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EFFECT OF BIOINOCULANT ON MORPHOLOGICAL GROWTH PARAMETERS OF DIFFERENT VARIETIES OF GREEN GRAM

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ABSTRACT: The present investigation aim to determine the effect of Bioinoculant on morphological growth parameters of different varieties of green gram in kharif 2017. The field experiment was consisting of twelve treatments and three replication with randomized block design at Barwani (Madhya Pradesh) in black cotton soil. Biofertilizers such as *Rhizobium leguminosorum* and *PSB* were applied to seed before sowing of seeds and RDF (NPK) applied in the soil at the time sowing below the seed. The morphological growth parameters like plant height, number of leaves per plant, number of branches per plant was recorded after 20, 40 and 60 DAS respectively. Significantly highest plant height (cm), number of branches per plant, number of leaves per plant was recorded in treatment T_{12} (100% RDF + *R. leguminosorum* + *PSB*) and lowest in control in both the varieties (Khargone - 5 and JM - 721) in all observation schedule (20, 40 and 60 DAS).

Keywords- Biofertilizers, RDF, DAS and Varieties of green gram.

Introduction:

Pulses are belonging to family fabaceae. It includes more than 600 genera and about 18,000 species of cultivated plant. It is the second largest family after poaceae. Word pulse is derived from the Latin word 'Pulse' meaning pottage, i.e. seeds boiled to make porridge (Sardana *et al, 1995*). The Pulse crops play a major role in Indian agriculture and it contains a high amount of protein nearly three times more as cereals (Dhakal, 2013). They are drought tolerant and inhibit soil erosion due to their long deep root and good ground cover, because of these best properties pulses is called as "Marvel of Nature" (Shrikant, 2010).

Legumes are beneficial for human and animal food and soil improving components of agricultural and agro forestry systems. The seeds of many legumes are important food stuff worldwide because they are rich source of oil and protein. In fact they are often called "poor man's meat and rich man's vegetables" because they are a cheap source of high quantity protein (Bukaya 2014).

Green gram has been cultivated in India for the last 3,000 years and is hence supposed to be indigenous to this country (Pandey and Chadha, 1997). Its cultivation in India is wide spread. The most important producing states are Madhya Pradesh, Maharashtra, Uttrapradesh, Punjab, Andhra Pradesh, Rajasthan, Karnataka and Taminadu (Verma, 1981). Its cultivation in Africa is more recent. It was introduced into West Indies in the 16th century by the Spaniards and to America in 1700 A.D. (Singh *et al,* 2011).

It is a small herbaceous annual crop obtains which has a height of 45-120cm. The flowers are purplish-yellow, occurring in clusters on long peduncled axillary racemes. The mature pods are grey or brown, 5-10 cm long and contain 10-15 small green seeds (Singh *et al*.2011). It grows successfully on sandy loam to clay loam soil, usually grown on low to medium depth throughout the time of Kharif and summer (Abraham and Lal, 2003).

In Madhya Pradesh during twelfth Plan (2012-2017) the total area covered under Mungbean 2.51 lakh ha with 1.16 lakh tones total production and productivity was 464 kh/ha (Annual Report DPD 2016-17). In Barwani it occupies an area of about 5.3 hectares producing 2.22 MT (Kumar *et al,* 2018).

Many factors ascribed for low productivity of green gram in India as compared to the world productivity are unavailability of good quality seeds of improved and short duration varieties, growing of green gram under marginal and infertile soil with low inputs and without pest and disease management, growing of green gram under moisture stress, unscientific post-harvest practices and storage under adverse conditions. Hence, there is a chance to enhance the production potential of this crop by use of inorganic manures, organic manures and bioinoculant (Dhakal, 2013). Government of India is now focusing to increase area, production and yield of pulses crop (Chaturvedi and Ali, 2002)

Biofertilizers is conjoined of two words first one is bio and another one is fertilizers. Bio"means biological act with microorganisms and fertilizers means the substance which makes the soil rich in nutrients for increased growth of plants. The basic principal involved in chemical fertilizers is to increase the fertility of the land by mixing chemical compounds. Biofertilizers are used to increase the fertility of any land by the use of microorganisms (Trivedi, 2008).

