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Effect of Different Sowing Depth on Germination and Growth Performance of Field Experiment of Maize

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Abstract

Maize is one of the most important cereal crops in India, but the production is unremarkable due to the inappropriate depth at which maize seeds are sown. This experiment was conducted under the agriculture science under-graduate programme of Lovely Professional University, Punjab; to determine the effect of sowing depth on germination and growth performance of maize. The experiment included 5 treatments of different sowing depths(2cm, 4cm, 6cm, 8cm,and 10cm) in randomized block design with 3 replications. The data of the germination percentage and date, along with the growth parameters was recorded periodically. The results showed that sowing at depth of 10cm produced the tallest plant, the highest number of leaves per plant, leaf length, leaf fresh weight and dry weight. The 10cm depth showed late in germination date and 2 cm showed early germination as 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 research is needed to be conducted until final yielding of maize for better recommendation.

Keywords:*Germination, Growth performance, Maize,Sowing depth.*

1. Introduction

Maize (*Zea mays*) is one of the most important cereal crops in the world. It belongs to the *Gramineae* family and it originated in Latin America (Essubalew *et al*., 2016). It can be grown on wide variety of soils but performs best on well drained, deep loams and silt loams containing adequate organic matter and available nutrients; and seeds germinate 4-5 days after sowing under warm, moist conditions. The pH range of soil should range from 7.5-8.5.The average temperature and precipitation for optimum production of maize are 21°C-32°C and 600-3000mm respectively. Maize can be sown as both, a kharif and a Rabi crop. Maize is an annual grass growing upto 4m tall. The female inflorescences, the ears, develop in leaf axils on the stalk, which terminate on the male inflorescence, the tassel. The broad leaf sheaths are arranged in two opposing rows along the stalk (Pradhenef *et al*, 2009)Maize is internationally superior to most of the other cereal crops, as its grain has greater nutritional value. It contains 72% starch, 10% protein, 4.8% oil, 8.5% fiber, 3.0% sugar and 1.7% ash (FAO, 2011). Maize is used for both, human and animal consumption. Its grain can be cooked and eaten in many

different ways and it is a great source of fodder for animals.Maize is ranked third among the cereal crops after wheat and rice in the world, in terms of area and production. It is cultivated throughout the world. The crop spreads and is cultivated over 139 million hectares of area and around 600 million tonnes in production (McDonald and Nicol, 2005, Essubalew *et al.*, 2016). In India, the production of maize is around 28Mt from an area of around 11 million hectares. More than half of the maize in India is produced in four states of MP, AP, Karnataka and Rajasthan. In Punjab, production of maize is relatively low at aroundlakh metric tonnes, in an area of around 1.8 lakhhectares.Maize is a sensitive crop and it cannot tolerate moisture stress, drought or waterlogged conditions. It need optimum moisture in soil and optimally warm temperatures. The low productivity of maize is attributed to many factors like frequent occurrence of drought, declining of soil fertility, poor agronomic practice like inappropriate sowing depth, limited use of input, insufficient technology generation, lack of credit facilities, poor seed quality, disease, insect, pests and weeds particularly Striga (Ghaderi-Far, *et al.,* (2010). Sowing depth is the first and most important factor for proper root development. When planting at deep and too shallow it causes the risk of increasing poor performance and uneven emergence. Hence, sowing plants either too shallow or too deep resulted in uneven germination and growth performance, yield reduction and even losses. Therefore, it is paramount to develop and determine the optimum of sowing depth of maize on germination and seedling vigoursity to maximize yields and even emergence Therefore; we are going to test the effect of varying depths on the germination and growth. We will be planting them at different depths and under different climate and soil conditions.

General Objectives:

- To determine the effect of different sowing depth on germinationdate and germination percentage of andmaize.
- To evaluate the impact of different sowing depths on growth performance ofmaize.

2. Materials and Methods

This experiment was conducted in a field in the town of Meham in Haryana, India, 124112. The experimental area was located at 28.960765 Latitude and 76.300465 Longitude. The soil in which the experiment was conducted was sandy in nature and slightly acidic. The experiment consisted of 5 treatments in terms of 5 different sowing depths namely; 2cm, 4cm, 6cm, 8cm, 10cm. The treatments were replicated 3 times under Randomized Block Design in an area of approx. 200 square meters. The variety of maize used in this experiment was P3408, and it was irrigated every third or fourth day after the first irrigation after sowing. To obtain results in this experiment a few parameters were recorded after the sowing of the crop like; germination date, germination percentage after the emergence of the crop and once the crop was established the parameters like, plant height, leaf length, leaf width, number of leaves, stem girth, were recorded.

