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EFFECT OF BIOFERTILIZERS ON SEEDLING GROWTH OF PADDY (*ORYZA SATIVA* L.) CV. PANVEL 3.

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ABSTRACT

The present investigation was carried out in kharif season, during 2015 and 2016 at research farm, 'Rayat Shikshan Sanstha's, M.P.A.S.C. College Panvel, District- Raigad (Maharashtra), India. To observed the effect of different biofertilizers on growth and yield parameters on Paddy (**Oryza sativa** L. cv. Jaya). The experimental farm was geographically situated at 18°, 59" 40' N latitude and 73°, 06' 50" E longitude at an altitude of 28 meters above mean sea level.The experiment was laid out in RBD replicated thrice with twelve treatmentsi.e.**(T0)** Control (without fertilizer), **(T1)** Chemical fertilizer(19:19:19,) **(T2)** Blue green algae**,(T3)** *Azospirillum brasilense*, **(T4)** *Bacillus megaterium*, **(T5)***Trichoderma viride*,**(T6)** Mycorrhizae, **(T7)** *Pseudomonas aeruginosa*,**(T8)**T2+T7,**(T9)**T2+ T6, **(T10)** T3+T4, and **(T11)** T3+T4+T7. RDC fertilizer was applied in three splitted doses. The first dose, consisting of 1/3 the normal dose, was applied before transplantation; the second 1/3 at the time of tillering; arid the last 1/3 at the panicle initiation phase. The study revealed the growth parameters like shoot length, root length, and dry matter production at various stages of growth in Paddy (Oryza sativa L.) cv. Jaya were favorably influenced by biofertilizers treatment. Overall results suggest that combine effect of Biofertilizers improves vegetative and reproductive growth of Paddy (***Oryza sativa*** L. cv. Jaya)".

KEYWORDS: *Biofertilizers, Growth and yield parameters, Paddy (**Oryza sativa** L. cv. Jaya*).

INTRODUCTION

Paddy (*Oryza sativa L.*) is most important stable food crop in the world and is grown under abroad range of environmental conditions.India is second largest producer and consumer of rice in the world after China. At national level, area under cultivation is 42.5 million hectares with the production of 152.6 million tones and average productivity is of 3.5 tones per hectares. At global level, paddy is cultivated under 158.4 million hactares area with annual production of around 697.2 million tones and average productivity of 2.85 tones per hectares (Sarvan et al,2016).

Fertilizers come in two types - they are either chemical or biofertilizers. Increasingly high inputs of chemical fertilizers during last 15decadess have not only left soils degraded, polluted and less productive but have also posed severe health and environmental hazards. Organic farming methods (such as the use of biofertilizers) would solve these issues and make the ecosystem healthier. Biofertilizers play a very significant role in improving soil fertility by fixing atmospheric nitrogen, both, in association with plant roots and without it, solubilise insoluble soil phosphates and produces plant growth substances in the soil. They are in fact being promoted to harvest the naturally available, biological system of nutrient mobilization (Venkatashwarlu, 2008). The role and importance of biofertilizers in sustainable crop production has been reviewed by several authors (Biswas et al. 1985; Wani and Lee, 1995; Katyal et al. 1994).

Biofertilizers are becoming increasingly popular in many countries and for many crops. They are defined as products containing active or latent strains of soil microorganisms, either alone or with albae or fungi that increase plant availability and uptake of mineral nutrients (Vessey et al.,2006)571-586.Bio-fertilizers containing beneficial bacteria and fungi improve soil chemical and biological characteristics, phosphate solutions and agricultural production (El- Habbasha et al., 2007; Yosefi et al., 2011). Microbiological fertilizers are important to environment friendly sustainable agricultural practices (Bloemberg et al., 2000).) The Biofertilizer includes mainly the nitrogen fixing, phosphate solubilizing and plant growth promoting microorganisms (Goel et al., 1999).

MATERIALS AND METHODS

Collection of seeds and raising seedlings

Paddy (*Oryza sativa* L. cv. JAYA) seeds were collected from the Kharland research station Panvel, Dist Raigad.Jaya is a medium duration high yielding variety of rice. It is recommended for both crop seasons. The variety is known for its greater yield potential. The grains are long and white with good cooking quality.

