The Pharma Innovation Journal 2022; 11(6): 307-311

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(6): 307-311

www.thepharmajournal.com
Received: 05-03-2022
Accepted: 24-05-2022

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Effect of integrated nutrient management on growth and productivity under rice-wheat cropping system under *central plain zone* of UP

Lalit Krishna Yadav and US Tiwari

Abstract
A field experiment was conducted during *Kharif* and *Rabi* season of 2017-18 and 2018-19 at Students' Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur in alluvial track of Gangetic plains in Central part of Uttar Pradesh. The field experiment was laid out in Randomized Block Design with twelve treatments *viz.*, T1: Control, T2: 125% RDN, T3: 100% RDN, T4: 100% RDN + 25% N through FYM, T5: 100% RDN + 25% N through Vermicompost, T6: 100% RDN + S (30 kg ha-1), T7: 100% RDN + S (30 kg ha-1) + Zn (5 kg ha-1), T8: 100% RDN + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha-1), T9: 100% RDN + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha-1) + B (1 kg ha-1), T10: 100% RDN + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha-1) + B (1 kg ha-1) + Azotobacter + PSB, T11: 100% RDN + 25% N through FYM + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha-1) + B (1 kg ha-1) + Azotobacter + PSB and T12: 100% RDN + 25% N through Vermicompost + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha-1) + B (1 kg ha-1) + Azotobacter + PSB and replicated thrice. After making individual experimental unit, the amount of fertilizer was applied as per treatment uniformly.
In hybrid rice crop, integrated nutrient management improved the growth and yield attributes such as panicle length, no. of grain per panicle, test weight and yield over the 100% RDN alone. The maximum improvement was notice with the application treatment T12 (100% RDN + 25% N through Vermicompost +S + Zn + Fe + B + Azo. + PSB) over the rest of the treatments. Similar trend was also observed in case of wheat crop. Application of treatment T12: 100% RDN + 25% N through Vermicompost +S + Zn + Fe + B + Azo. + PSB produced maximum number of growth attributed and yield was recorded.

Keywords: Rice, wheat, nitrogen, phosphorus, potassium, sulphur, zinc, iron, boron, vermicompost and *Azotobactor* etc.

Introduction
Rice-Wheat cropping system is the predominant cropping system of the Indo-Gangetic plains in India. It is the food bowl or food basket of India having 53 per cent of total area under rice and wheat crops (Koshal, 2014). Rice and wheat are the two major staple cereal crops contributing more than 70 per cent to the total cereal production in the country. Approximately, 10.5 million hectares area comes under this cropping system. About 33% of India's rice and 42% of wheat are grown in this rotation. Nearly 63% of total fertilizer used in the country is applied to rice and wheat crop alone (Yadav and Kumar, 2009) [18]. The Rice-wheat cropping system cover 12.5 million hectares acreage in Northern Indo- Gangatic Plains and contributes about 25 percent of total food grain production of India (Singh and Chandre, 2011).
There is indication of stagnation or even decline in the productivity of rice and wheat field due to decline in soil organic matter, over mining of nutrient reserve, loss of nutrient and non-availability of cost effective fertilizers. The application of inorganic fertilizer even in balance form may not sustain the soil fertility and productivity under continuous rice-wheat cropping system. However, integrated use of inorganics and organics including crop residues may improve the soil productivity (Chettry and Bandopadhya, 2005 and Mankotia, 2007) [2, 9]. The farm yard manure is proven source of nutrient in agriculture crop but its availability is quite inadequate (Mishra and Prasad, 2000) [8]. Continuous use of inorganic fertilizers have not only brought about loss of soil fauna and flora but also resulted in loss of secondary and micro nutrient in rice and wheat fields (Kharub and Chander, 2008) [4].

