45 cm distance and covered immediately after planting. The earthing up was done at 35 days after planting along with weeding to facilitate the development of tubers with the help of *kudal.* During earthing up the remaining nitrogen dose was side dressed and mixed thoroughly with the soil. The redomil gold 2% (Metalaxyl M 4%+ Mancozeb 64% WP) was one spray of Ridomil gold @ 500g/ha to protect the crop from late blight (*Phytophthora infestans*) at 60, 80 and 110 days after planting, respectively.

2.2 Experimental Details and Crop Culture

The treatments consisting of different levels of RDF along with manure sources of nutrients (FYM and TGG Enriched) were applied to potato as per treatments the details of the treatments are given in Table-1.

Table-1 Treatments details

T_1	Tata Geo Green (Enriched) @ 2.5 t ha^{-1} as soil application + Recommended dose of chemical fertilizer
T_2	Tata Geo Green (Enriched) @ 3.75 t ha^{-1} as soil application + Recommended dose of chemical fertilizer
T_3	Tata Geo Green (Enriched) @ 5 t ha^{-1} as soil application + Recommended dose of chemical fertilizer
T_4	Tata Geo Green (Enriched) @ 2.5 t ha^{-1} as soil application + 75 % in Recommended dose of chemical fertilizer
T_5	Tata Geo Green (Enriched) @ 3.75 t ha^{-1} as soil application + 75% in Recommended dose of chemical fertilizer
T_6	Tata Geo Green (Enriched) @ 5 t ha^{-1} as soil application + 75 % in Recommended dose of chemical fertilizer
T_7	Tata Geo Green (Enriched) @ 2.5 t ha^{-1} as soil application + 50 in Recommended dose of chemical

	fertilizer
T_8	Tata Geo Green (Enriched) @ 3.75 t ha^{-1} as soil application + 50 % in Recommended dose of chemical fertilizer
T_9	Tata Geo Green (Enriched) @ 5 t ha^{-1} as soil application + 50 % in Recommended dose of chemical fertilizer
T_{10}	FYM 12.5 t ha^{-1} + Recommended dose of chemical fertilizer
T_{11}	FYM 25 t ha^{-1} + Recommended dose of chemical fertilizer
T_{12}	FYM 12.5 t ha^{-1} + 75 % in Recommended dose of chemical fertilizer
T_{13}	FYM 25 t ha^{-1} + 75 % in Recommended dose of chemical fertilizer
T_{14}	FYM 12.5 t ha^{-1} + 50 % in Recommended dose of chemical fertilizer
T_{15}	FYM 25 t ha^{-1} + 50 % in Recommended dose of chemical fertilizer
T_{16}	Recommended dose of chemical fertilizer
T_{17}	Control

Soil samples (0-20 cm) were randomly collected (following zigzag way) and composited before planting. At harvest, soil samples were collected from each replicated treatment. The soil samples were air dried and ground to pass through a 2 mm sieve before analysis. The soil sample bags were well identified, labelled and analyzed at the laboratory of soil science &Agriculture chemistry, NDUA&T, Kumarganj Faizabad, for Physico-chemical analysis. The soil samples were then analyzed according to standard procedures (Pauwels *et al*., 1992). After planting the potato, a light irrigation was applied and at proper moisture level weedicide (sencorne) was spread for weed control. Data were collected for vegetative (plant height, No of shoots per plant) and yield (number and weight of tubers) parameters. For the vegetative parameters, data were collected from five randomly selected plants from each treatment in the three blocks while for the yield parameters, the entire plot was harvested and data taken. All the growth parameters were studied at different growth stages i.e 45, 60 and 75 DAP50%. Plant height was measured from the base of the plants to the apex. The yield parameters were collected at harvest i.e. 120 days after planting.

2.4 Chemicals Analysis

Soil samples were collected from effective root zone depth (0-20 cm) after harvest of crop and analyzed for various physico-chemical and biological parameters following standard procedures.