Transplanting of paddy seedlings: Twenty one days old paddy seedlings were transplanted at 20 cm x 15 cm spacing during both the seasons with five seedlingsper hill. Gap filling was carried out twelve DAT in order to ensure uniform plant population.

Experimental site

This investigation was carried out at research farm of RayatShikshanSanstha's MahatmaPhuleA.S.C.College, Panvel, Dist.Raigad (Maharashtra). The experimental farm is geographically situated at 18°, 59" 40' N latitude and 73°, 06' 50" E longitude at an altitude of 28meters above mean sea level.The experiment was conducted on the same site and layout during both the years. The study area is representative of the agro-ecological sub-region 19.3 coveringnorth Konkan coastal zone of Maharashtra (Sehgal ***et. al***., 1992), which comprises of Thane & Raigad districts.

Experimental details-	
Type of Soil	Garden clay-loamy
Name of the Method:	Seed treatment
No .of Replications	3
No. of seeds sown	20
Size of pot	1x1 m2
Treatment details-	
Notation for treatment	T
T0	Control
T1	*Azospirillum brasilense*
T2	*Bacillus megaterium*
T3	*Azospirillum brasilense +Bacillus megaterium*
T4	

*

Collection of experimental data

a) Growth parameters-

vi) Straw yield (q./ha.)- The weight of the straw harvested from the net area in each treatment was recorded after five days sun drying in the field and then converted onq/ha.

Statistical Analysis-Pooled data was used for analysis**.** Duncan's multiple range test (DMRT) was performed to determine the significant differenc.e between treatments (Gomez and Gomez, 1984).

Table 1: Effect of bio fertilizers on root length at various stages of growth in Paddy *(Oryza sativa* L.) variety, Jaya. (Pooled data of two yrs.).

Treatments	**Root length (cm.)**			
	30DAT	**60 DAT**	**90 DAT**	**At harvesting**
T0- Control	3.916	7.332	8.393	10.08
T1- Chemical fertilizer	6.15	8.855	9.828	11.985
T2- BGA	4.537	7.884	9.45	10.507
T3- *Azospirillum*	4.933	10.166	11.971	12.039
T4- *Bacillus*	4.809	10.431	11.9333	13.025
T5- *Trichoderma*	4.439	9.072	10.487	12.078
T6- Mycorrhizae	5.527	10.621	12.986	13.769
T7- *Pseudomonas*	5.274	9.894	12.881	13.781
T8- T2+ T7	6.129	11.863	14.186	15.099
T9- T2+ T6	6.964	13.794	15.435	16.057
T10- T3+T4	7.866	14.459	15.326	17.605
T11- T3+T4+T7	7.989	16.033	16.433	17.959
SE m ±	0.306	0.69	0.453	0.421
CD at 0.05 %	0.866	1.951	1.281	1.189
C.V.%	0.722	0.975	0.528	0.443

Values are the Mean of three replicates.

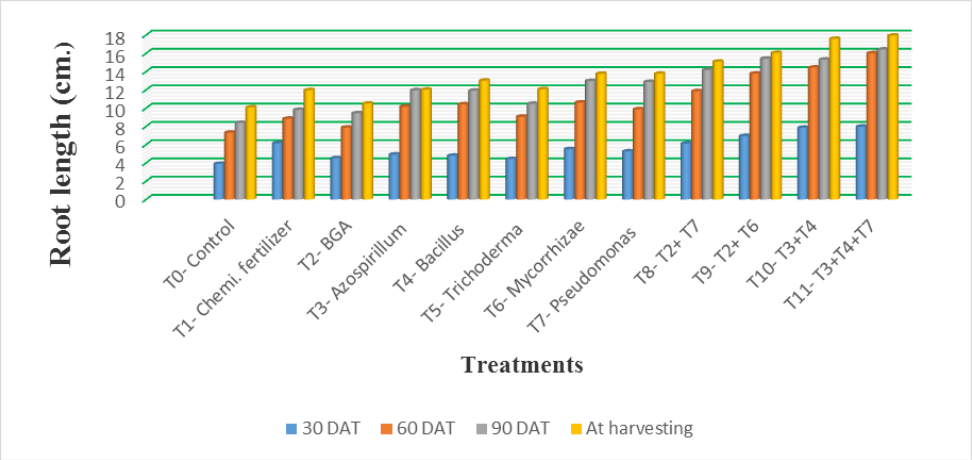

Fig. 1: Root length.

