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Effect of Different Sowing Depth and Different Types of Seed bed on Germination and Growth Performance of Field Experiment of Mung-bean

Rupesh[1], Shubham[2], Anita Jaswal[3].

[1]*Department of agronomy, Lovely Professional University, Punjab (India)*

[2]*Department of agronomy, Lovely Professional University, Punjab (India)*

[3]*Department of agronomy, Lovely Professional University, Punjab (India)*

Abstract : *Mung bean is a major pulse crop of India and one of the most cultivated crop throughout the year also, but the germination and the success rate majorly depends on the depth of the sowing as well as on the type of the bed at which the seeds are sown. So, with that vigour of curiosity we started this experiment as re-search project under the student project which is a part of under-graduate programme of Lovely Professional University, Punjab; to understand the effect of different sowing depths and types of beds on growth and germination of moong bean. This experiment included 9 treatments of different sowing depths (1 cm, 2 cm, 3cm) and different seed bed (flat bed, sunkenbed and raised bed,) in randomized block design with 3 replications each. The data of the germination percentage and date, along with the growth parameters was recorded periodically. The results showed that sowing depth of 2 cm in Raisedseed bed produced the tallest and the better healthy seedlings as well as highest number of leaves per plant, leaf length as well in overall growth parameters. The 3 cm depth in sunken bed showed that late germination as well has the poor performance compared to other sowing depth when looked over the result. However, the results of the experiment were only growth parameters and did not include yield. So, similar way this research is required to be conducted until final yield of mung bean for better understanding and to get the clear-cut image.*

keywords: *Germination, Growth performance, Mung-bean, Sowing depth, Type of the seed bed.*

1.Introduction

The mung bean (Vigna radiata L. Wilczek), Synonymously is called as green gram, mash and majorly called as moong dal in India , is a flora belonging to Leguminosae family and is indigenous to East Asia, Southeast Asia and also plays a crucial role in the diet of the people of India. Basically an Annual vine and also it owns the high ability of adaptability in whatever the cropping systems applied (Shanmugasundaram[1] *et al.,* 2009). As it belongs to the Leguminosae family it inherits the property of Nitrogen fixation with the assistance of root nodules (Sharma [2] *et al.,* 1996). One of the major supplier of protein in diet of humans around 240 g kg (Anwar [3] *et al.,* 2007). The mung bean plant is a an annual, erect or semi-erect, reaching the height around

0.15-1.25 mts (FAO,2012; Lambrides [4]*et al*., 2006; Mogotsi, 2006), generally hairy stem with tap root system and with a well-developed branching ability but with exemptions like sometimes twining at the tips (Mogotsi [5] , 2006). Where the leaves are with alternate pattern of arrangement and are trifoliolate. Papillonaceous type of flowering with the flower colors from yellow to purplish brown with the tough seed coat which is generally green in colour. Seed is basically a dicot and seeds germinate within 1-2 days under warm and moist conditions and fruit is a pod and the pods of the mung bean are usually pendulous type. The soil p^H range of soil should range from 6.5-7.5.

The optimum temperature and optimum precipitation required of moong bean is around 22^o C-26^o C and 70-90 cm rainfall respectively. Moong bean can be sown throughout the year. The uses of Moong bean are very vast such as one of the prominent suppliers of protein moong bean plays a crucial role in diet of the people especially in the various regions in India. Moong dal fry / curry has been one of the important dish in the Indian meal from the long back years and the changing diet habits was able to attract the large number of the people towards the green gram which is consumed as the sprouts which is the major part of salad and due to the recent times of corona the importance has surged a lot because of studies which proved the higher content of Vitamin C in sprouts of green gram which boosts the immune system and the blind fact i.e green gram crop is one of the important crop that belongs to the clan of green manure crops because of its high nutrition value and the ability of the nitrogen fixation ability into the soil and mung dal is also consumed in the foam of dessert also . Due to its high starch content its also used in the production of the noodles.