Germination Date: It is the date on which the seeds sown in a replication have germinated.

Germination Percentage: It is the ratio or the percentage of seeds germinated to the number of seeds sown.

Plant Height: It is the measurement of the total length of a plant from the base to the tip of the highest leaf or flag

leaf.

Leaf Length: It is recorded by measuring the length of the longest leaf or flag leaf of the plant from the base to the tip.

Leaf Width: it is the measurement of the width of the leaf at its widest observable part.

Number of Leaves: The total number of leaves on a plant.

Stem Girth: It is the measurement around the circumference of the stem near the base of the plant.

Most of these parameters are recorded from a few healthy looking plants in a randomly selected 1 square meter area. All the parameters except germination date and percentage were recorded at regular intervals of 15 days, to determine the growth performance of plants in different treatments and replications.

3. Result and Discussion

From the experiment and the observations made it is clear that the depth at which the seeds of maize are sown, significantly influences the germination and growth performance of maize plants. The results of the experiment show that sowing depth is a deciding factor for the germination time and percentage, the height of the plants and the length of the leaves, number and width of leaves, and the 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 on the growth of plant remains same at all stages of growth. The sowing depth variations uniformly affected the plants at 15DAS, 30DAS, 45DAS and 60DAS.Throughout the experiment, the different parameters were recorded regularly and it was observed that the plant sown at 10cm depth performed best, followed by the plants sown at 8cm, and the plants sown at 2cm depth showed the least growth performance along with delayed and affected germination. Although these results differ from other experiments conducted earlier, but this may have occurred due to the soil used for the experiment being mostly *Sandy* in the nature. But still, the justifications and the reasons for the results obtained is still in accordance with previous findings like the ones done by Seyum *et al.,* 2016.

Germination Date*:* The seeds sown at 2cm germinated and emerged first followed by 4cm and so on. This happened simply because of the smaller distance from surface in case of seeds sown at shallow depth and due to the increasing distance from the surface in case of other treatments.

Germination Percentage*:* This was highest at 10cm, followed by 6cm, and 2cm depth had the least germination percentage, even though it may have started germinating first. There was a high significance difference ($P<0.05$) among treatments on maize germination (Fig 1). The maximum germinated seedlings percentage was recorded with a planting depth of 10 cm and it has a significant difference among all treatments followed by the planting depth of 6 cm and 8 cm. Whereas the lowest number of germinated seedlings percentage was also recorded with a planting depth of 2 cm,. Generally, as the planting depth increased, the germination percentage of the crop increased. This might be as the depth may increase the moisture, temperature and other environmental factors might have been more suitable and the seeds may get favorable conditions. This decreases the risk of poor or uneven germination. This result is in confirmity with the findings of Paldh (2004) and Ghaderi-Far, *et al.,* (2010) reported that seed size, sowing depth, land preparation and environment 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 10cm treatment were best in all the parameters, followed by 8cm, and so on (Fig 2, 3). Although there were a few exceptions and variations, but the result was fairly uniform. This may have been due to the fact that moisture and nutrients leach downwards in sandy soil, granting the deeply sown plants with more nutrition, but the plants sown at shallow depth did not get the proper nutrition required to grow, producing these fairly unusual results in the plant height and stem girth of different treatments.

Number of leaves: There was a significant difference among treatments on maize leaf number (Fig 3). The maximum leaf number was recorded with the planting depth of 10cm and followed by 8 cm depth has a significant difference among all treatments. However, the lowest leaf numbers were recorded with a depth of 2cm followed by a depth of 4 cm they have a significant difference among them. So that, as planting depth increased, the number of leaves decreased. That means the more depth of plantation might have reduced the number of a leaf of maize. Generally, the planting depth of 10 cm is very important for the absorption of sunlight for the production of food.