Table 2: Effect of bio fertilizers on shoot lengthat various stages of growth in Paddy *(Oryzasativa* L.) variety, Jaya. (Pooled data of two yrs.).

Treatments	Shoot length (cm.)			
	30DAT	60 DAT	90 DAT	At harvesting
T0- Control	16.647	32.541	47.496	49.161
T1- Chemical fertilizer	23.329	43.349	54.469	55.735
T2- BGA	17.728	36.971	49.192	52.693
T3- *Azospirillum*	19.043	46.38	56.619	58.749
T4- *Bacillus*	19.612	43.899	54.983	56.996
T5- *Trichoderma*	18.334	34.902	52.956	54.226
T6- Mycorrhizae	19.899	37.438	54.924	57.219
T7- *Pseudomonas*	21.197	45.04	56.913	59.978
T8- T2+ T7	23.173	47.023	58.369	61.773
T9- T2+ T6	23.817	50.931	58.136	61.556
T10- T3+T4	26.081	51.044	58.004	63.031
T11- T3+T4+T7	26.911	53.884	60.314	63.635
SE m ±	0.519	1.049	1.107	1.001
CD at 0.05 %	1.469	2.967	3.132	2.833
C.V.%	0.351	0.344	0.285	0.254

Values are the Mean of three replicates.

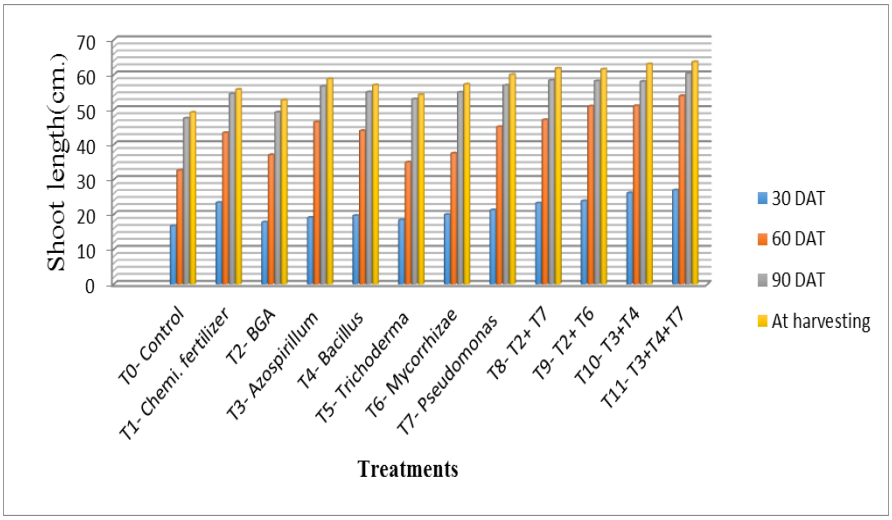

Fig. 2: Shoot length.

Table 3: Effect of bio fertilizers on dry matter production at various stages of growth in Paddy *(Oryza sativa* L.) variety, Jaya.(Pooled data of two yrs.).