Mung bean has a greater nutritional value. It contains 126 KJ (30 Kcal), 5.49 g Carbohydrates, 0.18 g Fat, 3.04 g Protein,0.84 mg Zinc, 27 mg calcium (USDA Nutrient Database). Mung bean is the major pulse crop of the India and its majorly 90 % grown in the Asian region. It has been domesticated around 1500 BC. Mung bean has introduced to southern and eastern Asia, Africa, Austronesia. It is also widespread along the tropics and also found at the altitude of 1850m from sea level in Himalayan region (Lambrides et al., 2006; Mogotsi, 2006). Mung bean is a salt tolerant crop also (Mogotsi, 2006). India is one of the major producer as well as consumer of mung bean. India produce more than 50% of the whole world produce alone itself. China produce mung dal around 19 % of its legume production is taken by moong dal and the Thailand is the main exporter as well as here the produce has seen a drastic rise by 22% per year between 1980 and 2000 (Lambrides et al., 2006). In India Mung bean is grown on 3 million hectares where the production obtained is around 1 million tones. The major Mung bean growing states are Orissa, Maharashtra, Andhra Pradesh, Telangana, Rajasthan, Madhya Pradesh, Bihar, Karnataka and Uttar Pradesh and Punjab with (838 kg/ha) followed by Jharkhand (680 kg/ha) and Tamil Nadu (675 kg/ha). The low productivity of Mung bean by many factors like inappropriate sowing depth, due to drought conditions, usage of inappropriate amount of inputs, insufficient nutrients, due to insects and the disease attacks, decline of nutrient properties of soil, lack of credit source and weeds (James begl ; 2002). Sowing depth and the seed bed is the most important factor for proper root development which decides the failure or success of the crop. If sown too deep and shallow it leads to the poor germination and poor growth of the plant where uneven germination, yield reduction and finally leads to losses. Therefore, its crucial to determine optimum depth and right type of seed bed for growing of mung bean to obtain the good yield So, we

are going to test the effect of varying depths and different types of seed beds on germination and growth. We will be planting them at different depths and different climate and soil conditions in different seed beds.

General Objectives:

- To determine the effect of different sowing depth on germination and germination percentage of Mung bean.
- To determine the effect of different types of seed beds on germination and germination percentage of Mungbean.
- To evaluate the impact of different sowing depths on growth performance of Mung bean.
- To evaluate the impact of different seed beds on growth performance of Mung bean.

2. Materials and Methods

This experiment was conducted in a field in the location of village Mahabigha, District Nalanda in Bihar. The experimental area was at 85.350 Latitude and 25.163247 Longitude. The soil in which the experiment was conducted was sandy loamy soil in terms of soil profile and slightly acidic in terms of $p^{H.}$ This experiment involves 9 treatments with each 3 replications where the different sowing depths was 1 cm, 2 cm, 3 cm and the types of seed beds were Flat bed, Sunken bed, Raised bed. Here Randomized Block Design was followed in the area of approx., 200 square meters per treatment. The variety of Mung bean used in this experiment was local variety, and it was irrigated every third and fourth day after the first irrigation after sowing. To obtain results in this experiment a few parameters were also recorded after the sowing of the crop like; germination date, germination percentage, plant height, stem girth, number of leaves, leaf length, width of the leaf were recorded.

Germination Date: It is the date on which seeds sown on the experimental plots got germinated.

Germination Percentage: Described as the ratio or the percentage of seeds germinated to the number of seeds sown.

Plant Height: Referred as the length of the plant where it is measured from the base to the tip of the flag leaf.

Leaf Length: Length of the longest leaf or flag leaf where it is recorded by measuring it from the base to the tip of that leaf (flag leaf).

Leaf With: It is the measurement of the width of the leaf at its widest observable part.

Number of Leaves: The total number of leaves present on the plant.

Stem Grith: It is referred as the measurement around the circumference of the stem near the base of the plants.

Number of pods:described as the total number of pods per plant.

Number of seeds per pod : Referred as the number of the seeds present per pod.

Most of these parameters are recorded on considerations of few healthy plants where the random 1 square meter area was selected and here the data was collected on the weekly basis in the intervals of 7 days to determine the growth performances of plants in different plants in different treatments and replications.