Leaf Length, Leaf Width: The analysis of variances showed that there was a highly significant different ($P<0.05$) among the treatment on maize leaf size (Fig 5,6). The maximum leaf length and width was recorded with a planting depth of 10cm and it has a significant difference among all treatments followed by the planting depth of 6 cm. However, the lowest leaf length and width was recorded with a depth of 2cm followed by 4cm, and also, they have a significant difference among them. Therefore, the planting depth of 10 cm gave greater leaf size production, which is very important for the absorption of sunlight and photosynthesis of plants to produce their food. This means that as planting depth increased, leaf size decreased. In addition, the leaf size of the plants is directly proportional to sunlight for production. The results of this research were in line with Aikins and Afuakwa (2008) and ASOSA (2002). These peculiar results may have occurred due to the sandy nature of the soil in which the plants were grown, which under regular irrigation, leached the nutrients along with water, making them unavailable for plants at shallow depths and that availability increases with increase in sowing depth.

4. Figures

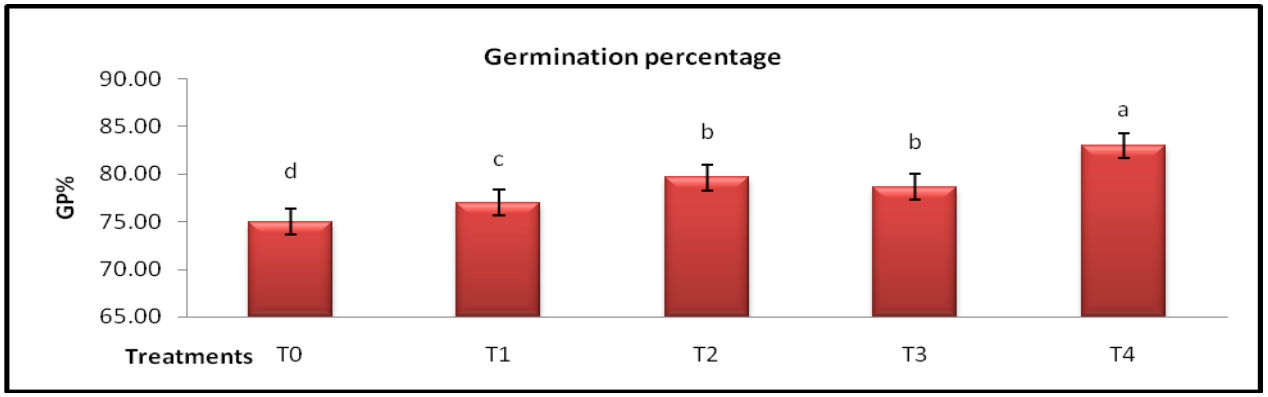

Fig.1 Representing the Germination percentage Data shown as mean of S.E. means with same letters for each figure are not significantly different according to LSD at $p<0.05$.

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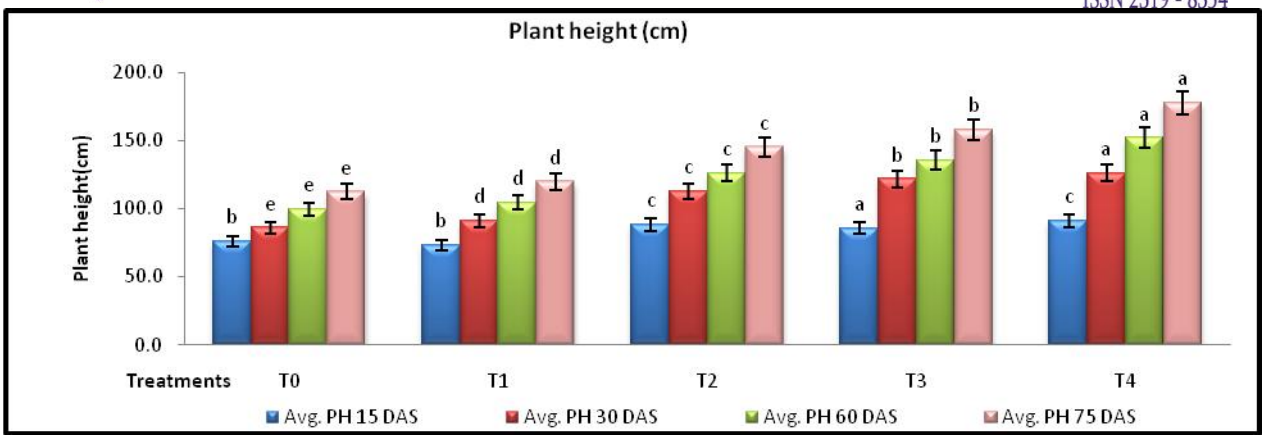