Agricultural production is an attempt to reduce environmental risk and cost with integrated use of chemical and biofertilizers (Cabello *et al*, 2005). Although chemical fertilizers are playing an important role to meet the nutrient need of the crop. Persistent nutrient depletion is posing a greater threat to the sustainable agriculture. Therefore, there is an urgent need to reduce the usage of chemical fertilizers and in turn increase in the usage of organics which needed to check the productivity and quality levels. Use of Bioinoculant alone does not result in spectacular increase in crop yields; due to their low nutrient status (Ali *et al*, 2010).

Material and methods

An experiment was conducted at farmer's field (Village – Rehgun, district – Barwani Madhya Pradesh) in black cotton soil during *kharif* 2017. The field was prepared by ploughing once, with tractor drawn plough followed by two cross harrowing. Final operation was done by rotavator to obtain fine seed bed. Physico chemical properties of the experimental field were done by according to standard procedure. For that soil sample was collected in sterile plastic bages and transported to the soil laboratory for soil analysis. The randomized block design was choose for statistical analysis and all treatments were randomized within three replications as per plan of layout. Seeds of green gram (*Vigna radiata)* variety Khargone – 5 and JM-721 were obtain from Regional Pulse Research Station, Agriculture college, Indore (M.P) India. Seeds were treated with biofertilizers such as *R. leguminosorum* and *PSB* before sowing and RDF (NPK) applied in the soil at the time sowing below the seed at 30 cm row distance with the combinations of 12 different treatments i.e. (1) Control (No fertilizers), (T_2) *Rhizobium leguminosorum*, (T_3) *Phosphate Solublisizing Bacteria* (PSB), (T_4) Both *Rhizobium* + PSB, (T_5) 50 % N (N = 10 Kg N ha^{-1}) + PSB, (T_6) 50% P_2O_5 (20 Kg P_2O_5 ha^{-1}) + *R. leguminosorum*, (T_7) RDF (10:20:0 Kg N: P_2O_5 & K_2O ha^{-1}), (T_8) 100 % RDF (20:40:0 Kg N: P_2O_5 & K_2O ha^{-1}), (T_9) 50 % RDF *leguminosorum*, (T_{10}) 50 % RDF + PSB, (T_{11}) 50 % RDF + *R. leguminosorum* + PSB and (T_{12}) 10 % RDF *R. leguminosorum* + PSB.

3.11.2 Plant height (cm)

In each plot ten plants were selected randomly and tagged for periodic study for the crop. The height (cm) was noted at 20, 40 and 60 DAS. Plant height was measured from the bottom of the plant up to the apex of the main stem with the help of ruler at 20 DAS and by measuring tap at 40 and 60 DAS and average mean value was recorded.

3.11.3 Number of branches per plant

The number of basal branches arising from main shoot was counted in all ten randomly tagged plants at 20, 40 and 60 DAS, and average mean value was recorded.

3.11.4 Numbers of leaves per plant

The numbers of trifoliate leaves was counted from the ten tagged plants in each plot at 20, 40 and 60 DAS, and average mean value was recorded.

Result and discussion

Plant height, number of branches, number of leaves/plant was observed at 20, 40 and 60 DAS. The plant height, number of leaves and number of branches/plant gradually increased 20, 40 DAS, and 60 DAS in both varieties (Table 1, 2, 3). The highest plant height, number of branches/plant, number of leaves/plant was found with treatment contain T_{12} treatment (100% RDF + *Rhizobium* + PSB) in both varieties.

Kumawat *et al*, (2017) observed significant maximum plant height of 68.50 cm with treatment of 75% RDF + *Rhizobium* + PSB liquid formulation as soil application (T_7) in fenugreek plant. Besides this, in cowpea maximum plant height 56.66 cm was observed by Chauhan (2016) under T_4 treatment consisting of 75% RDF + *Rhizobium* 2.4 kg/ha + PSB 2.5 kg/ha.

Kumawat *et al* (2017) observed that higher number of branches /plant at harvest (4.88) was found with the application of 75% RDF + *Rhizobium* + PSB liquid formulation as soil application (T_7). *Rhizobium* with recommended doses of fertilizer (RDF) was more effective for the vegetative growth of green gram. This finding was supported by Duary *et al* (2004), Bhattacharya and Pal (2001).

Singh *et al* 2017 have found that number of leaves/plant of pea showed maximum increase with the application of 100% RDF + PSB @ 200 g/kg seed. In fenugreek, higher number of leaves/plant was 82.35 at harvest stage under T_{11} treatment consisting of 50% RDF + *Rhizobium* + PSB + Neem Cake as reported by Anitha *et al* (2016).