Treatments	Dry matter production (gm./hill)			
	30DAT	60 DAT	90 DAT	At harvesting
T0- Control	14.982	30.012	37.321	39.012
T1- Chemical fertilizer	17.691	35.779	42.332	43.766
T2- BGA	16.156	33.563	39.975	42.605
T3- *Azospirillum*	16.675	32.001	40.6118	43.977
T4- *Bacillus*	16.321	32.827	41.2637	43.292
T5- *Trichoderma*	15.501	31.206	41.058	42.552
T6- Mycorrhizae	18.277	37.306	46.728	49.828
T7- *Pseudomonas*	17.442	33.899	44.319	45.986
T8- T2+ T7	20.68	37.826	46.626	50.339
T9- T2+ T6	20.732	39.286	48.994	53.328
T10- T3+T4	20.937	40.433	51.143	53.641
T11- T3+T4+T7	21.294	40.737	52.11	55.99
SE m ±	0.457	0.621	0.668	0.684
CD at 0.05 %	1.293	1.756	1.891	1.935
C.V.%	0.367	0.263	0.215	0.206

Values are the Mean of three replicates.

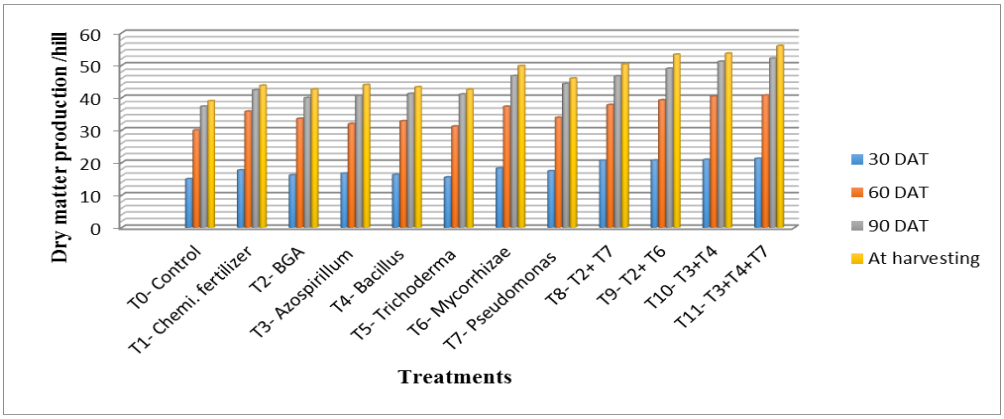

Fig. 3: Dry matter production.

Table 4a: Effect of different bio fertilizers on length of panicle, weight of panicle and number of spikelet's/panicle of Paddy *(Oryza sativa* L.) variety, Jaya. (Pooled data of two yrs.).

Treatments	Yield parameters		
	Length of Panicle (cm.)	Weight of panicle (gm.)	No. of Spikelet's Per panicle
T0- Control	20.344	2.191	10.836
T1- Chemi. fertilizer	23.395	2.395	11.823
T2- BGA	20.653	2.346	11.122
T3- *Azospirillum*	21.215	2.357	10.926
T4- *Bacillus*	22.238	2.435	11.218
T5- *Trichoderma*	21.444	2.344	11.265
T6- Mycorrhizae	23.601	2.541	12.343
T7- *Pseudomonas*	24.208	2.476	12.775
T8- T2+ T7	25.586	2.546	13.513
T9- T2+ T6	26.331	2.922	14.401
T10- T3+T4	26.461	3.114	14.992
T11- T3+T4+T7	27.088	3.153	15.498
SE m ±	0.293	0.09	0.296
CD at 0.05 %	0.832	0.257	0.837
C.V.%	0.183	0.511	0.334

Values are the Mean of three replicates.