Fig.2 Representing the Plant height(cm) Data shown as mean of S.E. means with same letters for each figure are not significantly different according to LSD at p<0.05

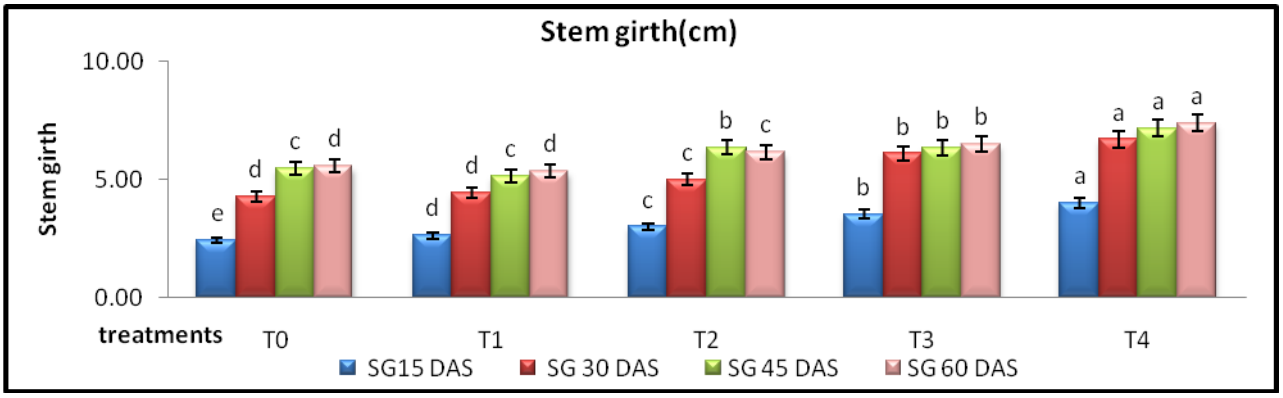


Fig.3 Representing the Stem girth (cm). Data shown as mean of S.E. means with same letters for each figure are not significantly different according to LSD at p<0.05

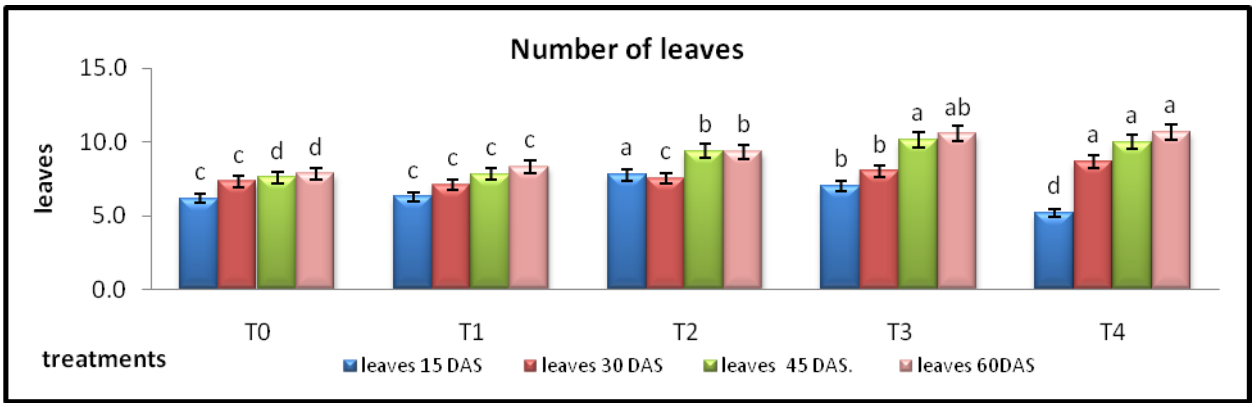


Fig.4 representing the number of leaves per plant. Data shown as mean of S.E. means with same letters for each figure are not significantly different according to LSD at p<0.05.