Table: 1 Effect of different treatments on plant height (cm) of both varieties at different DAS

Treatments	Khargone 5			Jawahar Mung 721		
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
T_1	16.67	44.57	45.90	10.75	36.60	42.40
T_2	16.76	45.02	47.37	12.91	38.31	43.80
T_3	16.96	44.79	46.07	12.67	37.11	43.03
T_4	17.35	45.47	48.30	13.05	39.20	43.90
T_5	17.39	46.09	48.93	13.37	39.55	44.97
T_6	17.41	46.26	49.63	14.15	41.81	46.44
T_7	17.42	47.26	50.47	14.53	42.04	47.73
T_8	18.46	47.57	50.97	14.61	42.14	48.07
T_9	18.52	47.91	51.27	15.56	43.05	49.33
T_{10}	18.57	48.21	51.70	15.81	43.51	51.53
T_{11}	19.15	48.35	53.60	15.85	45.21	51.87
T_{12}	19.97	49.20	53.61	16.16	46.23	53.33
SE (d) ±	0.62	1.32	1.64	0.43	1.18	1.53
CD (5%)	1.22	2.58	3.21	0.85	2.31	3.00
CV (%)	7.40	5.98	6.98	6.53	6.06	6.88

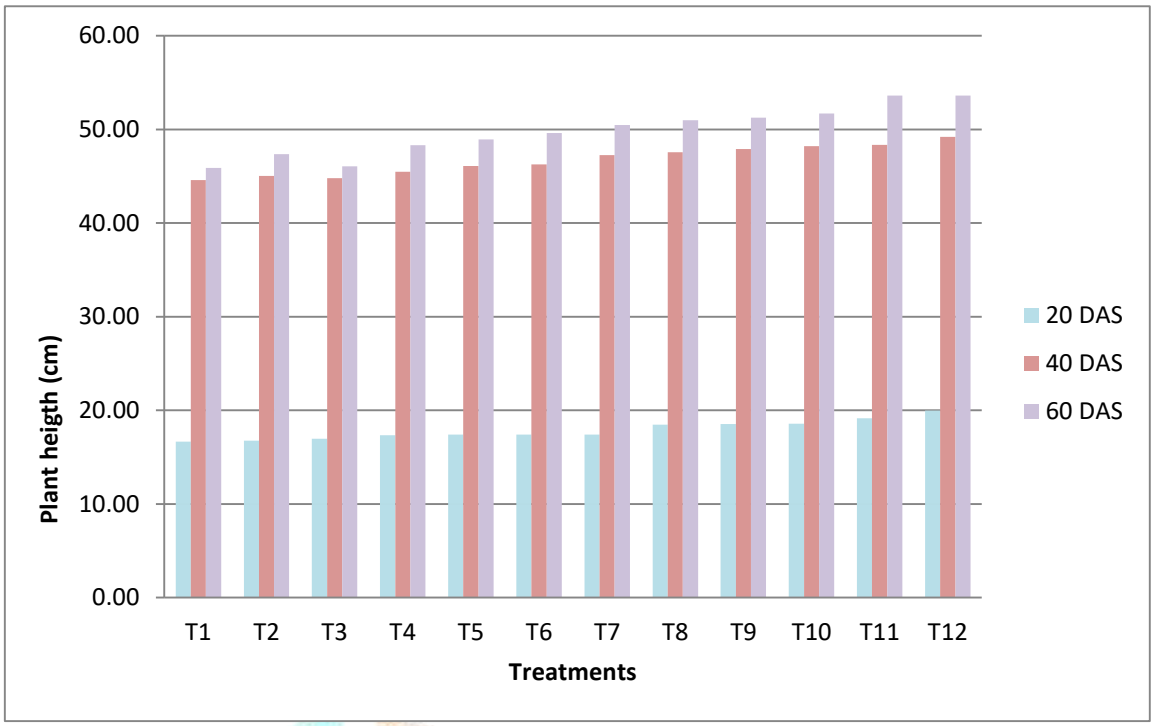

Figure - 1 Effect of different treatments on plant height (cm) khargone 5 at (20, 40 and 60 DAS)

