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Effect of organic amendments on growth and yield parameters of wheat (*Triticum aestivum)*

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ABSTRACT

Wheat is the most important cereal food crop ranking first in India with respect to area and production of the total grain crops. System of wheat intensification depends on the standards of rice intensification.Another wheat cultivation method which demands appropriate plant spacing and plant density which takes into consideration of adequate air circulation, water holding capacity, sunlight and nutrient accessibility which leads toroot development in early phase of plant development till harvesting. SWI is the modified practices, for example, seed treatment, less seed rate, planting of seeds at appropriate distance, which bring about higher proportion of tillers in parent seedlings, expanded number of viable tillers, and bolder grains lastly improved yield of wheat.In conventional system, 100-140 kg/ha of seeds are used by the farmers, however in SWI technique seed used by farmers is just 5-7% of conventionalsystem. SWI is the technique by which productivity can be increased which directly counts to the food security of small land holding farmers.

***Keywords**: Agriculture, Conventional, spacing, SRI, SWI*

INTRODUCTION

Wheat is the essential cereal crop for the most of the people. Wheat used as staple food by almost 36% of the total population of world, which accounts for almost for almost more than 2 billion people of the world.Globally, 55% carbohydrates and 20% food calories are consumed by People (Breiman and Graur, 1995). Wheat gains a special place among all other cereal crop in respect to the total area and production. Wheat is the widely cultivated food

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crop after rice in the world and utilizes by more than a billion people in the world in various forms. Wheat flour is commonly used to making "chappati" which is most consumable form. Wheat provides 327 calories from 100 grams and is an excellent source of essential nutrients.

SWI is dependenton the standards of SRI (System of Rice Intensification). SWI is another wheat sowing method in which the distance between plants is to be 8 cm and between lines 20 cm. (Adhikari 2013). In such type of sowing the exact plant density takes into consideration adequate air circulation, sunlight, moisture, and nutrient accessibility prompting appropriate root framework from the beginning stages of growth. Just after sowing, the plant population has to be maintained by filling the gaps and thinning out the dense seedlings. Wedding has to be done atleast 2 to 3 times. Along with that irrigation has to be done for better results. Such kind of practices begins from the early phase of growth in wheat. SWI is the best method for increasing the productivity, which directlyfavours to the food security of farmers (Rakib SR and Islam N.2016).

MATERIALS AND METHODS

Location

The present investigation was carried in *Rabi* season of the year 2017-2018 at the Agriculture Farm, Lovely Professional University, Punjab. The soil of experimental plot was sandy loam having pH 7.2 (Singh et al. 2018). The climate of the field comes under Central Plain Zone.

Climatic and Soil Conditions

The experimental site is situated in the central zone of the Punjab state. Monsoons in this plain is well distributed from December to April with a lower coefficient of variation. The

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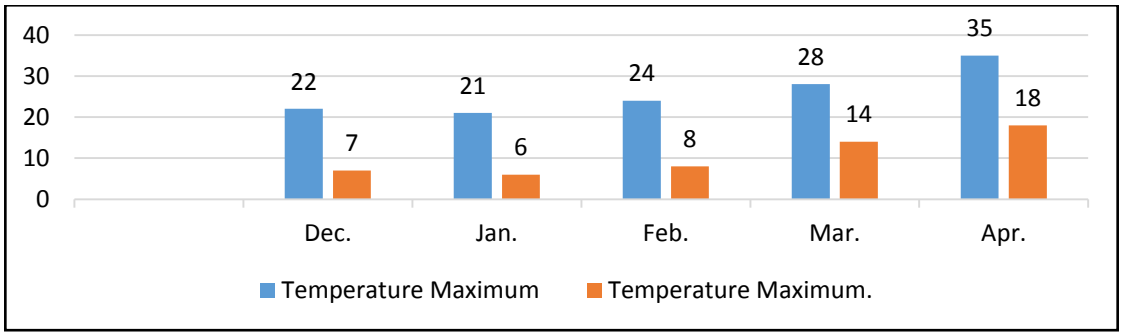
monthly metrological data of relative humidity, temperature and rainfall during the period of experimentation 2017-2018 is given in Fig 3.1.