The pH was determined in a 1:2.5 soil: water suspension (Jackson, 1973), Chemical properties of organic carbon was determined by Walkey and Black (1934), available N by alkaline potassium permanganate method (Subbiah and Asija, 1956), available P by Olsen's method (Olsen *et al.,* 1954) and available K by ammonium acetate extraction method (Jackson, 1973).

Statistical Analysis

The analysis of variance methods (Snedecor and Cochran, 1967) was followed to statistically analyze the various data. The significance of different sources of variations was tested by Error mean square of Fisher Snedecor's 'F' test at probability level (P = 0.05). In the summery tables of the results, the standard error of mean (Sem ±), the value of critical difference (CD) and coefficient of variation (CV) to compare the difference between the means have been provided.

RESULTS AND DISCUSSION

Significantly higher plant height at 30, 60 and 75 days after planting were observed under T_3 (Tata Geo Green (Enriched) @ 5 t ha^{-1} as soil application +100% Recommended dose of chemical fertilizer) as compared to RDF alone and control(Table 2). The application of 100% RDF with TGG @ 2.5, 3.75 and 5 t ha^{-1} and increased the (27.78, 36.28 and 42.42 %) plant height respectively over 100% RDF alone supplied though inorganic fertilizer. Applications of 100% RDF through FYM on nitrogen basis were not capable to enhance the growth attributes similar to other treatments of integration of RDF with FYM. The rate of mineralization of organic manure might be slow in this region due to low temperature in autumn season resulted poor availability of nutrients to the crop. This increase in plant height might be due to increase in uptake of nitrogen, phosphorus and potassium. Sharma *et al.* (1980) indicated that a heavy dressing of farmyard manure (30 tonnes/ha/annum) could supply potatoes with enough P and K. These results are in close conformity with those Pradip *et al*. (2017). number of shoots per plant at different growth stages ware observed highest in treatment T_3 (Tata Geo Green (Enriched) @ 5 t ha^{-1} as soil application + 100% Recommended dose of chemical fertilizer) which is significantly superior over all the

treatments except treatment T_2 (Tata Geo Green (Enriched) @ 3.75 t ha^{-1} as soil application + 100% Recommended dose of chemical fertilizer). Pandey *et al.* (2008) studied the various options of nutrient management in potato and reported that plant growth parameters remains unaffected upto 50% replacement of inorganic by organics sources but yield decreased significantly.

Yield attributes

Generally yield is denoted as the product of total No of tubers, weight of tuber $plant^{-1}$ and tubers yield (q ha^{-1}). Highest average number of tubers/plant were recorded with the application of integration of Tata Geo Green (Enriched) @ 3.75 t ha^{-1} soil application + Recommended dose of chemical fertilizer which were significantly superior to 100% RDF and control, but remained at par with rest of treatments (Table 3). Number of tubers was not much affected than weight of tubers per plant due to integration of nutrient sources during the investigation. This might be due to application of fertilizers in combination with organic manure which increased the nutrient-use efficiency through modification of soil physical condition, and resulted in higher total uptake of nutrients because of better root penetration leading to better absorption of nutrients and moisture. Kushwah *et al*. (2005) were of similar view and reported that manures have sufficient residual effect on soil nutrient supply system. They also supply micro-nutrients in addition to major plant nutrients.

The maximum tuber yield (301.60 q ha^{-1}) was recorded with treatment (T_2) Tata Geo Green (Enriched) @ 3.75 t ha^{-1} soil application +100% Recommended dose of chemical fertilizer which is significantly superior to over all the treatments except treatment T_6, T_3 and T_1 (Table 4). The various levels of TGG (Enriched) showed significant improvement in tuber yield as compared to 100% recommended dose of chemical fertilizers along with supplied through inorganic fertilizers. Tuber yield showed impressive improvement through use of TGG (Enriched) and FYM in combination with inorganic fertilizers. Improvements in tuber yield was relatively more under the treatments having TGG (Enriched) as compared to FYM. Therefore, the maximum tuber yields in these treatments due to increased tuber weight, higher proportion of large and medium sized tuber. These results are in confirmation with Sood (2007) who observed higher potato tuber yield under integrated use of organic (FYM) and inorganic sources, Similar results have been reported by Baishya *et al.* (2010) and Islam *et al.* (2013)