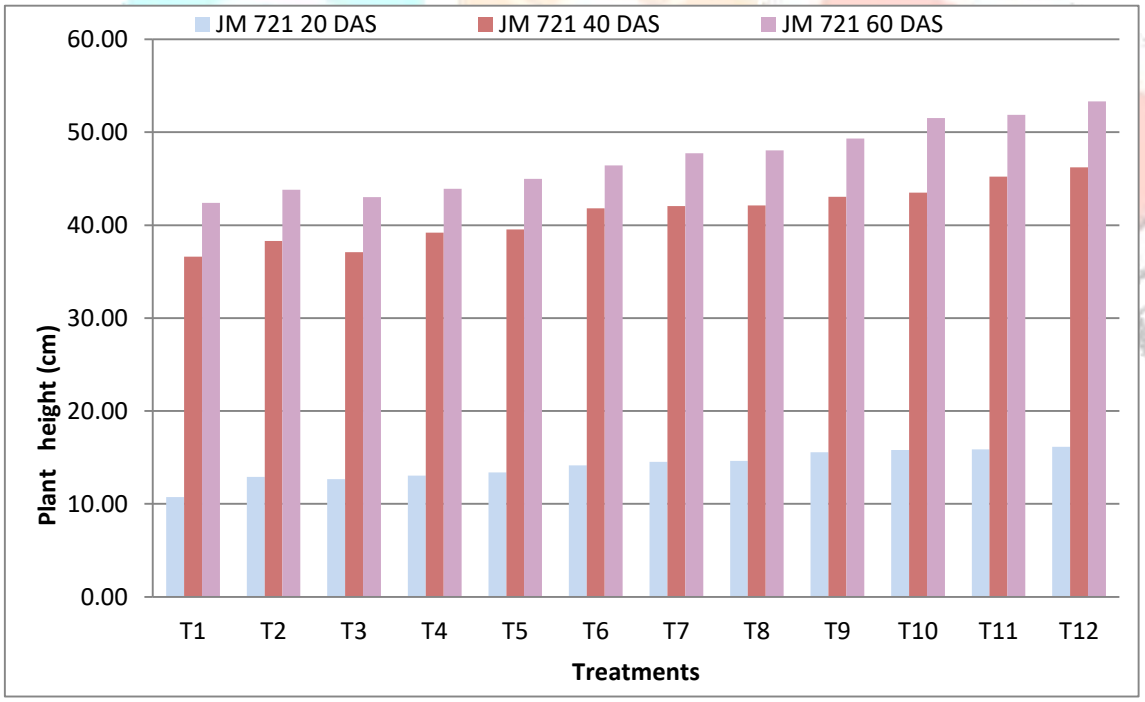

Figure - 1 Effect of different treatments on plant height (cm) JM 721 at (20, 40 and 60 DAS)

Table: 2 Effect of different treatments on number of branches per plant of both varieties at different DAS

Treatments	Khargone 5			Jawahar Mung 721		
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
T_1	2.47	6.77	8.07	2.20	8.20	11.33
T_2	2.57	7.07	8.73	2.40	8.47	12.13
T_3	2.53	6.87	8.13	2.33	8.33	12.00
T_4	2.60	7.23	8.87	2.47	8.73	12.67
T_5	2.63	7.40	9.07	2.53	8.80	13.03
T_6	2.67	7.43	9.40	2.63	8.93	13.27
T_7	2.73	7.67	9.47	2.70	9.00	13.33
T_8	2.80	7.73	9.73	2.73	9.20	13.43
T_9	2.87	7.80	9.80	2.80	9.33	13.60
T_{10}	3.00	7.93	9.87	2.93	9.40	13.93
T_{11}	3.13	8.13	10.00	3.00	10.33	15.13
T_{12}	3.27	8.20	10.13	3.07	11.60	17.27
SE (d) ±	0.10	0.30	0.36	0.11	0.33	0.51
CD (5%)	0.20	0.60	0.71	0.22	0.65	0.99
CV (%)	7.88	8.58	8.25	8.83	7.71	8.00