It is true that the rice and wheat production increases with the introduction of high yielding varieties. However due to inadequate and unbalanced fertilizer application, farmers are not receive full yield potential of rice crop. Consigned application of organic and inorganic fertilizer can increase the yield, improve the totally status of the soil, improve the input-use efficiency by the crop and can minimize the expenditure of costly fertilizers (Laxminarayana and Patiram 2006).
Therefore, suitable combination of chemical fertilizers, organic manures and microbial cultures need to be developed for particular cropping system and soil. In central plain zone of Uttar Pradesh, rice based cropping systems particularly rice-wheat is predominant under irrigated production system. Cultivation of both these crop components under this cropping system is not only costly, time and labour consuming but also deteriorates the soil properties.

Materials and Methods

A field experiment was conducted during *Kharif* and *Rabi* season of 2017-18 and 2018- 19 at Students' Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur in alluvial track of Gangetic plains in Central part of Uttar Pradesh. The experimental site was silt-loam in texture and slightly alkaline in reaction (8.14 pH), medium in organic carbon (0.427%) and potassium (146.76 kg ha-1), low in available nitrogen (213 kg ha-1), available phosphorus (12.48 kg ha-1), available sulphur (8.6), available zinc (0.542 ppm), available iron (4.02 ppm) and available boron (0.268 ppm). The field experiment was laid out in Randomized Block Design with twelve treatments *viz.,* T1: Control, T2: 125% RDN, T3: 100% RDN, T4: 100% RDN + 25% N through FYM, T5: 100% RDN + 25% N through Vermicompost, T6: 100% RDN + S (30 kg ha-1), T7: 100% RDN + S (30 kg ha-1) + Zn (5 kg ha-1), T8: 100% RDN + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha-1), T9: 100% RDN + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha-1) + B (1 kg ha-1), T10: 100% RDN + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha- 1) + B (1 kg ha-1) + Azotobacter + PSB, T11: 100% RDN + 25% N through FYM + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha-1) + B (1 kg ha-1) + Azotobacter + PSB and T12: 100% RDN + 25% N through Vermicompost + S (30 kg ha-1) + Zn (5 kg ha-1) + Fe (10 kg ha-1) + B (1 kg ha-1) + Azotobacter + PSB and replicated thrice.
After making individual experimental unit, the amount of fertilizer was applied as per treatment uniformly. In hybrid rice half dose of nitrogen and total phosphorous, potash, sulphur, zinc, iron and boron were applied as basal application before puddling and incorporated in the top 15 cm soil. Remaining dose of nitrogen was applied at maximum tillering and panicle initiation stages during both the year. In wheat recommended dose of fertilizer *i.e.* NPK were applied @ 150:75:40 kg ha-1 half dose of nitrogen and total phosphorous and potash were applied at the time of sowing and rest amount of nitrogen was applied at two splits in standing crop at tillering and milking stage during both the years. The application of farm yard manure and vermicompost as per treatment was done through incorporated in soil before puddling for transplanting of rice seedlings. Biofertilizers were applied @ 10 kg ha-1 after seven days of rice transplanting in standing water condition through uniform broadcasting in treatment plots.

Result and Discussion

Rice crop

(A) Growth attributes

Plant height (cm)

It is clear from the table-1 that plant height varied in all the treatments but the variation in plant height within all the treatments were found non-significant. Maximum plant height 106.40 cm and 107.06 cm was recorded with T12 (100% RDN + 25% N through Vermicompost + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) which was found at par with treatment T11 (100% RDN + 25% N through FYM + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) plant height 106.25 cm and 106.75 cm and minimum plant height 96.50 cm and 95.90 cm was recorded at control (T1) during first year and second year respectively. Application of 125% RDN (T2) showed slight increase in plant height over 100% RDN treatment (T3). Integration of organic, inorganic and biofertilizers alone or combination also influenced plant height but the increase in plant height within all the treatments was found non-significant during both the years. Application of organic manures and biofertilizers improves release patterns of nutrients by making its slowing available, synchronizing with crop requirements at different phenophases. Similar results have been reported by Singh *et al.* (2002) [13] and Yadav *et al.* (2009) [18].