Soil fertility

The organic carbon and available nitrogen, phosphorus, potassium content were significantly influenced by integrated nutrient management practices (Table 5). Application of fertilizers in combination with organic significantly improved the soil available nutrients status and the highest values were found with the Tata Geo Green (Enriched) @ 5 t ha^{-1} soil application + Recommended dose of chemical fertilizer as compared to RDF and Control. Significantly highest organic carbon (%) and available nitrogen, phosphorus and potassium content in soil at harvest were recorded with the application of (T_3) Tata Geo Green (Enriched) @ 5 t ha^{-1} soil application + Recommended dose of chemical fertilizer as compared to RDF and Control. significant buildup of organic carbon was observed with all treatments as compared to control except T_1, T_2, T_5 and T_8 respectively, The application of 100% RDF along with TGG @ 2.5, 3.75 and 5 t ha^{-1} organic carbon were increased (28.26%, 30.43% and 34.78%) respectively over 100% RDF alone. Similarly, application of 75 % RDF along with TGG @ 2.5, 3.75 and 5 t ha^{-1} organic carbon was increased (23.91%, 30.43% and 28.26 %) respectively, over 100% RDF alone. Application of FYM @ 12.5 and 25 t ha^{-1} along with 100 % RDF, the organic carbon percent was increased 17.39% and 26.08 % respectively over the 100 % RDF alone. This could be attributed to direct addition of organic substances in soil and due to better root growth, more plant residues after crop harvest and their indirect influence on physico-chemical characteristics of the soil (Kaushik *et al.,* 1984 and Ojha *et al.,* 2009). The application of 100% RDF along with TGG @ 2.5, 3.75 and 5 t ha^{-1}, available nitrogen were increased (1.56%, 7.29% and 12.81%) respectively over 100% RDF alone. This could be attributed to direct addition of organic substances in soil and due to better root growth, more plant residues after crop harvest and their indirect influence on physico-chemical characteristics of the soil (Biswas *et al.,* 1970; Kaushik *et al.,* 1984 and Ojha *et al.,* 2009). The highest phosphorus and potassium availability was recorded in treatment T_3 Tata Geo Green (Enriched) @ 5 t ha^{-1} soil application + Recommended dose of chemical fertilizer (21.30 Kg/ha). Selvamani *et al.* (2011) reported that phosphorus content in soil increased the significantly by application of organics and bio-inoculants in rice. Organic acids released during decomposition of organic manures increased availability of phosphorus (Mehdi *et al.* 2011). The organic materials forms a protective cover on sesquoxide and thus also reduce the phosphate fixing capacity of soil and hence, increase available P status of soil (Singh *et al.,* 2006).

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Table-2: Effect of INM on growth parameters of potato

Treatments	Plant height (cm)			No of shoots per plant		
	45 DAP	60 DAP	75 DAP	45 DAP	60 DAP	75 DAP
T_1	17.89	39.32	47.92	4.10	4.42	4.60
T_2	19.08	41.00	49.11	4.38	4.66	4.80
T_3	19.94	41.98	50.76	4.40	4.72	4.86
T_4	15.94	35.60	42.50	3.98	4.18	4.33
T_5	17.85	38.90	46.90	4.02	4.46	4.76
T_6	17.76	39.60	47.86	4.00	4.35	4.48
T_7	12.12	28.36	30.18	3.10	3.33	3.49
T_8	14.20	31.55	34.90	3.40	3.68	3.76
T_9	14.96	33.23	37.70	3.52	3.78	3.98
T_{10}	15.98	34.05	39.55	3.60	3.82	4.00
T_{11}	17.75	36.06	41.80	3.89	4.18	4.20
T_{12}	14.20	30.98	34.10	3.30	3.50	3.42
T_{13}	16.00	34.18	39.83	3.67	3.86	3.78
T_{14}	11.96	27.87	29.33	3.00	3.16	3.00
T_{15}	13.97	31.90	37.00	3.36	3.52	3.35
T_{16}	14.00	31.17	34.19	3.38	3.56	3.81
T_{17}	10.05	21.14	26.98	2.20	2.48	2.96
SEm±	0.67	0.71	0.76	0.98	0.14	0.17
CD at 5%	1.76	1.98	2.19	0.28	0.32	0.41