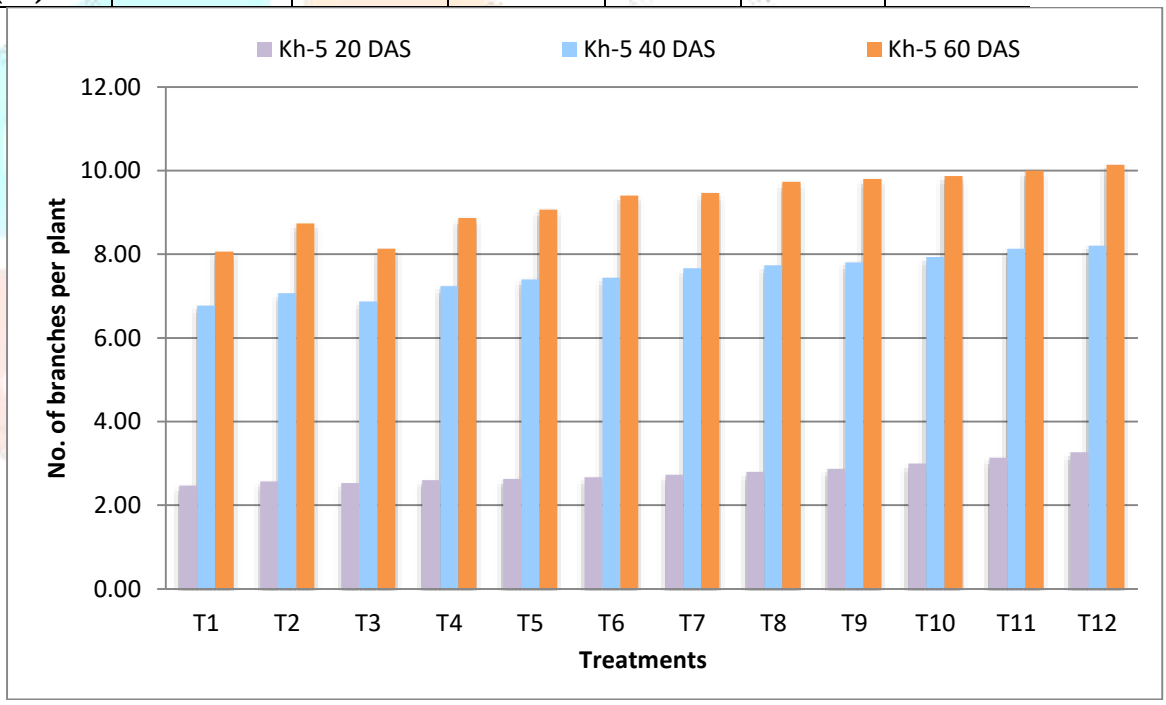

Figure - 2 Effect of different treatments on number of branches per plant khargone 5 (20, 40 and 60 DAS)