Fig1: Data on weather parameters mean maximum and minimum temperature (°C)



. **Treatment Details:**

For the present investigation wheat variety Bansi was used with six different treatments. The combination of six different treatments were tried in Randomized Block Design (RBD) using three replications. The treatments were To: Control, $T_{1:}$ Seed treatment with CSR-BIO formulation +Soil application@5kg/100FYM, T_2: 25%RDF+ Seed treatment with CSR-BIO formulation +Soil application@5kg/100FYM, T_3: Seed treatment with Jaggery solution, T_4: 25%RDF+ Seed treatment with Jaggery solution, T_5: 100%RDF and T_6: Curd Fertilizer treatment. The morphological observations were recorded on Leaf Area Index, Number of tillers/plant, Number of grains/spike, Number of spikes/meter square, 1000 grain weight (g), Grain yield (g) and Straw yield (t ha^{-1}).

Description of variety

Bansi (Wheat variety) mainly use for the irrigated areas. It is highly fertile and timely sown variety for the north western plain zone (NWZP) of India. Average plant height of this variety is 121.00 cm. It produced profuse tillering Ears are filling medium dense and shape on

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tapering and white glums. The gains are medium bold, hard, amber & lustrous .Yield of This variety is 30-32quantal/acre.(www.daana.in)

Statistical analysis

Data incurred were subjected for analysis of variance by using the method which was suggested by Gomez and Gomez (1984), using M.S Excel and/or SPSS (window version 12.0; SPSS Inc, Chicago, IL. USA). Least significance difference (THST) Tukey's Honest Significance Test at P = 0.05 was used to determine if the means differed significantly.

RESULTS AND DISCUSSION

Leaf Area Index (LAI)

By comparing the values, the highest leaf area at 15 DAS was recorded for T_1 (0.23 m) while it was significantly lowest for T_0 (0.5 m). This is due to the effect of nitrogen that was directly supplied to the plants via CSR-BIO Formulation treatment. At 30 DAS the highest leaf area was recorded for T_6 (0.79 m) while lowest was recorded for T_0 (0.28 m).This is due to the effect of nitrogen that was directly supplied to the plants via curd fertilizer treatment. At 45 DAS the highest leaf area was recorded for T_6 (1.69 m) while it was lowest for T_0 (1.17m).This is due to the effect of nitrogen that was directly supplied to plants *via* curd fertilizer treatment. At 60 DAS the highest leaf area was recorded for T_6 (2.89 m) and lowest was recorded for T_0 (2.35 m).This is due to the effect of nitrogen that was directly supplied to plants via curd fertilizer. The results of thisexperiment are nearly similar with the findings of Abate *et al.* 2016.

Table 1: Impact of different organic amendments on leaf area index (m^2)