3. Result and Discussion

From the following experiment as well as the observations it's made clear that the depth and the type of the seed bed where the seeds are sown has a major impact on the germination and the growth performance of mung bean. The results of the performed research work show that sowing depth and the type of the seed bed is the deciding factor for the proper and the good germination and the germination percentage, height of the plant, and the length of the leaves, number and the width of the leaves, girth of the stem, and also the overall growth vigour of the plants. It is also clear from the experiment that the effect of sowing depth and the type of the seed bed on the growth of plant remains same at all stages of growth. The sowing depth and the type of seedbed variations uniformly affected the plants at 10 DAS, 20 DAS, 30 DAS and 40 DAS. Throughout the experiment, the different parameters were also recorded just like the above mentioned and it was observed that the seeds sown at 2 cm depth at raised seed bed performed well followed by the seeds sown at 1 cm at flat seed bed and the seeds sown at 3 cm depth at sunken bed showed the least performance along with the delayed / poor germination with affected germination. Although these outcomes differs from the other research works carried out earlier, but this may be occurred due to the type of the soil and the geographical features of that respective locations. But still, the justifications and the reasons for the results obtained is still in accordance with previous findings like the ones done by

Germination Date: The seeds sown at 1 cm germinated first followed by the 2 cm in Raised seed bed This happened simply because of the smaller distance from surface incase of seeds sown at very shallow depths but the survival ability wise seeds sown at 2 cm performed well when compared to 1 cm sown seeds and at lastly the seeds sown at 3 cm depth got germinated.

Germination Percentage: This was highest at 2 cm in raised seed bed sown seeds followed by 1cm sown seeds in raised bed followed by 3 cm seeds sown in same raised seed bed than other seed beds on the same variations of depth (Fig.1).The maximum germinated seedlings percentage was recorded at 2 cm in raised seed bed only followed by 1 cm in raised seed bed and the least performance was seen in 3 cm sown seeds in raised seed bed. Generally appropriate planting depth may increase the germination percentage. This might be as the depth increased it might increase the moisture, temperature and other environmental factors might been more suitable and favorable for germination of seeds. However too much shallowness as well as too much depth also lead to low or less germination od seeds which results in poor germination percentage ultimately. If optimum depth is followed we can reduce the risk of poor or uneven germination. This result is in conformity with the findings of Siddig A. Ali, Abdellatif Y. Idris (2015) reported that the seed size, sowing depth and environment conditions influence the germination and emergence of the seedlings.

Plant Height, Stem Girth: At all recording intervals and growth stages of the crop under experiment, the plants in the 2cm treatment in raised seed bed were best in all the parameters, followed by 1 cm in raised seed bed and so on (fig 1). Although there were variations but we can say that results were fairly uniform. This may have been due to the fact that moisture and nutrients are subjected to downwards in sandy soil, granting deeply sown plants with more nutrition, but the plants sown at shallow depth did not get enough nutrients to grow, producing these fairly unusual results in the plant height and girth of the stem of different treatments.

Number of leaves: There was clear cut difference among the number of leaves on the Mung bean (fig 2). Here also the maximum number of leaves were observed at the seeds sown at 2 cm in raised seed bed followed by 1 cm in raised seed bed , However the least number of leaves was recorded with a depth of 3 cm in raised seed bed when compared with the other treatments and other replications. So, here as the planting depth increased the number of leaves got decreased. Here its clear that as the depth got increased it has lowered number of leaves on Mung bean plant. But, 2 cm at raised bed is the best the appropriate depth for the proper absorption of sunlight for the successfulness of the crop.

Leaf Length, Leaf Width: The analysis of these parameters has given the clear image of highly significant difference among those treatments which we conducted on mung bean (fig 3,4). The highest leaf length and leaf width was recorded with the planting depth of 2 cm on raised seed bed i.e treatment -7 replication-2, However the least / lowest leaf length and leaf width was observed with planting depth of 3 cm in raised bed (T-8, R-3) as well seeds with planting depth 1 and 3 cm in sunken bed (T-3, T-5, R-1,R-3). And addition to it in leaf width were still more least performance observed in seeds sown at 3 cm depth in flat seed bed (T-2, R- 3). Therefore the seeds sown at 2 cm depth in raised seed bed have the greater leaf size production, which is very important for the absorption of sunlight and photosynthesis of plants to produce their food. This means as the planting depth increased, leaf size is decreased. The results of this research are inline with research work carried out by the Raju Thiyam et.al; Here few variations are observed because they may be subjected to the properties of the soil and biotic and the abiotic environmental conditions where the crops are grown.