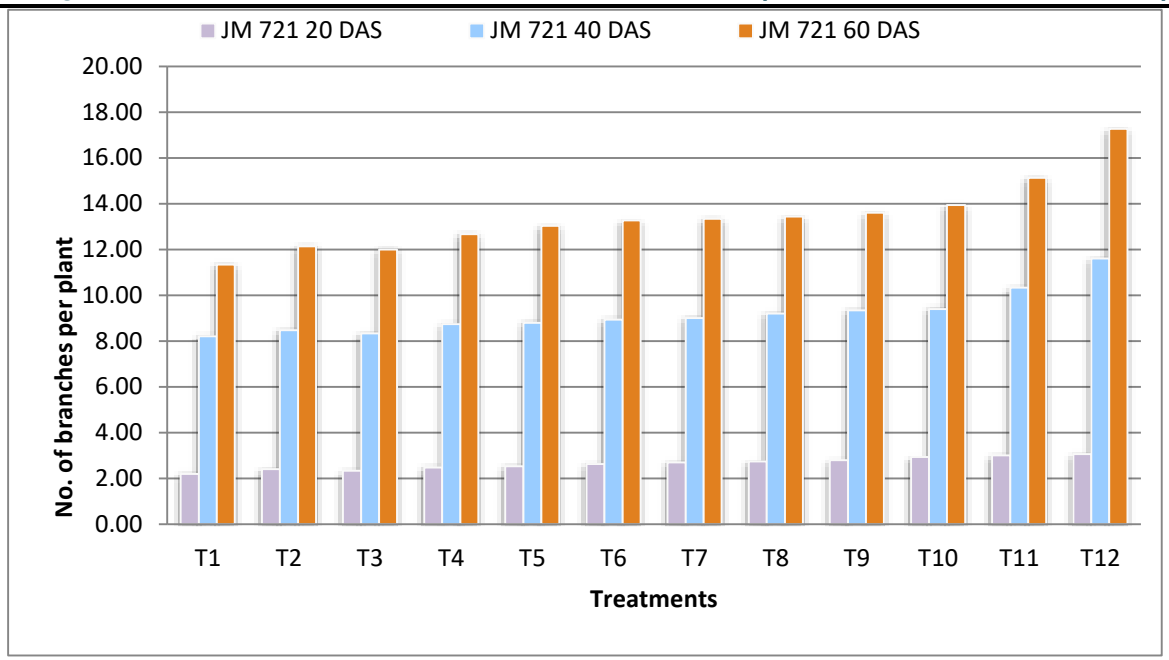

Figure - 2 Effect of different treatments on number of branches per plant JM 721 (20, 40 and 60 DAS)

Table: 3 Effect of different treatments on number of leaves per plant of both varieties at different DAS

Treatments	Khargone 5			Jawahar Mung 721		
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
T_1	6.70	14.96	28.56	9.07	22.77	42.94
T_2	7.00	15.55	30.60	9.87	22.96	46.11
T_3	6.80	15.40	29.47	9.60	22.87	44.84
T_4	7.20	15.84	30.83	10.00	23.71	46.36
T_5	7.50	15.99	31.73	9.60	23.89	47.37
T_6	7.73	16.13	31.96	10.53	24.27	47.88
T_7	8.00	16.87	32.53	10.67	24.64	49.15
T_8	8.20	17.01	32.87	11.20	25.01	50.67
T_9	8.60	17.16	33.32	11.30	25.57	50.92
T_{10}	8.80	17.89	33.77	11.73	27.25	52.19
T_{11}	9.40	18.04	34.23	12.00	28.93	57.51
T_{12}	9.80	20.68	34.45	12.27	32.48	58.77
SE (d) ±	0.28	0.71	1.31	0.42	1.06	1.73
CD (5%)	0.55	1.39	2.56	0.83	2.08	3.39
CV (%)	7.51	8.93	8.66	8.45	8.89	7.41