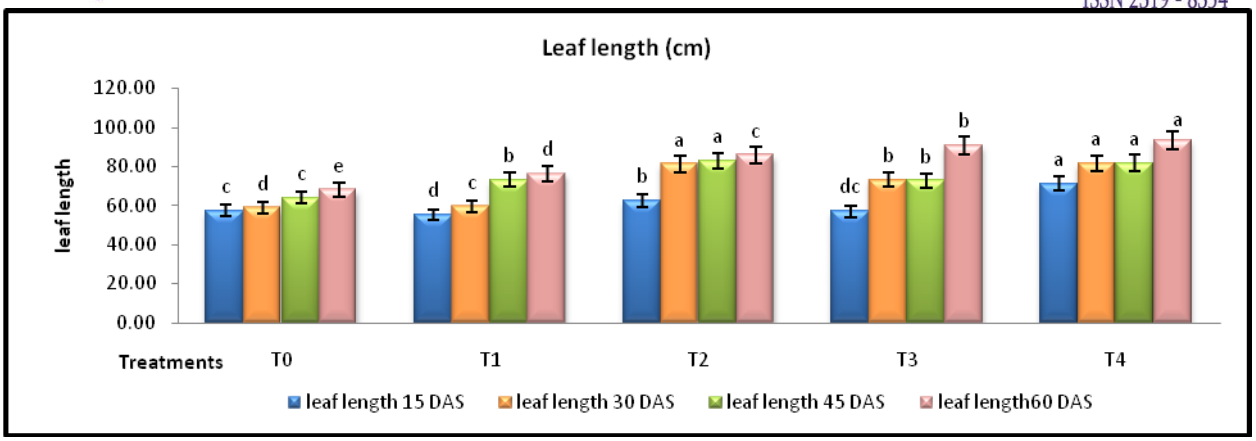
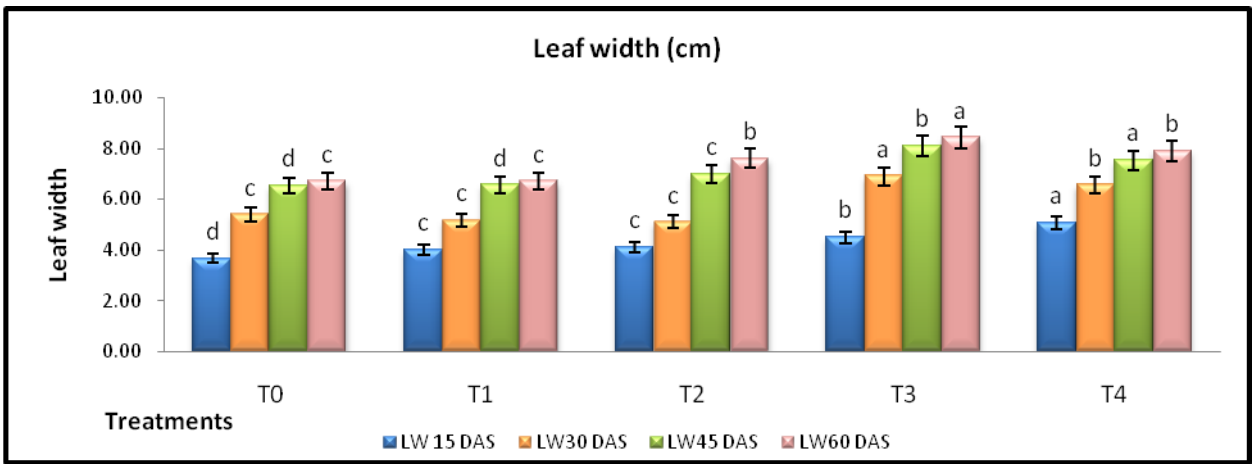


Fig.4 representing the leaf length (cm). Data shown as mean of S.E. means with same letters for each figure are not significantly different according to LSD at $p<0.05$.



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

5. Conclusion

Maize is one of the most important crops in the India and the whole world, and despite its immense importance, its growth and productivity is influenced by a number of factors. The sowing depth being the one of the most important factor affecting the overall performance of maize. Depending on the soil in which it is grown, the sowing depth critical to the performance of maize. Conventionally, it is recommended that maize grows best at a depth of about 5cm. If sown too shallow or too deep, the plant does not perform upto its full potential. 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 perform well. Therefore, maize should be sown at appropriate depth to optimize its growth and productivity.

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