	Leaf Area Index

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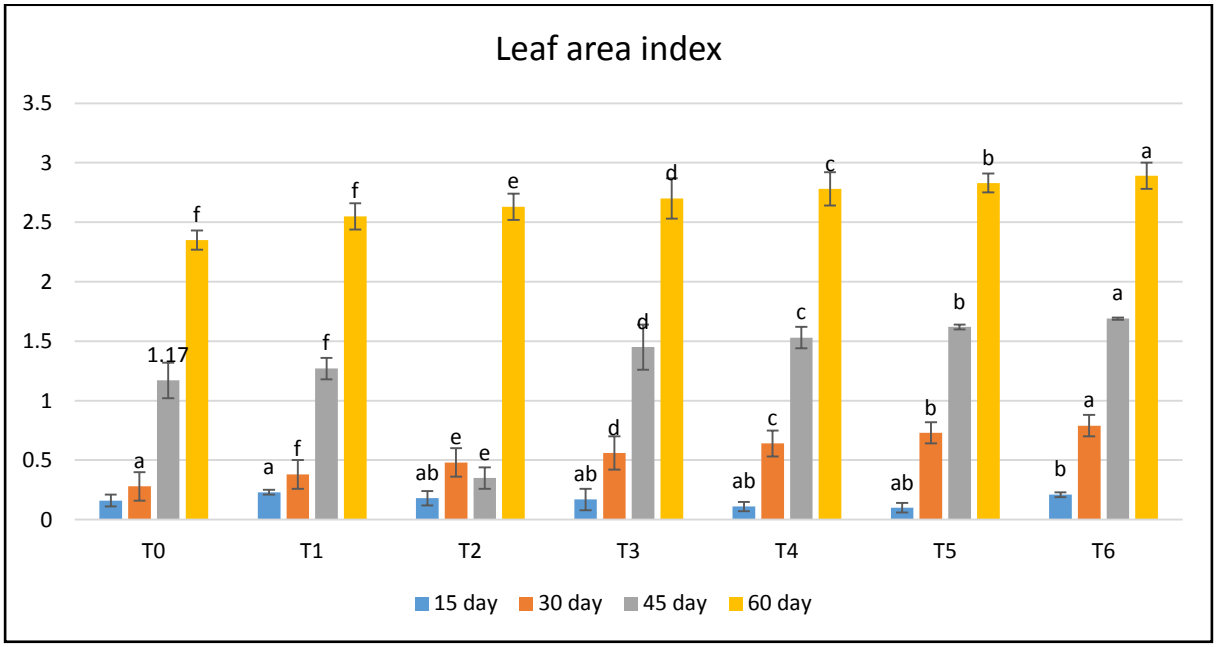
Treatments	15 DAS	30 DAS	45 DAS	60 DAS
T_0	0.16^{b}±0.15	0.28^{g} ±0.12	1.17^{g}±0.15	2.35^{g}±0.08
T_1	0.23^{a} ±0.24	0.38^{f} ±0.12	1.27^{f}±0.09	2.55^{f}±0.11
T_2	0.18^{ab} ±0.29	0.48^{e} ±0.12	1.35^{e}±0.09	2.63^{e}±0.11
T_3	0.17^{ab}±0.04	0.56^{d} ±0.14	1.45^{d}±0.19	2.70^{d}±0.17
T_4	0.11^{ab}±0.11	0.64^{c} ±0.11	1.53^{c}±0.09	2.78^{c}±0.14
T_5	0.10^{ab}±0.25	0.73^{b} ±0.09	1.62^{b}±0.02	2.83^{b}±0.08
T_6	0.21^{b}±0.22	0.79^{a} ±0.09	1.69^{a}±0.01	2.89^{a}±0.11

The mean followed by different letters significantly varies at p<0.05, as per THST (Tukey's Honest Significance Test) for separation of means.

Fig. 2: Impact of different organic amendments on leaf area index (m^2)



Number of tillers per plant

Tillers numbers/plant lies in range from 6.26 to 13.38.The highest value (13.38) of number of tiller/plant was found in T_6 (curd treatment) significant followed by T_1 (Seed treatment with CSR-BIO formulation +Soil application @5 kg/100 FYM) i.e. 12.11 while the lowest value (6.26) was recorded in T_0(Control) (Table 4.3).As compared to T_0, T_6 7.13% increase in number of tillers due to the combination of organic product curd fertilizer treatment. Our results are in accordance with the result of Styger *et al.* 2009.