No. of Hills m-2

The data in regard to no. of hills m-2 were embodied in Table-1 did not reach to the level of significance in either of the year indicating, thereby that nutrition did not affect the emergence of seedlings. The no. of hill m-2 varied from 44.25 to 49.90 per square meter in first year whereas it varied from 43.08 to 49.95 per square meter in the second year. Integration of organic, inorganic and biofertilizers did not influence the no. of hills m-2 of hybrid rice. Negligible variation in no. of hills m-2 with in all the treatments indicating little effect of INM approach on number of hills-2 during both the years. It may be due to increase availability of nutrients with integrated use of organic inorganic and biofertilizer. These findings are related to the findings of Shah *et al.* (2018) [14], Singh *et al.,* (2003) [15] and Khan *et al.* (2007) [5].

No. of effective tillers square meter-1

It is clear from the Table-1 that significantly increases in all the treatments in comparison to control (T1). Application of 30 kg S ha-1, 5 kg Zn ha-1, 10 kg Fe ha-1, 1 kg B ha-1, biofertilizers, FYM and vermicompost individually did influence in no. of effective tillers m-2 but when combined together there was spectacular response in no. of effective tillers m-2 was observed in no. of effactive tillers m-2 during both the years. Maximum no. of effective tillers m-2 was noted down 376.60 and 381.20 with T12 (100% RDN + 25% N through Vermicompost + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) followed by 368.20 and 375.50 T11 (100% RDN + 25% N through FYM + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) and minimum 280.40 and 276.70 at control (T1) during first year and second year respectively. It was also observed that application of 125% RDN (T2) showed significantly increased in no. of effective tillers/m2 over 100% RDN (T3) during both the years. The increasing number of tillers with increasing levels of nutrients may be attributed to the fact that nutrient seems to have played a vital role in the formation of new tissues which are dependent on the protoplasmic structure, cell division and cell elongation. Similar results have also been reported by Barik *et al*. (2006) [1] and Gohad (2010) [3].

Yield

Biological yield (q ha-1)

It is apparent from the data given in table-1 that biological yield of hybrid rice increased significantly in all the treatments in comparison to control during both the years. Maximum biological yield 174.14 q ha-1 and 177.04 q ha-1 was recorded with T12 (100% RDN + 25% N through Vermicompost + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) followed by 167.67 q ha-1 and 169.71 q ha-1 with T11 (100% RDN + 25% N through FYM + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) and minimum 67.77 q ha-1 and 64.89 q ha-1 at control, during first year and second year respectively. Integration of FYM, vermicompost 30 kg S ha-1, 5 kg Zn ha-1, 10 kg Fe ha-1, 1 kg B ha-1 and biofertilizer with 100% RDN individually showed significant increase in biological yield over 100% RDN during both the years. Combined application of 30 kg S ha-1, 5 kg Zn ha-1, 10 kg Fe ha-1, 1 kg B ha-1 and biofertilizer with 100% RDN + 25% N through FYM and 100% RDN + 25% N through Vermicompost showed statistically at par biological yield during both years. Application of 125% RDN (T2) showed higher increased biological yield over 100% RDN treatment (T3) during both the years. This may be probably due to higher density of tiller and increased rate of dry matter production. Similar findings were reported by Sharma *et al.* (2013) [12].

Grain yield (q ha-1)