Table-3: Effect of INM on Number of tuber grades per plant and total number of tubers plant^{-1} of potato

Treatments	Number of tuber grades plant^{-1}			Total No of tubers plant^{-1}
	(<20 g)	(25-50g)	(>50 g)	
T_1	2.77	3.38	2.71	8.86
T_2	2.52	3.46	2.97	8.95
T_3	2.47	3.34	3.11	8.92
T_4	2.34	2.86	2.22	7.42
T_5	2.26	3.04	2.64	8.11
T_6	2.19	2.92	2.80	8.78
T_7	2.29	1.59	1.18	5.06
T_8	2.21	2.62	1.29	6.12
T_9	2.11	2.88	1.47	6.46
T_{10}	2.57	2.44	1.77	6.78
T_{11}	2.40	3.50	1.86	7.76
T_{12}	2.02	2.03	1.22	5.53
T_{13}	1.92	3.09	1.57	6.95
T_{14}	2.22	1.57	1.13	4.82
T_{15}	2.10	2.90	1.24	6.24
T_{16}	2.32	2.37	1.23	5.72
T_{17}	1.46	1.08	0.68	3.22
SEm±	0.14	0.15	0.13	0.26
CD at 5%	0.34	0.40	0.30	0.66

Table-4: Effect of INM on grade wise weight of tuber plant^{-1} of potato

Treatments		Weight of tuber grades plant^{-1} (g)				Tuber yield (q ha^{-1})
		(<25 g)	(25-50g)	(>50 g)	Total weight of tuber	
T_1	Tata Geo Green (Enriched) @ 2.5 t ha^{-1} soil application + Recommended dose of chemical fertilizer	98.49	209.02	152.60	470.11	295.10
T_2	Tata Geo Green (Enriched) @ 3.75 t ha^{-1} soil application + Recommended dose of chemical fertilizer	91.84	234.47	163.22	489.53	301.60
T_3	Tata Geo Green (Enriched) @ 5 t ha^{-1} soil application + Recommended dose of chemical fertilizer	87.40	226.62	168.10	482.12	299.58
T_4	Tata Geo Green (Enriched) @ 2.5 t ha^{-1} soil application + 75 % in Recommended dose of chemical fertilizer	82.56	198.64	155.36	436.56	282.40
T_5	Tata Geo Green (Enriched) @ 3.75 t ha^{-1} soil application + 75 % in Recommended dose of chemical fertilizer	80.21	220.02	160.27	469.50	295.00
T_6	Tata Geo Green (Enriched) @ 5 t ha^{-1} soil application + 75 % in Recommended dose of chemical fertilizer	76.96	211.50	168.00	461.15	293.40
T_7	Tata Geo Green (Enriched) @ 2.5 t ha^{-1} soil application + 50 % in Recommended dose of chemical fertilizer	80.90	170.25	112.12	362.27	243.30
T_8	Tata Geo Green (Enriched) @ 3.75 t ha^{-1} soil application + 50 % in Recommended dose of chemical fertilizer	78.18	184.87	119.55	382.60	254.00
T_9	Tata Geo Green (Enriched) @ 5 t ha^{-1} soil application + 50 % in Recommended dose of chemical fertilizer	77.11	191.97	126.06	395.14	260.60
T_{10}	FYM 12.5 t ha^{-1} + Recommended dose of chemical fertilizer	93.05	188.65	123.70	405.40	266.00
T_{11}	FYM 25 t ha^{-1} + Recommended dose of chemical fertilizer	86.95	191.94	140.24	423.13	275.33
T_{12}	FYM 12.5 t ha^{-1} + 75 % in Recommended dose of chemical fertilizer	75.00	180.42	119.90	375.32	250.17
T_{13}	FYM 25 t ha^{-1} + 75 % in Recommended dose of chemical fertilizer	68.96	209.96	127.22	406.14	266.39
T_{14}	FYM 12.5 t ha^{-1} + 50 % in Recommended dose of chemical fertilizer	77.96	167.29	113.79	359.04	241.60
T_{15}	FYM 25 t ha^{-1} + 50 % in Recommended dose of chemical fertilizer	76.50	196.08	118.00	390.58	247.15
T_{16}	Only Recommended dose of chemical fertilizer	80.15	182.26	116.59	379.66	247.15
T_{17}	Control (No fertilizer)	70.03	75.12	72.25	201.10	153.16
SEm±		3.42	4.32	4.12	6.98	3.09
CD at 5%		10.12	12.76	11.96	20.55	9.06

