

Comparative Analysis on the Germination and Growth of Chickpea and Mungbean Seeds under different Soil Conditions

Sheeba Menon¹, Chintan Patel, Anil Pandey²

^{1,2}*Biology Department, K K Shah Jarodwala Maninagar Science college, Rambaug, Maninagar, Ahmedabad-380008, Gujarat*

Abstract - Plants belonging to Family Leguminosae provide important protein which is a good source of protein. Legumes are the second most important food crops for human beings after the cereals. Chickpea grows in cold season and its seeds are the most edible part. Mungbean contain proteins, dietary fibers, minerals, nutrients, vitamins and large amount of bioactive compounds. Chickpea and Mungbean seeds were selected for the study and germination. Chickpea seeds are consumed as food, used traditionally as aphrodisiac for bronchitis, constipation, diarrhoea, sunstroke, snakebite and warts. Chickpea seeds contain Malic acid and oxalic acid that can lower blood pressure. Mungbean seeds can prevent cancer and melanogenesis. Chickpea and Mungbean seeds have the ability to maintain the soil fertility by enhancing the physical properties of soil by fixing atmospheric nitrogen. For the study of germination, two different types of soil were collected. One soil sample was from Maninagar and another soil sample was from Dastan farm at Naroda. Chickpea and Mungbean seeds were grown in pots and trays. Individual pots were filled with collected from Maninagar and the trays were filled with soil from Dastan farm, Naroda. The seeds were allowed to grow by watering regularly. The germination percentages, root length, shoot length and number of leaflets readings were taken after ten, fifteen and twenty days respectively. The results were analysed using SPSS/PC software. The results indicated that Chickpea and Mungbean seeds grown in tray showed higher growth in terms of root length and shoot length. The growth is responsible for good yield of both Chickpea and Mungbean plants. It can be postulated that perhaps the type of soil and its moisture content play a vital role in germination of a seed. Also, plants including Chickpea experience external and internal stress (abiotic and biotic stress) that can affect germination and growth. Thus, further advanced research is required.

Index Terms - Chickpea, germination, Mungbean, seeds.

INTRODUCTION

According to Vanucchi et al, 2005, Legume seeds are an important protein source for human consumption. Since the development of most seeds is terminated by a period of maturation drying, it has been suggested that desiccation (whether natural or imposed) plays an essential role in the transition from a developmental programme to a germinative mode (Sanhewe and Ellis, 1996). Amino acid incorporation suggests that protein synthesis is initiated upon embryo hydration and increases in rate during the period leading to cell elongation. Chickpea is planted under varied soil moisture conditions from the sub tropics to Mediterranean climate regions. In sub-tropical areas, it is sown after the summer monsoon rains and in Mediterranean regions it is grown in autumn during the cool wet months of winter or spring (Hosseini et al, 2009). Mungbean is a leguminous crop that can store atmospheric nitrogen in root nodules, thereby reducing the usage of chemical fertilizers in farm applications. Incorporation of Mungbean flour with wheat flour can offer better bakery products to consumers (Naik et al., 2020). Mungbean seeds also contain abundant nutrients and bioactive compounds like polyphenols, polysaccharides, polypeptides and various pharmacological properties (Hou et al., 2019). Chickpea is considered as the poor man's meat because of its high nutritional value and its protein content (Rasool et al., 2015). The chemical composition, pharmacological and therapeutic effects of Chickpea is promising as it is safe and effective (Snafi, 2016).

OBJECTIVES

1. To collect soil samples.

- To select seeds.
- To grow selected seeds in pot and tray and analyse data.

MATERIALS AND METHODS

1. Soil samples

Two types of soil samples were collected. First sample from Maninagar and second sample was collected from Dastan farm, Naroda. The soil collected from Mnainagar is sandy – loam in texture whereas the soil from Dastan Farm was sandy - loam and added with fertilizers.

2. Mungbean seeds

Twenty Mungbean (*Vigna radiata* L.) seeds was selected/ used to study the germination and growth using the two soil samples.

3. Chickpea seeds

Twenty Chickpea (*Cicer arietinum* L.) seeds was selected/ used to study the germination and growth using the two soil samples.

4. Pots and Trays

Pots and Trays were used to grow Mungbean and Chickpea seeds. First soil sample collected from Maninagar was filled in pots and both seeds were grown. Second soil sample collected from Dastan farm, Naroda was filled in Trays and both seeds were grown.

5. Data analysis

All experiments were carried out three times independently and the data collected was analysed using SPSS software/computer.