Table 2: Impact of different organic amendments on tillers number per plant

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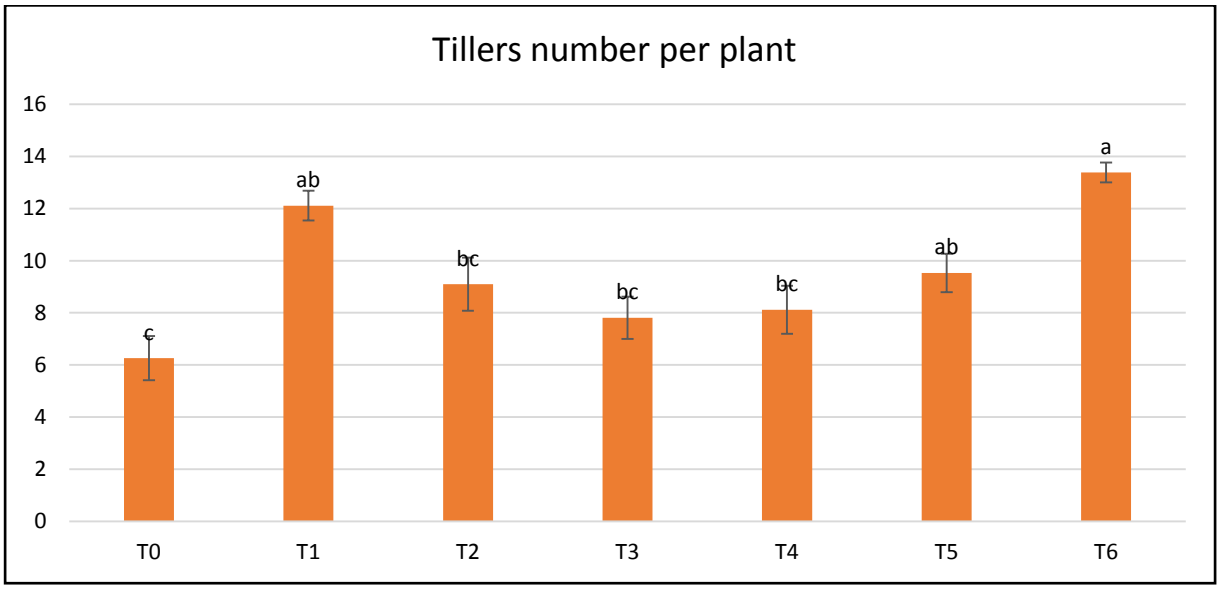
Treatments	Tillers number per plant
T_0	$6.26^{c}\pm0.85$
T_1	$12.11^{ab}\pm0.57$
T_2	$9.10^{bc}\pm1.02$
T_3	$7.81^{bc}\pm0.81$
T_4	$8.12^{bc}\pm0.92$
T_5	$9.53^{ab}\pm0.74$
T_6	$13.38^{a}\pm0.38$

The mean followed by different letters significantly varies at $p<0.05$, as per THST (Tukey's Honest Significance Test) for separation of means.

Fig3: Impact of different organic amendments on tillers number per plant



Number of grains per spike

Grains numbers/spike lies in range from 43.20 to 69.09.The highest value (69.09) of numbers of grains/spike was found in T_6 (curd treatment) significant followed by T_1 (Seed treatment with CSR-BIO formulation +Soil application @5 kg /100 FYM) i.e. 68.02 while the lowest value (43.20) was recorded in T_0 (control).

As compared to T_0, T_6 showed 26.8% increase in number of grains per spike due to higher organic matter content in curd fertilizer. Curd fertilizer improve the physical, chemical and biological properties of soil. The fertilizer effect enables a reduction in cost for nitrogen and phosphorous mineral fertilizers and may improve crop yield on curd fertilizer treated