It is apparent from the data depicted in table-2 showed that all the treatments significantly influenced the grain yield over control. Highest grain yield 78.44 q/ha and 79.75 q ha-1 was recorded with T12 (100% RDN + 25% N through Vermicompost + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) which was found 163.66% and 179.43% higher to the lowest yield 29.75 and 28.54 q ha-1 at control (T1) and 56.25% and 53.66% higher to 100% RDN treatment (T3) during first year and second year respectively. Integration of sulphur with 100% RDN (T6) produced 16.23% and 15.31% higher grain yield over 100% RDN (T3). Application of 30 Kg S ha-1, 5 Kg Zn ha-1 with 100% RDN (T7) also influence grain yield 8.14% and 7.10% higher over 100% RDN + 30 Kg S ha-1 (T6) likewise 30 Kg S ha-1 and 5 Kg Zn ha-1. Application of 10 Kg Fe ha-1 with 100% RDN + S (30 Kg ha-1) + Zn (5 Kg ha-1) (T8) produce 4.04% and 3.58% higher grain yield in comparison to 100% RDN + S (30 Kg ha- 1) + Zn (5 Kg ha-1). Application of 1 Kg B ha-1 (T9) was also influenced 6.01% and 5.57% higher grain over 100 RDN + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 (T8). Combined application of biofertilizer with 100% RDN + 30 kg S ha-1+ 5 kg Zn ha-1+ 10 kg Fe ha-1 + 1 kg B ha-1 (T10) also showed 5.10% and 4.70% higher grain yield in comparison to 100% RDN + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1+ 1 kg B ha-1 (T9). Combined application of 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 and biofertilizers with 100 RDN + 25% N, Vermicompost (T12). Produced more grain yield over 100% RDN + 25 N, FYM + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 and biofertilizer (T11) but the increase in grain yield was found non-significant during both the years. Application of 125% RDN (T2) produced higher yield over 100% RDN (T3) but increase in yield was found non-significant during both the years. This may be due to adequate availability of different nutrients which contributed to increase dry matter accumulation. Productivity of a crop is collectively determined by vigour of the vegetative growth, development as well as yield attributes which is the result of better translocation of photosynthates from source of leaves and stem to the grains. Similar results have been reported by Mishra (2000) [8] and Kumar *et al.* (2000) [6].

Wheat crop

Growth attributes

Plant height (cm)

Plant height was recorded at maturing of wheat crop. It is clear from the table-2 that non- significant increase in plant height over control, during both the year. Maximum plant height 99.60 cm and 99.52 cm to was recorded with T12 (100% RDN + 25% N through Vermicompost + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) followed by 99.15 cm and 99.50 with T11 (100% RDN + 25% N through FYM + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) and minimum 93.32 cm and 92.90 cm at control during first year and second year respectively. Residual effect of FYM, vermicompost, S, Zn, Fe, B and biofertilizers with 100% RDF which was applied in preceding rice crop markedly influenced the plant height but the increase in plant height was found non-significant during both the years. It is interesting to report here that residual and combined effect of FYM and vermicompost along with major nutrients, micronutrients and biofertilizer showed greater impact on in plant height over its individual and combined application of inorganic and biofertilizer during both the years. It is also obvious from the data that application of 125% RDN (T2) in *kharif* showed higher increase in plant height of wheat over 100% RDN application (T3) during both the years which was mainly due to enhanced availability of more nutrients in sufficient which enhanced more leaf area resulting in higher photo assimilates and thereby resulted in more dry matter accumulation. The effect of different nutrients in the improvement of plant height can be explained by the fact that nitrogen is the main growth promoter element and helps for more synthesis of food resulting into greater cell division and cell enlargement (Meena *et al*., 2003) [10].

No. of Tillers plant -1

Number of tillers plant-1 in wheat was recorded at maturity of crop. It is apparent from the table-2 which revealed non-significant variation in no. of tillers plant-1 over control during both the years. Residual effect of combined application of S, Fe, Zn, B and biofertilizer with 100% RDN super seeded the no. of tillers plant-1 over 100% RDN during both the years. Residual effect of superimposition of 25% N through FYM and Vermicompost influenced no. of tillers plant-1 over 125% RDN during both the years. Residual effect of combined application of vermicompost, S, Zn, Fe, B and biofertilizer with 100% RDN (T12) showed maximum 7.60 and 7.90 no. of tillers plant-1 followed by 7.25 and 7.55 with T11 and minimum no. of tillers plant-1 was recorded 4.35 and 4.20 with (T1) control during first year and second years.