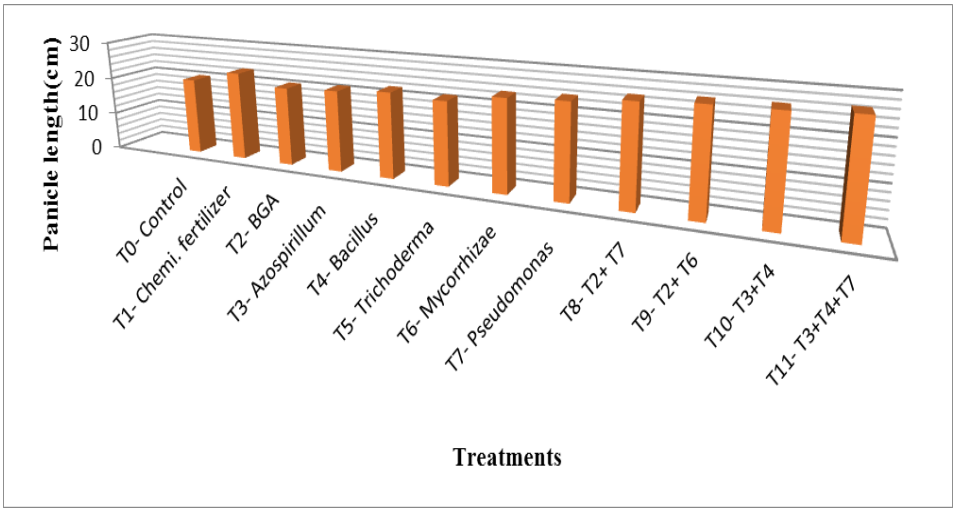

Fig. 4: Panicle length.

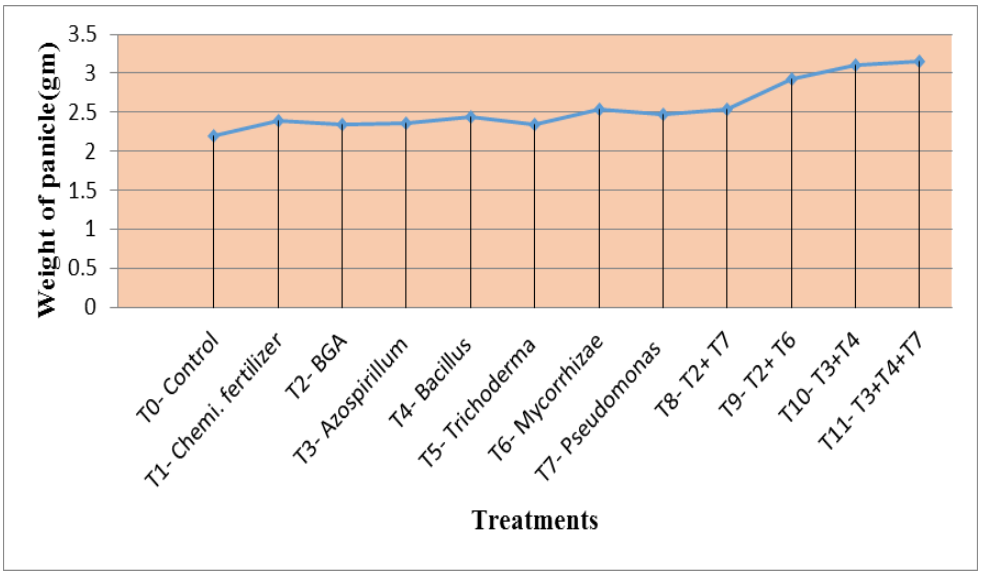

Fig. 5: Weight of Panicle.

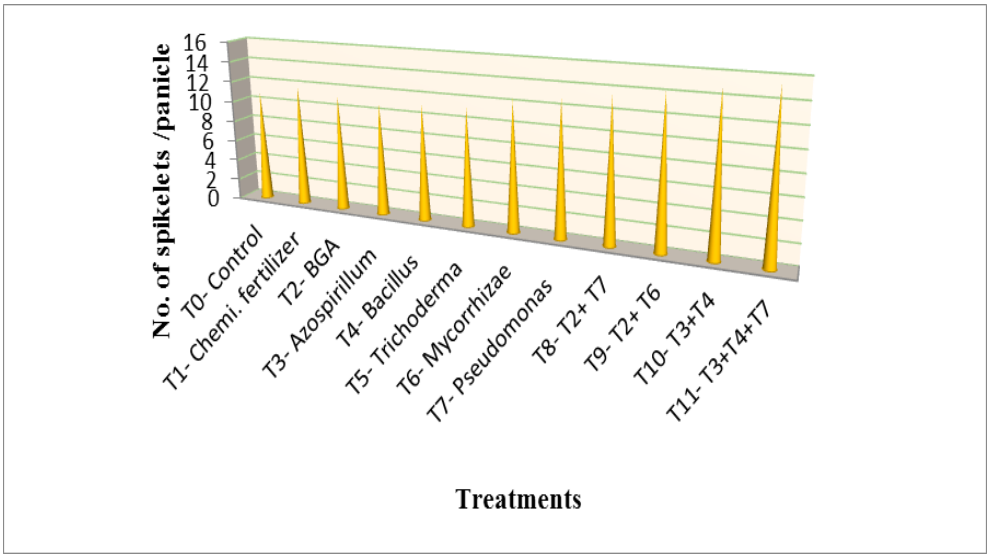

Fig. 6: No. of spikelet's/ panicle.