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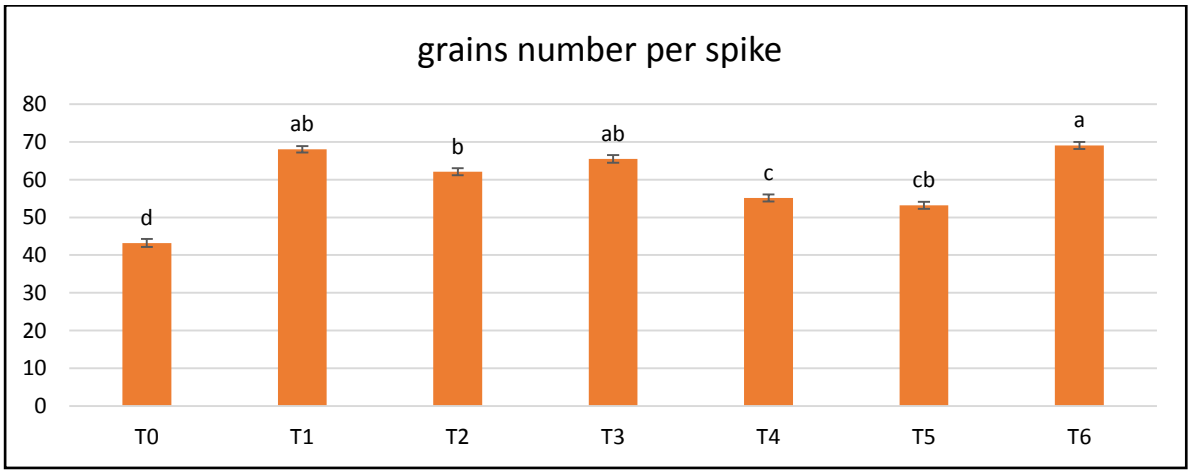
fields. Hence, number of grains per spike was highest (Table 4.4). Thefindings are nearly same with the results of Dhar *et al.* 2016.

Table 3: Impact of different organic amendments on Grains number per spike

Treatments	Grains number per spike
T_0	$43.20^{d} \pm 1.05$
T_1	$68.02^{ab} \pm 0.85$
T_2	$62.07^{b} \pm 0.94$
T_3	$65.47^{ab} \pm 1.01$
T_4	$55.17^{c} \pm 0.95$
T_5	$53.17^{cb} \pm 0.91$
T_6	$69.09^{a} \pm 0.93$

Fig4: Impact of different organic amendments on grains number per spike



Number of spikes per m^2

Number of spikes/m^2 ranged from 92.00 to 115.67.The highest value (115.67) of spikes per m^2 was recorded in T_6 (Curd treatment) significant followed by T_1 (Seed treatment with CSR-BIO formulation +Soil application @5kg /100 FYM) i.e. 112.00 while the lowest value (92.00) was recorded in T_0 control.

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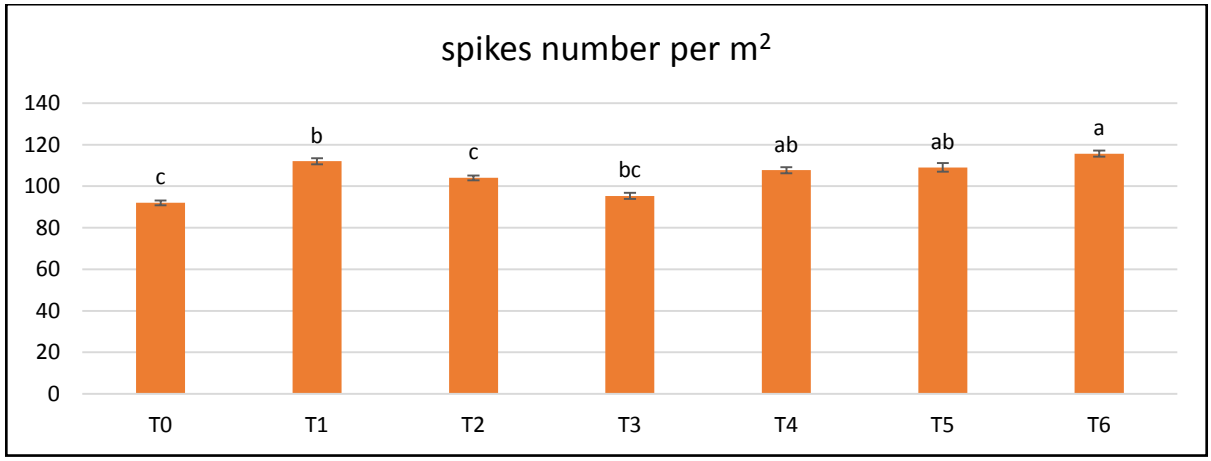
As compared to T_0, T6 showed 23% increase in number of spike per m^2.Spike increase is highest T_6 curd help to improve vegetative growth and increase the multiplication of micro-organism in soil.