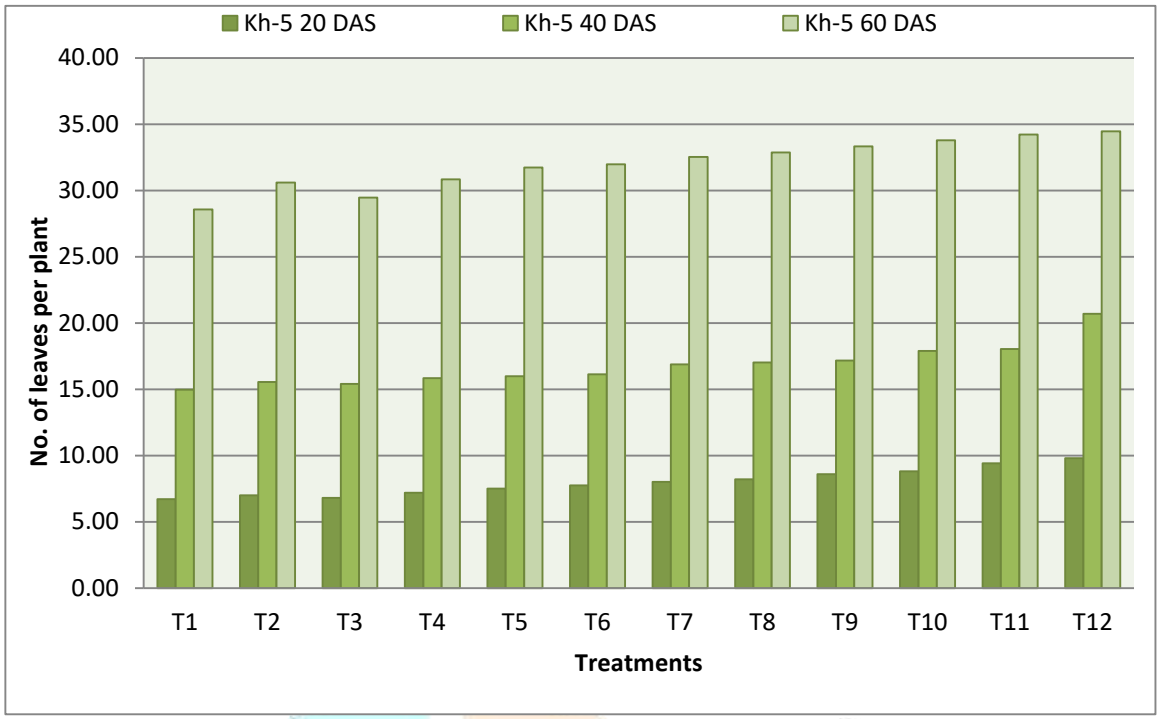

Figure - 3 Effect of different treatments on number of leaves per plant khargone 5 (20, 40 and 60 DAS)

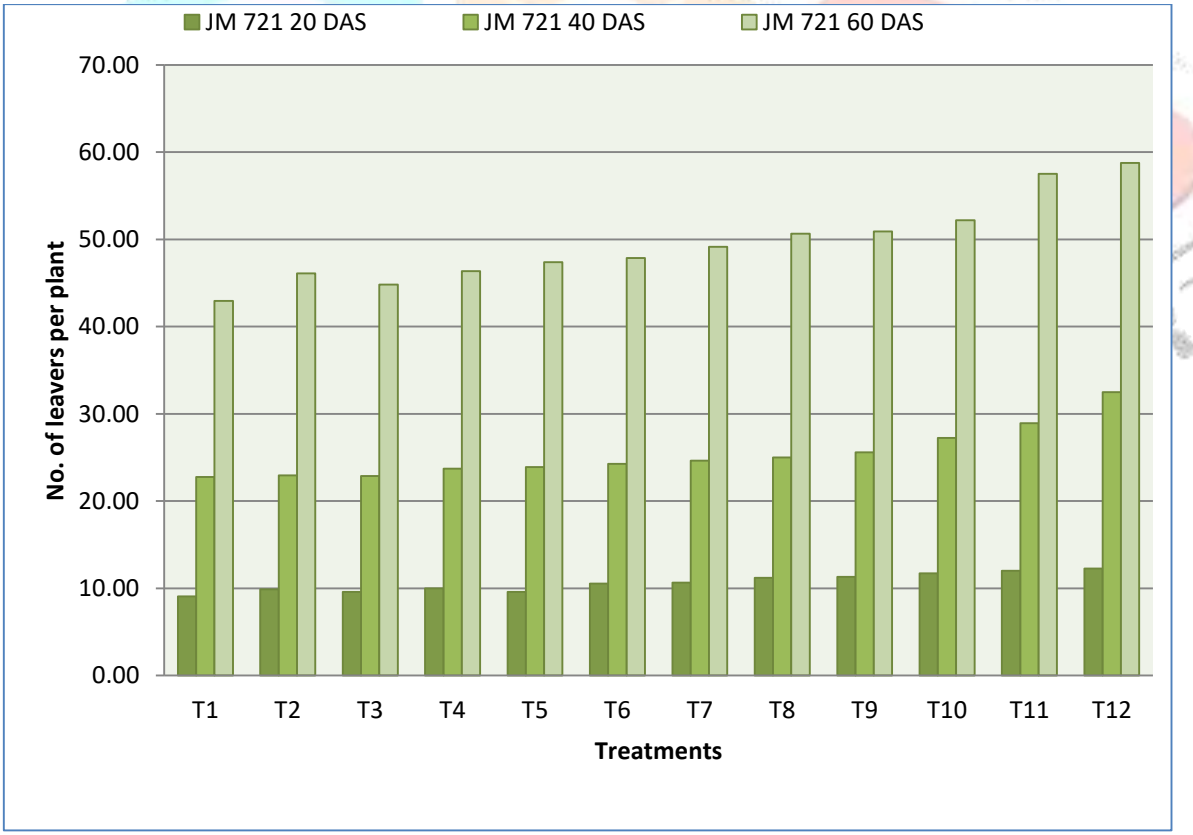

Figure - 3 Effect of different treatments on number of leaves per plant JM 721 (20, 40 and 60 DAS)

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Conclusion:

When seed treated with bacterial bioinaculent *Rhizobium* + *PSB* with 100% RDF showed highest result in morphological growth parameter, hence the use of biofertilizes should be encouraged to the organic farmers because chemical fertilizers are expensive due to this reason soil fertility management is the big challenge in organic farming systems.