Table-5: Effect of INM on OC, available N, P_2O_5 and K_2O of soil at harvest of potato crop

Treatments		O C (%)	Available N (Kg ha^{-1})	Available P_2O_5 (Kg ha^{-1})	Available K_2O (Kg ha^{-1})
T_1	Tata Geo Green (Enriched) @ 2.5 t ha^{-1} soil application + Recommended dose of chemical fertilizer	0.59	139.14	18.90	292.10
T_2	Tata Geo Green (Enriched) @ 3.75 t ha^{-1} soil application + Recommended dose of chemical fertilizer	0.60	147.00	20.60	298.00
T_3	Tata Geo Green (Enriched) @ 5 t ha^{-1} soil application + Recommended dose of chemical fertilizer	0.62	154.55	21.30	309.15
T_4	Tata Geo Green (Enriched) @ 2.5 t ha^{-1} soil application + 75 % in Recommended dose of chemical fertilizer	0.57	135.00	17.40	289.30
T_5	Tata Geo Green (Enriched) @ 3.75 t ha^{-1} soil application + 75 % in Recommended dose of chemical fertilizer	0.60	140.56	18.10	284.55
T_6	Tata Geo Green (Enriched) @ 5 t ha^{-1} soil application + 75 % in Recommended dose of chemical fertilizer	0.59	148.10	20.00	301.12

T_7	Tata Geo Green (Enriched) @ 2.5 t ha^{-1} soil application + 50 % in Recommended dose of chemical fertilizer	0.55	131.45	16.74	279.45
T_8	Tata Geo Green (Enriched) @ 3.75 t ha^{-1} soil application + 50 % in Recommended dose of chemical fertilizer	0.58	137.52	17.16	271.20
T_9	Tata Geo Green (Enriched) @ 5 t ha^{-1} soil application + 50 % in Recommended dose of chemical fertilizer	0.59	142.76	18.35	282.00
T_{10}	FYM 12.5 t ha^{-1} + Recommended dose of chemical fertilizer	0.54	145.13	18.63	264.50
T_{11}	FYM 25 t ha^{-1} + Recommended dose of chemical fertilizer	0.58	149.90	19.90	273.00
T_{12}	FYM 12.5 t ha^{-1} + 75 % in Recommended dose of chemical fertilizer	0.55	129.86	17.60	258.15
T_{13}	FYM 25 t ha^{-1} + 75 % in Recommended dose of chemical fertilizer	0.58	135.90	18.40	270.00
T_{14}	FYM 12.5 t ha^{-1} + 50 % in Recommended dose of chemical fertilizer	0.52	121.50	15.84	261.30
T_{15}	FYM 25 t ha^{-1} + 50 % in Recommended dose of chemical fertilizer	0.55	133.50	17.13	268.22
T_{16}	Only Recommended dose of chemical fertilizer (150 kg N, 60 kg P_2O_5 and 100 kg K_2O)	0.46	137.00	16.40	254.78
T_{17}	Control (No fertilizer)	0.41	120.90	14.80	246.00
$SEm^{\pm}$		0.012	2.51	0.69	3.21
CD at 5%		0.03	7.39	1.71	9.52

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