Table 4b: Effect of different bio fertilizers on test weight, grain and straw yield of Paddy *(Oryza sativa* L.) variety, Jaya.(Pooled data of two yrs.).

Treatments	Yield parameters		
	Wt. of 1000 Seeds(gm.)	Grain yield (q./ha.)	Straw yield (q./ha.)
T0- Control	18.265	44.905	67.941
T1- Chemi. fertilizer	23.113	57.291	74.648
T2- BGA	23.007	54.819	74.078
T3- *Azospirillum*	25.453	55.214	75.375
T4- *Bacillus*	22.808	53.667	73.781
T5- *Trichoderma*	21.527	52.385	72.908
T6- Mycorrhizae	26.244	53.675	74.363
T7- *Pseudomonas*	24.855	53.716	75.243
T8- T2+ T7	25.771	58.524	76.921
T9- T2+ T6	27.015	61.867	77.896
T10- T3+T4	27.467	62.043	77.923
T11- T3+T4+T7	27.973	62.685	78.715
SE m ±	0.463	1.153	1.679
CD at 0.05 %	1.301	3.261	4.726
C.V.%	0.274	0.297	0.324

Values are the Mean of three replicates.

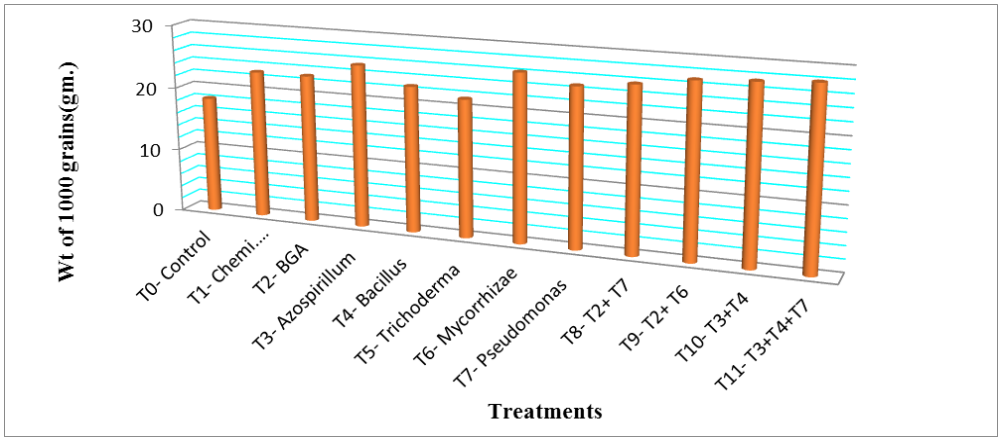

Fig. 7: Test weight of grains.