Table 4: Impact of different organic amendments on spikes number per m^2

Treatments	Spikes number per m^2
T_0	$92.00^{c}\pm1.15$
T_1	$112.00^{b}\pm1.45$
T_2	$104^{bc}\pm1.20$
T_3	$95.33^{bc}\pm1.45$
T_4	$107.67^{ab}\pm1.45$
T_5	$109.00^{ab}\pm2.08$
T_6	$115.67^{a}\pm1.45$

The mean followed by different letters significantly varies at $p<0.05$, as per THST (Tukey's Honest Significance Test) for separation of means.

Fig 5: Impact of different organic amendments on spikes number per m^2



Test weight (g)

Test weight (1000 grains) ranged from 34.00 to 58.00 gm. The highest value (58.00 gm) of test weight (1000 grains) was recorded in T_6 (Curd treatment) significantly followed by T2 (25% RDF+ Seed treatment with CSR-BIO formulation + Soil application @ 5kg /100 FYM) i.e 55.33g while the lowest value (4.00 gm) was recorded in T0 (control).

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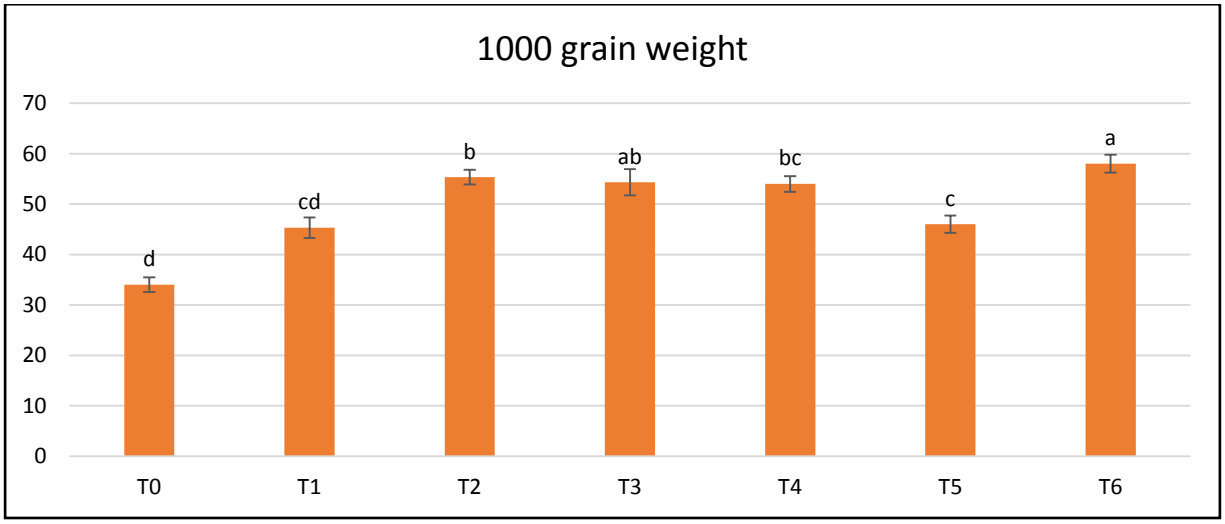
As compared to T_0, T6 showed 24% increase in test weight (1000 grains).The current findings confirm with the earlier findings by various workers (Table 4.6). The findings of this investigation are nearly similar with the results of Adhikari *et al.* 2013.