Number of Pods: As already mentioned that it is described as the total number of pods per plant. Pod is a fruiting type of Mung bean. Here the highest number of pods were once again observed in seeds sown at 2 cm in raised seed bed (T- 7, R-2) followed by the 1 cm and 3 cm in raised seed bed (T-6, T-8, R-1, R-3) and the least number of pods were observed in seeds sown at 1 cm in sunken seed bed (T-3,R-1) followed by seeds sown at 3 cm in sunken seed bed (T-5, R- 3).The reason behind these events might be seeds sown at 1 cm were too shallow were the successfulness of the crop is affected and in 3 cm because of too much depth which caused the least performance and in 2 cm in raised seed bed the seeds performed well because as the optimum light was obtained which were helpful for the leaves to perform the photosynthetic activity in increased amounts so, as a blind fact higher the photosynthetic activity higher will be the produce of the plant(MD Tariqul Islam; 2015.

Number of seeds per pod: Referred as the number of seeds present in per pod of the plant. Once again here the highest number of are present in the seeds present in the seeds sown at 2 cm depth on raised seed bed i.e. (T-7, R-2) with avg. of 13 seeds per pod in ever treatment carried out, followed by the seeds sown at 1 cm depth

in raised seed bed as well as in 3 cm depth in raised seed bed (T- 6, T- 8, R-1 and R-3) and the least number of seeds are seen in the seeds sown at depth of 1 cm in sunken bed (T-3, R- 1). Here again the above-mentioned reason is applicable i.e better the sun light and the nutrients availability higher the number of the pods which indirectly leads to higher number of seeds in the pod.

4. Figures

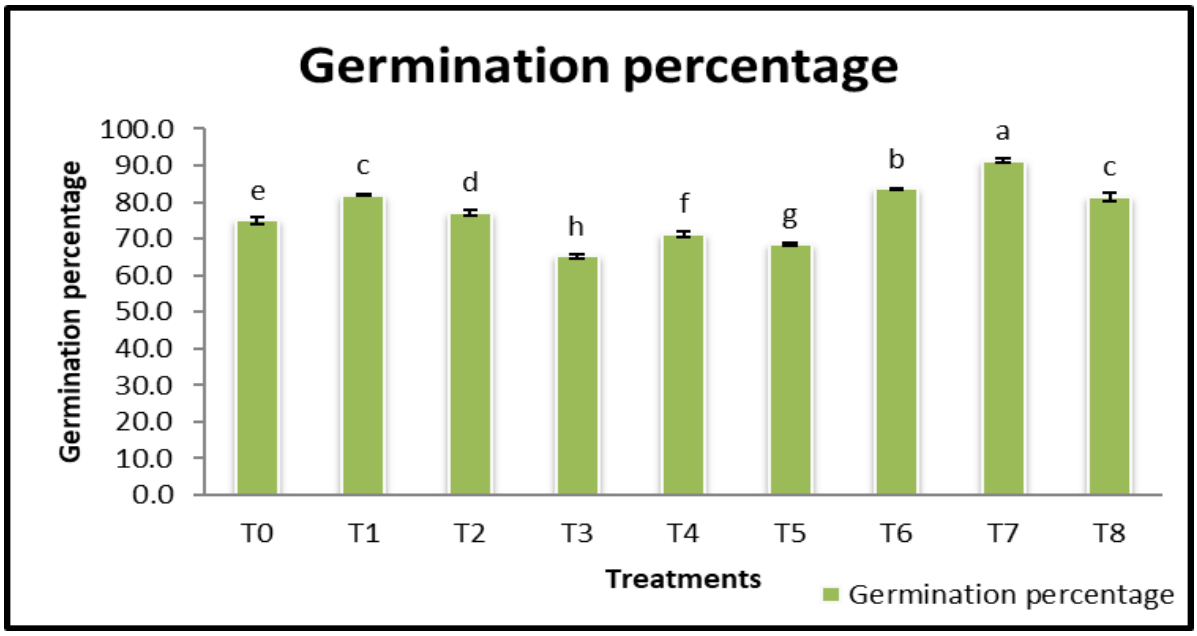

Fig.1 Representing the Germination percentage of the seeds sown. Data shown as mean of S.E means with same letters for each figure are not significantly according to LSD at $p<0.05$.