No. of effective tillers m-2

An appraisal of the data given the table-2 showed significant increase in no. of effective tillers m-2 all the treatments over control during both the years. Residual effect of combined application of organic inorganic and biofertilizers showed maximum increase was recorded 327 and 360 with T12 (100% RDN + 25% N through Vermicompost + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) and (T11) (100% RDN + 25% N through FYM + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB)over other treatments. Minimum no. of effective tillers m-2 226 and 222 was noted in control (T1) during first year and second years. It is also obvious from the data that no. of effective tillers m-2was higher in second year except control over first year. Superimposition of 25% N FYM and vermicompost influenced higher no of effective tillers m-2 than 100% RDN (T3) and 125% RDN (T2) during both the years. It was also observed that alone or combined application of vermicompost with inorganic and biofertilizers in rice crop showed higher influence in growth attributes over FYM during both the years. These finding are supported to the findings of Mankotia *et al.* (2007) [9], Hedge (1998) [11].

Yield

Biological Yield

The data in regard to biological yield given in table-2 showed that biological yield of wheat showed significant increase in all there treatments over control during both the years. Maximum biological yield 130.12 q ha-1 and 131.22 q ha1 was recorded with T12 (100% RDN + 25% N through Vermicompost + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) and minimum 63.01 q ha1 and 61.46 q ha1 at control (T1) during first year and second year respectively. Residual effect of alone and combined together application of organic inorganic and biofertilizer also influenced biological yield during both the years but the variation in biological yield within all the treatments were found non-significant during both the years. It was also observed that biological yield in second year was noted higher over the first year. This may be probably due to higher number of tillers, LAI and increased rate of dry matter production. Similar findings were reported by Kumar and Prasad (2003) [7].

Grain Yield

It is visualized from the data given in table-2 indicated that grain yield of wheat increased significantly in all the treatments over control during both the years. Maximum grain yield 55.85 q ha-1 and 56.30 q ha-1 was recorded in the plot receiving treatment T12 100% RDN + 25% N through Vermicompost + 30 kg S ha-1 + 5 kg Zn ha-1 + 10 kg Fe ha-1 + 1 kg B ha-1 + Azotobacter + PSB) which was found 27.80% and 24.83% over to 100% RDN (T3) and 111.55% and 118.64% over control during first year and second year, respectively. Application of FYM, vermicompost, S, Zn, Fe, B and biofertilizer in preceding rice crop exerted residual effect on succeeding wheat crop during both the years.

It is interesting to report here that super imposition of FYM and vermicompost with 100% RDN applied in preceding rice crop showed its residual effect statistically at par on succeeding wheat crop during wheat crop. This may be due to adequate supply of different nutrients which contributed to increase dry matter accumulation. Trop productivity is collectively determined by vigour of the vegetative growth, development as well as yield attributes which is the result of better translocation of photosynthates from source of leaves and stem to the grains. The similar results were also reported by Yadav *et al.* (2005) [17] and Singh *et al.* (2017) [16].

Table 1: Effect of different treatments on growth and yield of rice crop during both of the year.

S. No.	Treatments combination		Plant Height (cm)		No. of hills square meter-1		No. of effective tillers square meter-1		Biological yield (q ha-1)		Grain yield (q/ha)	
	Kharif	Rabi	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
T1	Control	Control	96.50	95.90	44.25	43.08	280.40	276.70	67.77	64.89	29.75	28.54
T2	125% RD	100% RDF	101.48	102.35	46.90	47.10	315.45	322.50	121.53	126.23	53.78	55.85
T3	100% RDN	100% RDF	99.55	100.30	46.23	46.35	302.90	312.70	113.96	117.82	50.20	51.90
T4	100% RDN + 25% N Through FYM	100% RDF	101.60	101.90	46.50	46.80	310.60	316.50	119.52	124.96	52.75	55.15
T5	100% RDN + 25% N Through VC	100% RDF	102.45	103.75	46.98	47.08	324.70	328.70	122.14	126.85	54.30	56.40
T6	100% RDN + S	100% RDF	102.90	103.95	47.65	47.80	330.85	335.40	131.10	134.42	58.35	59.85
T7	100% RDN + S + Zn	100% RDF	103.40	104.85	47.86	47.90	336.70	342.70	141.60	143.84	63.10	64.10
T8	100% RDN + S + Zn + Fe	100% RDF	103.85	104.20	48.25	48.36	346.50	351.67	147.05	148.76	65.65	66.40
T9	100% RDN + S + Zn + Fe + B	100% RDF	104.30	104.85	48.68	48.85	354.70	362.70	155.69	156.81	69.60	70.10
T10	100% RDN + S + Zn + Fe + B + Azo.+ PSB	100% RDF	105.70	106.10	49.25	49.50	365.60	372.50	163.12	163.68	73.15	73.40
T11	100% RDN+ 25% N Through FYM + S + Zn + Fe + B + Azo. + PSB	100% RDF	106.25	106.75	49.83	49.91	368.20	375.50	167.67	169.71	75.35	76.27
T12	100% RDN + 25% N Through VC +S + Zn + Fe + B + Azo. + PSB	100% RDF	106.40	107.06	49.90	49.95	376.60	381.20	174.14	177.04	78.44	79.75
SE(m)			3.09	3.08	2.16	2.11	11.58	11.10			1.75	1.81
C.D. (P=0.05)			NS	NS	NS	NS	34.15	32.76			5.15	5.35