Table 6: Impact of different organic amendments on test weight (g)

Treatments	1000 grain weight
T_0	34.00^{d} ±1.15
T_1	45.33^{cd}±2.02
T_2	55.33^{b}±1.45
T_3	54.33^{ab}±2.60
T_4	54.00^{bc}±1.55
T_5	46.00^{c}± 1.73
T_6	58.00^{a}±1.76

The mean followed by different letters significantly varies at p<0.05, as per THST (Tukey's Honest Significance Test) for separation of means.

Fig.6: Impact of different organic amendments on test weight (g)



Grain Yield

Grain yield (t ha^{-1}) varied from 5.87 to 2.36 t ha^{-1}.The highest value (5.87 t ha^{-1}) of Grain yield (t ha^{-1}) was recorded in T_6 (curd treatment) highest significant **(P<0.05)** followed by T_1 (Seed treatment with CSR-BIO formulation + Soil application @ 5kg/100 FYM) i.e. 5.17 t ha^{-1}.The least value (2.36 t ha^{-1}) was found in T_0 (control).

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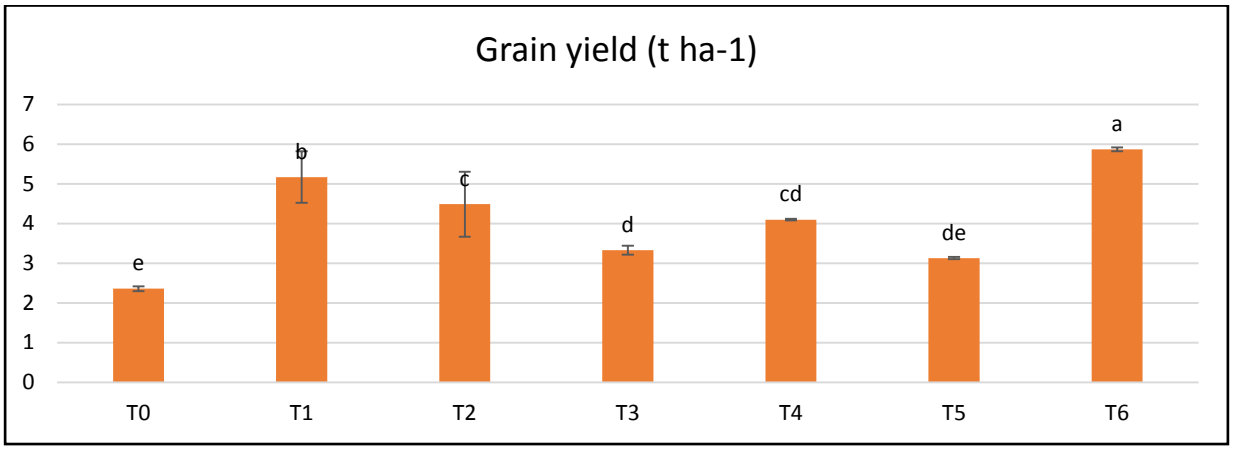
As compared to T_0, T_6 showed 13.04% high grain yield (t ha $^{-1}$).We know that the RDF when we apply to soil, it give result to plant very quickly. Because the RDF dissolve in soil very fast and RDF give good result during early period of crop and remaining organic manure that taken some time to decompose in soil and that's why the curd fertilizer decompose after some time and crop taken benefit after flowering and good fruit set and give good grain yield. This finding is nearly similar with the result of Thapa *et al.* 2014.

Table 4.7 Impact of different organic amendments on grain yield

Treatments	Grain yield (t ha$^{-1)}$
T_0	2.36^{e} ±0.06
T_1	5.17^{b} ±0.65
T_2	4.49^{c} ± 0.82
T_3	3.33^{d} ± 0.11
T_4	4.10^{cd} ± 0.02
T_5	3.13^{de} ± 0.03
T_6	5.87^{a} ± 0.05

The mean followed by different letters significantly varies at p<0.05, as per THST (Tukey's Honest Significance Test) for separation of means.