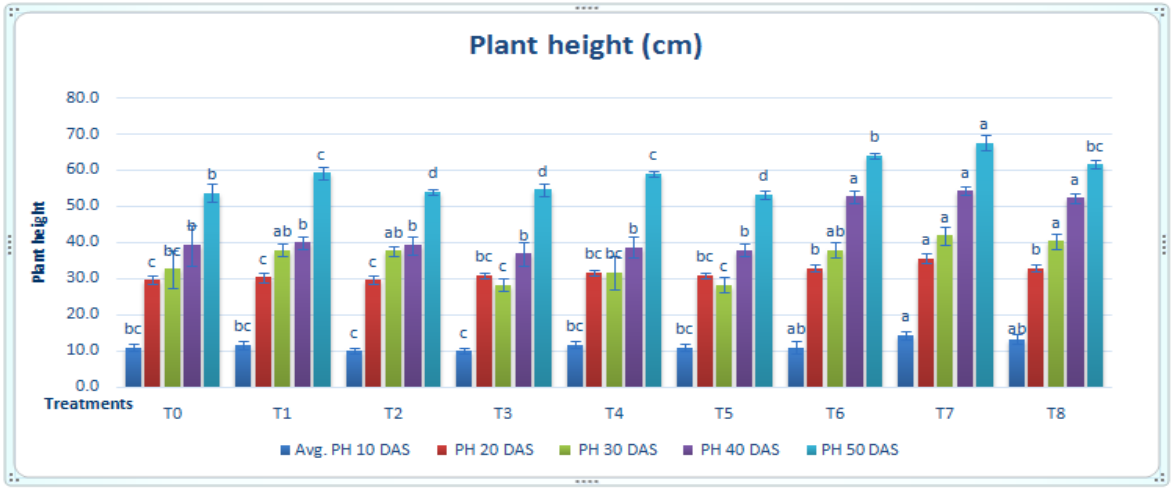

Fig.2 Representing the plant height (cm) Data shown as mean of S.E means with same letters for each figure are not significantly different according to LSD at $p<0.05$.

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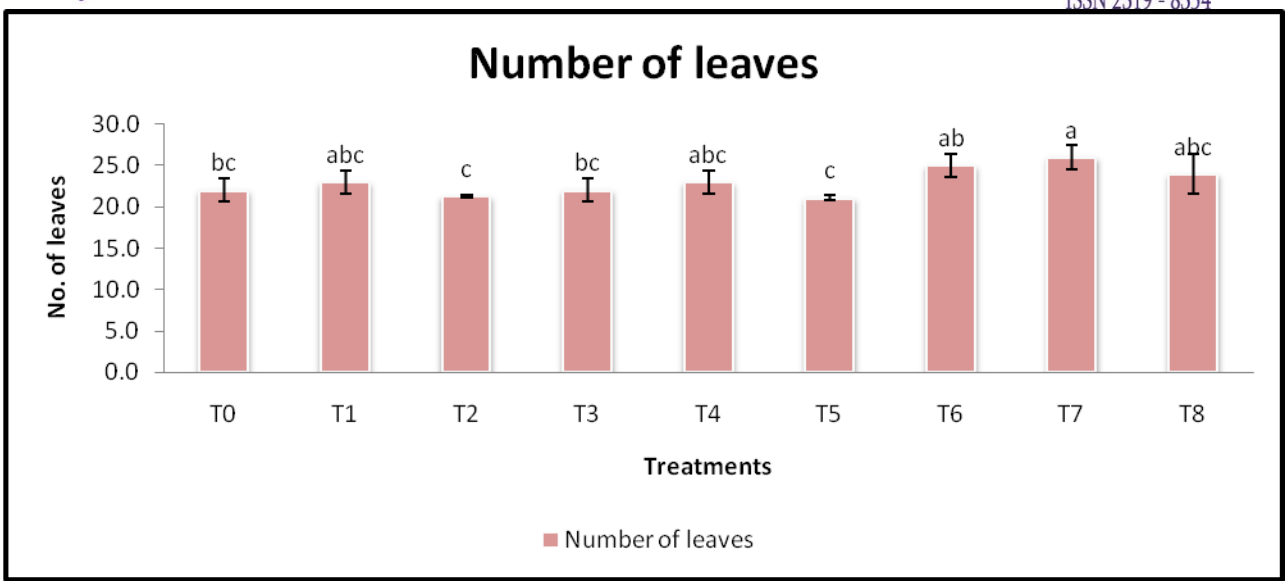

Fig.3 Representing the number of leaves per plant. Data shown as mean of S.E means with same letters for each figure at $p<0.05$.