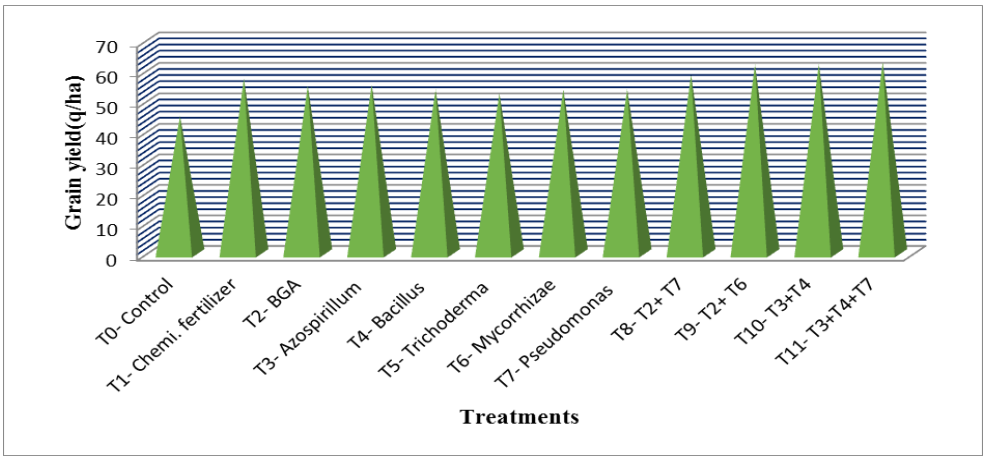

Fig. 8: Grain yield.

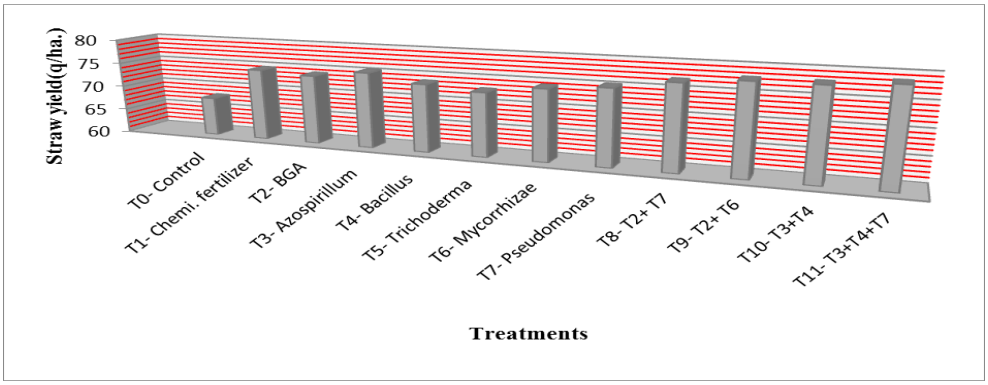

Fig. 9: Straw yield.

RESULTS AND DISCUSSION

Data on mean values of growth parameters pertaining to different treatments are presented in **Table 1 to -4.** The good results were observed in biofertilizer treated plants in all respects and the results suggested that the treatment of biofertilizers in single, dual and multiple combination enhance the growth of paddy plants when compared to chemical fertilizer treated plants and control.The results on yield attributes such as Panicle length, weight of panicle, no. of Spikelet'sperpanicle, wt. of 1000Seeds, Grain yield (q./ha.) and Straw yield(q./ha) showed a favorable influence during the entire study period **(Table 2).**

Combined application of *Azospirillum brasilense +Bacillus megaterium +Pseudomonas aeruginosa* recorded significantly higher growth parameters compared to single application. The results are in conformity with earlier reports (Nanda et al., 2016). Growth parameters viz. plant height, number of tillers hill–1 and dry matter production hill–1 were significantly affected by bio-fertilizers. Combined application of *Azospirillum brasilense +Bacillus megaterium +Pseudomonasaeruginosa* recorded significantly higher growth parameters compared to singleapplication. Theresults of the present experiment confirmed the findings ofMurthy *et al.* (2015). Increase in yield components, grain andstraw yield might be due to higher photosynthetic activitybecause of increased leaf area index, which ultimatelypromoted dry matter production resulted in higher grain andstraw yield. These results confirmed the findings of Davariand Sharma (2010) and Singh *et al.* (2013).

CONCLUSIONS

It can be seen from the above data that all the treatments were significantly higher than each other. The treatments T8 *(BGA+ pseudomonas aeruginosa*), T9(*BGA+ Mycorrhizae*), T10 *(Azospirillus umbrasilense +Bacillus magisterium)* and T11 (*Azospirillus umbrasilense +Bacillus megaterium +Pseudomonas aeruginosa*) was significantly higher than all other treatments in growth and yieldparameters. Based on these reports, it can be assumed that biofertilizers could offer an opportunity for rice farmers to increase yields, productivity, and resource use efficiency.

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