Fig. 4.7 Impact of different organic amendments on grain yield



Straw yield (t ha^{-1})

Straw yield t ha $^{-1}$ varied from 6.14 to 9.97 tonnes/ha.The highest value (9.97 t) of straw yield was recorded in T_6 (curd treatment) significantly followed by T_1 (Seed treatment with

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CSR-BIO formulation + Soil application @ 5kg/100 FYM) i.e. 9.18 t while the lowest value (6.14 t) was recorded in T_0 (control).

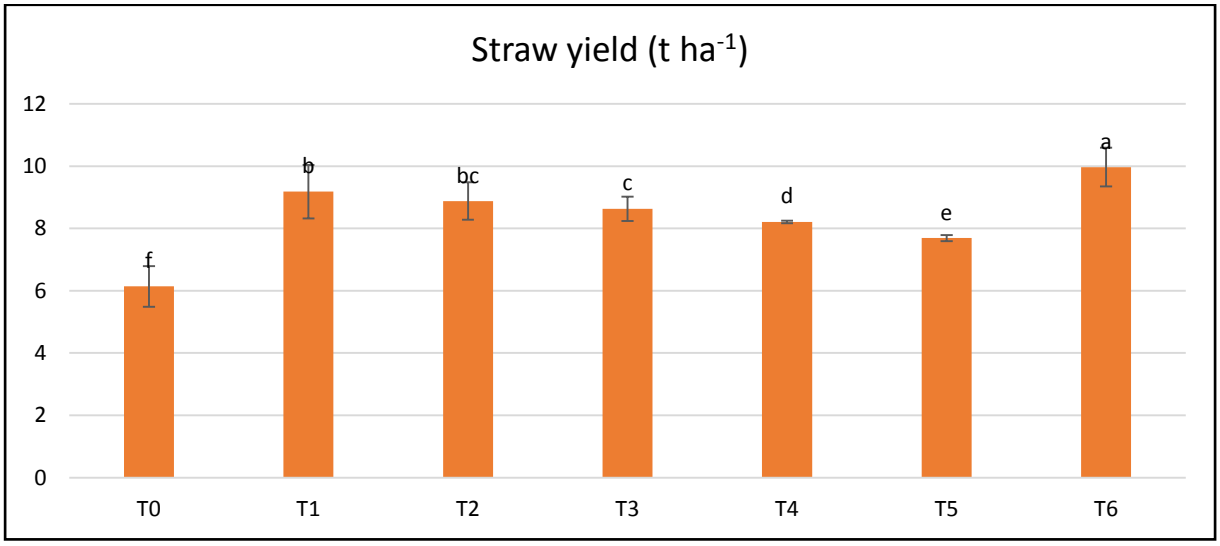
As compared to T_0, T_3 50.15% increase in straw yield. We know that the RDF when we apply to soil, it give result to plant very quickly. Because the RDF dissolve in soil very fast and RDF give good result during early period of crop and remaining organic manure that taken some time to decompose in soil and that's why the curd fertilizer decompose after some time and crop taken benefit after flowering and good fruit set and give good straw yield. This finding is nearly similar with the result of Rakib *et al.* 2016.

Table 4.8 Impact of different organic amendments on straw yield

Treatments	Straw yield (t ha^{-1})
T_0	6.14^{f}±0.65
T_1	9.18^{b}±0.86
T_2	8.88^{bc}±0.60
T_3	8.63^{c}±0.39
T_4	8.21^{d}±0.04
T_5	7.69^{e}±0.10
T_6	9.97^{a}±0.62

The mean followed by different letters significantly varies at p<0.05, as per THST (Tukey's Honest Significance Test) for separation of means.

Fig.4.8 Impact of different organic amendments on straw yield



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