Note: VC is abbreviation of Vermicompost and Azo. is abbreviation of Azotobactor

Application of Sulphur, Zinc, Iron and Boron- 30, 5.0, 10.0 and 1.0 kg ha-1

Table 2: Effect of different treatment on growth attributes and yield of wheat crop during both of the year.

S. No.	Treatments combination		Plant Height (cm)		No. of tillers plant-1		No. of effective tillers square meter-1		Biological yield (q ha-1)		Grain yield (q/ha)	
	Kharif	Rabi	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
T1	Control	Control	93.25	92.90	4.35	4.20	226.00	222.00	63.01	61.46	26.40	25.75
T2	125% RD	100% RDF	96.25	96.60	5.65	5.75	259.00	254.00	106.20	109.38	44.90	46.25
T3	100% RDN	100% RDF	95.50	95.80	5.25	5.40	249.00	254.00	104.17	107.52	43.70	45.10
T4	100% RDN + 25% N Through	100% RDF	96.80	97.05	5.85	5.98	273.00	276.00	107.38	111.10	45.05	46.30

	FYM											
T5	100% RDN + 25% N Through VC	100% RDF	95.90	96.50	5.83	5.95	267.00	266.00	106.77	109.98	45.20	46.55
T6	100% RDN + S	100% RDF	97.25	97.50	6.10	6.20	278.00	281.00	111.05	114.01	47.10	48.35
T7	100% RDN + S + Zn	100% RDF	97.75	97.80	6.45	6.60	285.00	288.00	115.25	117.14	49.05	49.85
T8	100% RDN + S + Zn + Fe	100% RDF	98.10	98.45	6.80	6.90	290.00	294.00	119.30	120.55	50.85	51.40
T9	100% RDN + S + Zn + Fe + B	100% RDF	98.60	98.75	6.90	7.00	303.00	307.00	122.86	122.88	52.40	52.70
T10	100% RDN + S + Zn + Fe + B + Azo.+ PSB	100% RDF	98.80	99.05	7.05	7.20	309.00	312.00	125.77	125.90	53.75	53.80
T11	100% RDN+ 25% N Through FYM + S + Zn + Fe + B + Azo. + PSB	100% RDF	99.15	99.50	7.25	7.55	318.00	322.00	128.35	130.19	54.40	55.75
T12	100% RDN + 25% N Through VC +S + Zn + Fe + B + Azo. + PSB	100% RDF	99.60	99.52	7.60	7.90	327.00	360.00	130.12	131.22	55.85	56.30
SE(m)			5.77	5.98	1.24	1.09	13.17	13.38	3.07	2.97	1.57	1.69
C.D. (P=0.05)			NS	NS	NS	NS	38.85	39.46	9.06	8.75	4.63	4.99

Note: VC is abbreviation of Vermicompost and Azo. is abbreviation of Azotobacter
Application of Sulphur, Zinc, Iron and Boron- 30, 5.0, 10.0 and 1.0 kg ha-1

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