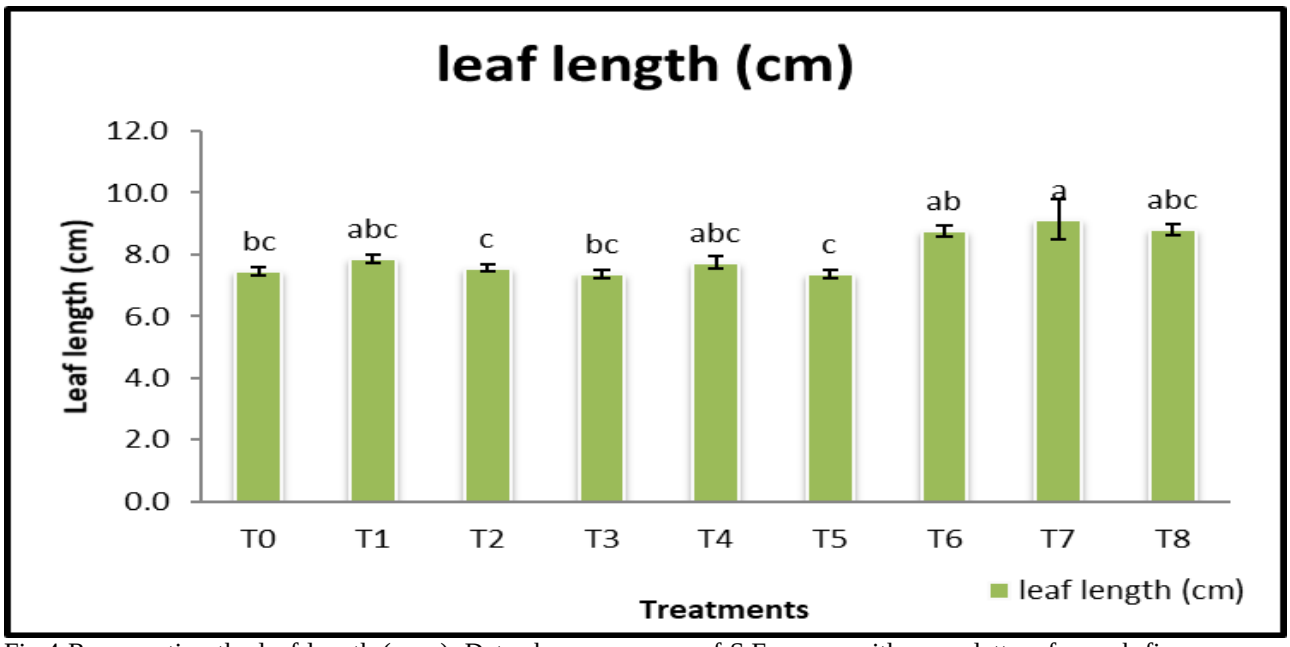

Fig.4 Representing the leaf length (cm). Data shown as mean of S.E means with same letters for each figure are not significantly different to LSD at $p < 0.05$.