RESULTS

Table – 1.1 –Vegetative parameters of Mungbean seeds grown in pots after ten days

MUNGBEAN SEEDS GROWN IN POTS AFTER TEN DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
100	3.7±0.3	13.1±0.8	2

Table – 1.2 –Vegetative parameters of Mungbean seeds grown in trays after ten days

MUNGBEAN SEEDS GROWN IN TRAYS AFTER TEN DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
100	3.3±0.4	14.9±2.0	1.7±0.2

100	3.3±0.4	14.9±2.0	1.7±0.2
-----	---------	----------	---------

Table – 1.3 –Vegetative parameters of Mungbean seeds grown in pots after fifteen days

MUNGBEAN SEEDS GROWN IN POT S AFTER FIFTEEN DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
100	3.6±0.8	13.9±0.9	6

Table – 1.4 –Vegetative parameters of Mungbean seeds grown in trays after fifteen days

MUNGBEAN SEEDS GROWN IN TRAYS AFTER FIFTEEN DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
100	4.7±0.8	15.5±4.4	6

Table – 1.5 –Vegetative parameters of Mungbean seeds grown in pots after twenty days

MUNGBEAN SEEDS GROWN IN POT S AFTER TWENTY DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
90	3.3±0.4	14.2±1.0	10

Table – 1.6 –Vegetative parameters of Mungbean seeds grown in trays after twenty days

MUNGBEAN SEEDS GROWN IN TRAYS AFTER TWENTY DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
100	2.7±0.4	20.0±1.3	10

Table – 1.7 –Vegetative parameters of Chickpea seeds grown in pots after ten days

CHICKPEA SEEDS GROWN IN POTS AFTER TEN DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
90	6.3±0.4	11.3±0.8	31.3±2.1

Table – 1.8 –Vegetative parameters of Chickpea seeds grown trays after ten days

CHICKPEA SEEDS GROWN IN TRAYS AFTER TEN DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
90	10.5±1.3	19.1±1.3	37.3±2.4

Table – 1.9 –Vegetative parameters of Chickpea seeds grown in pots after fifteen days

CHICKPEA SEEDS GROWN IN POTS AFTER FIFTEEN DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
100	6.2±0.7	11.6±1.7	32.5±4.8

Table – 2.0 –Vegetative parameters of Chickpea seeds grown in trays after fifteen days

CHICKPEA SEEDS GROWN IN TRAYS AFTER FIFTEEN DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
100	7.2±2.0	17.1±3.2	34±6.0

Table – 2.1 –Vegetative parameters of Chickpea seeds grown in pots after twenty days

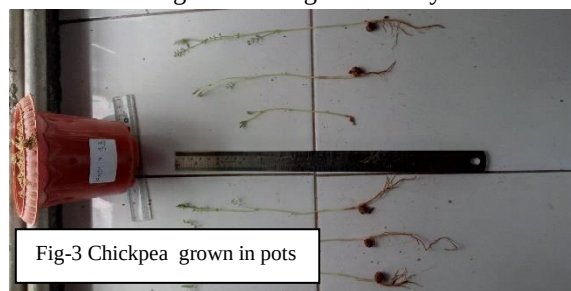
CHICKPEA SEEDS GROWN IN POTS AFTER TWENTY DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
100	6.4±0.9	11.6±1.4	29.5±3.4

Table – 2.2 –Vegetative parameters of Chickpea seeds grown in trays after twenty days

CHICKPEA SEEDS GROWN IN TRAYS AFTER TWENTY DAYS			
Germination (%)	Root length (cm)	Shoot length (cm)	Number of leaflets
100	14.4±1.9	20.1±1.6	39.2±3.5



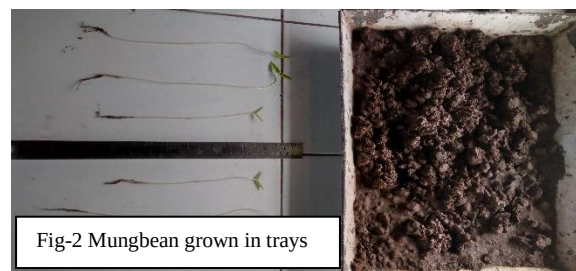
Fig – 1.2 Mungbean in tray



DISCUSSION

The data was taken after ten, fifteen and twenty days for Mungbean and Chickpea seeds respectively (Table – 1.1 – 1.6) and (Fig – 1.1-1.4). There was little effect on germination percentages when Mungbean and Chickpea seeds were grown in pots and trays. The Mungbean seeds grown in Tray with soil from Dastan farm, Naroda had high shoot length as compared to that grown in pot with soil from Maninagar. According to Slemi et al., 2013, germination is affected by soil temperature and the optimum temperature is 10°C and 15°C. The Mungbean seeds kept in pots may have the effect of soil temperature and osmotic potential. Germination and its speed as also due to increase in osmotic potential which can alter water uptake in seeds (Arya et al., 2020)

Similarly the Chickpea seeds grown in Tray with soil from Dastan farm, Naroda showed high root length and shoot length as compared to that grown in pot with soil from Maninagar. According to Iqbal et al., 2018, soil is one of the most important natural resources and a major factor in global food production, seed germination and seedling growth which can be affected by soil type. The Chickpea seeds showed high growth due to better soil quality from Dastan farm, Naroda.



Moreover according to Sladonja et al., 2014, Nutrient quality and organic matters are not among the most relevant soil parameters for germination. Humidity and better aeration to the seeds can also favour both

germination rates and speed of germination (Rodriguez et al., 2013).