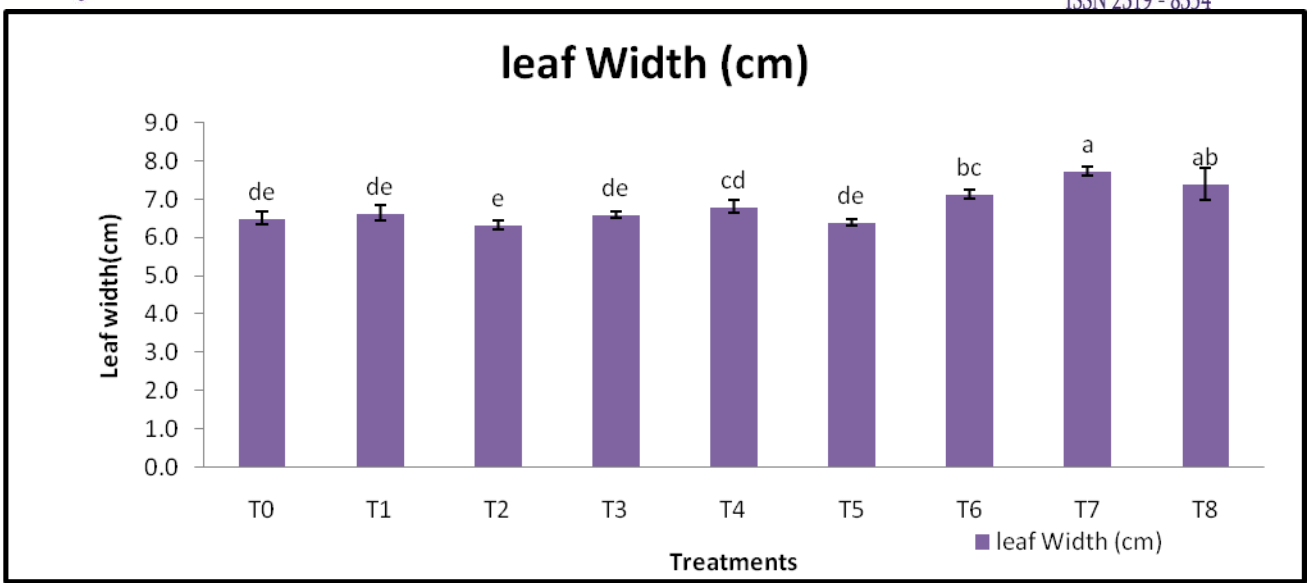

Fig.5 Representing the leaf width (cm). Data shown as mean of S.E means with same letters for each figure are not significantly different to LSD at $p<0.05$.

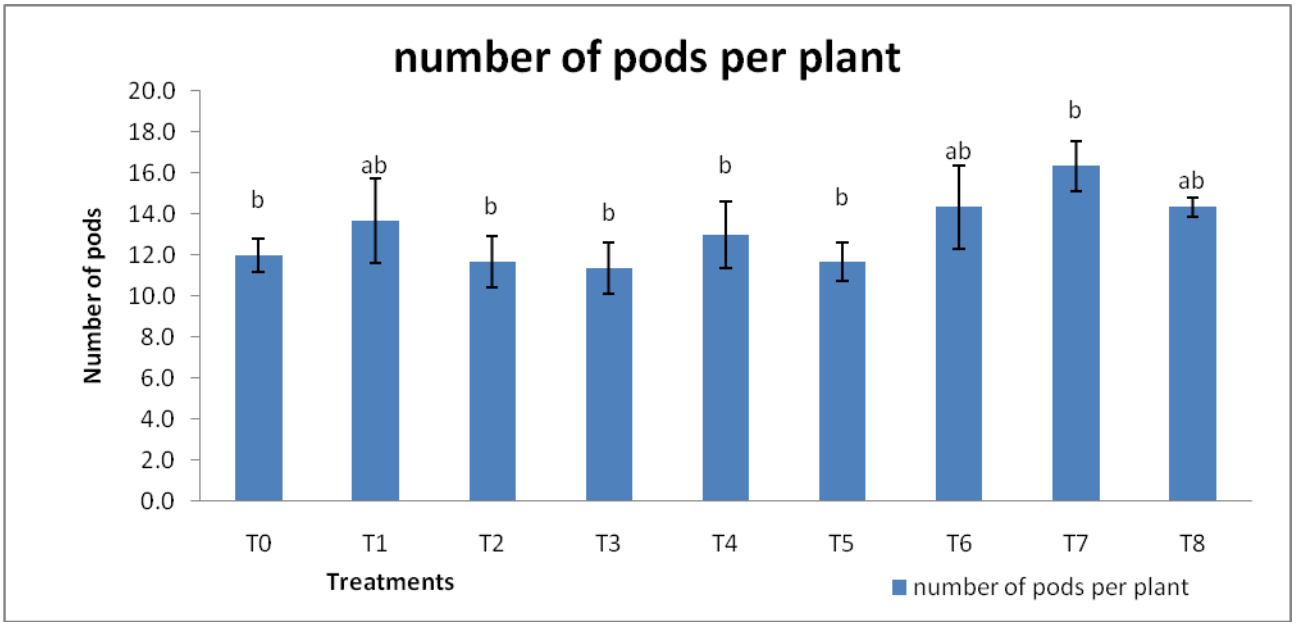

Fig.6 Representing the number of pods per plant. Data shown as mean of S.E. means with same letters for each figure are not significantly different according at $p<0.05$.

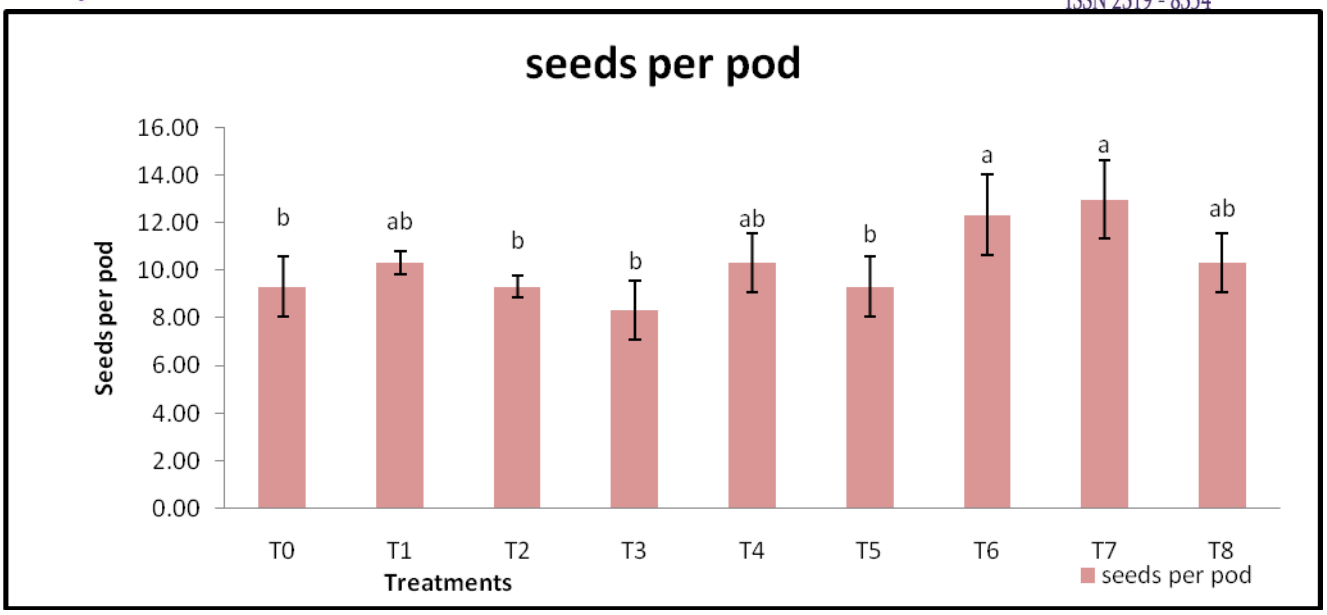

Fig.7 Representing the number of seeds per pod. Data shown as mean of S.E means with same letters for each figure are not significantly different to LSD at $p<0.05$.

5. Conclusion

Mung bean is one of the major pulse crops of India and also one of the most consumed pulse in India as well as in worldwide too. Here the growth and germination are influenced by the various factors among them sowing depth and type of the seed bed is two important factors affecting the overall performance of the Mung bean. It also depends on the type of the soil grown, the sowing depth and the type of the seed bed is also crucial for the successfulness of the Mung bean crop. So, it is recommended that mung bean crop grows best at a depth of 2 cm in Raised seed bed. If sown too shallow or too deep, the plant does not perform well, because at shallow depths, the nutrients are leached and the plant is exposed to harsh environments. Deeply sown seeds may get suffocated and buried, or even after emergence the plant does not perform well and when seeds sown on Raised bed they perform well when compared with the seeds sown on the flat and the sunken bed. Therefore, Mung bean should be sown at appropriate depth to optimize its growth and productivity.

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