According to Anisuzzaman et al., 2001, some soils have low water holding capacity. Therefore, surface soils which absorb more solar radiation dry up rapidly, especially during the seedling emergence. Moreover, moisture and thermal conditions are considered to be the primary regulators of seed germination in alpine regions also.

According to Martin et al., 2017, resource availability at the seedling stage is important for determining the survival of the seedling. The above ground and below ground resources affected early seedling growth and performance for a large number of tree species. However, the legume seedlings are better at taking advantages of increased resource availability which contributes to their successful regeneration

CONCLUSION

Soil quality effects the germination and growth of a plant. The soil quality includes the soil temperature, soil pH, and the nutrients available. Due to soil pollution the quality of soil is degraded. Even polluted water from effluents pollutes the soil. There are different types of soil in India. The crops/plants are specific to those soil types. In our studies it was been found that the soil collected from Maninagar area lacked in nutrients or in other factors which needs to be researched. However, the soil collected from Dastan farm had all the qualities which a plant requires. The states have started soil testing with a view to understand the soil and teach the farmers about the fertilizers required. It is also observed that the seed mass is also a vital factor in initial seedling growth. Plant species with larger seed mass grows taller after germination and those with smaller seed mass later on has higher relative growth. Thus there are enormous physiological factors responsible for seed germination.

ACKNOWLEDGEMENT

The authors are thankful to the Principal and staff members of the Biology department for their constant help and admiration. It is impossible without the role and help from our student who helped in collecting soil samples.

REFERENCES

- [1] Anisuzzaman G M, Suzuki H, Kibe T and Masuzawa T. Response of germination and seedling growth to soil particle size of three herbaceous perennials on alpine zone of Mt. Fuji. *Polar BioScience*, vol-14, pp 88 – 98, June 2001.
- [2] Arya K, Shreshta A and Subedi R. Effect of various seed priming methods on germination characteristics of Black Gram, *HSOA journal of protein research and bioinformatics*, vol-2(2), pp 1 – 5, July 2020.
- [3] Hosseini M, Siddhique K H M, Palta J A and Berger J. *Journal of agriculture, science and technology*, vol-11, pp 401 – 411, June 2009.
- [4] Hou D, Yousaf L, Xue Y, Hu J, Wu J, Hu X, Feng N and Shane Q. Mungbean (*Vigna radiata* L.): Bioactive polyphenols, polysaccharides, peptides and health benefits. *Nutrients*, vol-11 (1238), pp 1 – 28, January 2019.
- [5] Iqbal M Z, Niaz A, Shafiq M, Kabir M and Farooqi Z U R. Effects of soil types on germination and growth of Mash Bean (Black Gram). *Scholars journal of research in agriculture and biology*, vol-3(1), pp 147 – 154, October, 2018.
- [6] Martin C M S, Gel M G, Bergstrom E, Becklund K K, Becknell J M, Waring B G, Werden L K and Powers J S. Effects of soil type and lighton height growth, biomass partitioning and nitrogen dynamics on 22 species of tropical dry forest tree seedlings: Comparisons between legumes and non-legumes. *American journal of Botany*, vol-104(3), pp399 – 410, June 2017.
- [7] Nail G M, Abhiramani P and Vankatachalapathy. MungBean. Department of food Engineering, Indian Institute of food processing Technology, Thanjavur, Tamilnadu, India. Published by Springer Nature, Switzerland, 2020.
- [8] Portari G V, Tavano O L, da Silva M A and Neves V A. Effect of chickpea (*Cicer arietinum* L.) germination on the major globulin content and invitro digestibility. *Cienc Tecnol Aliment Campinas*, vol- 25(4), pp 807 – 812, July, 2005.
- [9] Rasool S, Latef A A H A and Amad P. Chickpea: Role and responses under abiotic and biotic stress. Book - Legumes and Environment stress: Yield, improvement and adaptation, 1st edition, edited by Azooz MM and Ahmad P, Published by John Wiley and sons ltd, 2015, ch-4.

- [10]Rodriguez A V, Sanchez O S and Vazquez A P. Effect of soil texture on germination and survival of non-toxic *Jatropha curcas* seeds. *Biomass and Bioenergy*, vol- 48,pp 167 – 170,July 2013.
- [11] Sanhewe A J and Ellis R H. Seed development and maturation in *Phaseolus vulgaris* L. ability to germinate and to tolerate desiccation. *Journal of Experimental Biology*, vol- 47 (300), pp949 – 958, February 1996.
- [12] Sladonjia B, Krapac M,Bib D, Uzila Z, Dudas S and Dorcic D. Effect of soil type on *Pyrethrum* seed germination. *Journal of plant protection research*, vol-54(4), pp 421 – 425, April 2014.
- [13] Slemi N, bankaji I, Touchan H and Corbineau F. Effects of temperature and water stresses on germination of some and water stresses on germination of some varieties of Chickpea, *African Journal of Biotechnology*, vol-12(7), pp2201 – 2206, April 2013.
- [14] Snafi A E A. The medical importance of *Cicer arietinum* –A review. *IOSR journal of pharmacy*, vol- 6(3),pp29–40,April,2016