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Response of *Phaseolus aureus* L. to various pH and Moisture content of soil

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Abstract

Phaseolus aureus (mung) L. was cultivated throughout the Vidharbha. The soil condition has a direct impact on agricultural system. In this study the two main physical factors pH and moisture content were taken into consideration.

For the study of pH different sets of pH levels were measured. The low pH levels affected the microorganisms and increasing plant diseases. The pH 7.3 from set II showed maximum healthy, yield production. Set III pH observed that plants on higher end of the pH failed to thrive. The study of moisture content of the soil revealed that *Phaseolus* plant responded very well at 16% (MC 2 treatment). It was further showed that the microorganism has been responded a maximum and affects the chemical availability of nutrients in soils at given moisture content.

Keywords – *Phaseolus aureus,* pH, moisture content

Introduction

Legumes obtain nitrogen from air when grown in soil which was not treated. The texture of a soil depends on the percentage of sand, silt and clay in it (Bower et al,2005). Other physical factors in soil affecting plant growth are pH and moisture content. Acid or alkaline soils are not generally as suitable for plant growth as neutral soils. Solubility and availability of plant nutrients are related to soil pH. The nutritional value of crop plants can be degraded if the crops are grown in an acidic environment. This condition has a direct impact on agricultural systems and practices. low pH environments need to be taken into account when considering the problems of acid rain and acidic soils.

Analysis of soil

Much of the earlier knowledge on soil Science in relation to plant growth was due to lack from experimental evidence on generation study. Plant nutrients were thought of principles in rain water, in soil and in plant and animal remains until the German Chemist Liebig (1840) attempted chemical analysis of plants and soils and arrived at the conclusion that chemical elements in plants came from soil and air. Acid soils are usually characterized by excess availability of aluminum, iron, manganese, copper and zinc which may even prove toxic to plants. The reverse is generally true of alkaline soils and in such soils, plants show symptoms of deficiency to many of the elements (Munns, 1977). Neutral soils, in particular, favor the growth of such microorganism.

Moisture content

The microorganism has been reported to show a heavy demand for soil moisture. The establishment of water logged conditions as well as wetting and drying cycles favoured nitrogen fixation especially under an aerobic atmosphere suggestively due to the development of a favourable aerobic, anaerobic interface in soil and availability of easily utilizable energy substrates (Magdoff and Bouldin, 1970).

Moisture supply affects both the chemical availability of nutrients in soils and also the use that plants make of them. Olsen (1954) showed that phosphorus uptake by maize due to proper moisture content of soil.

Material and Methods

1) Collection of soil samples- The soil samples were collected from the pots of respective plant for this study. Each soil sample was taken in a depth of 15-20 cm in a zigzag pattern. Experiment is carried out in three replicates.

2) Determination of soil pH- The pH of soil was measured with the pH meter. An aliquot was made by selecting 20 gm of soil in 40 ml distilled water in 50 ml beaker. Aliquot was kept on a shaker for half an hour.

3) pH treatments- Two different chemicals were used to change the pH balance of the distilled water used to nourish the plants. They were NaOH (Sodium Hydroxide), HCI (Hydrochloric Acid).The growth factors were then tracked for each of the different following sets of pH levels as acidic, Neutral and alkaline **Set I**- pH 2,4,6 **Set II**- pH 7, **Set III**- pH 8,10,12.

Using pH testing strips, we were able to determine that the pH of the solution was at the desired level. The solutions were contained in glass container, each labelled with the pH level of the contained solution. All potted plants will be watered with the same volume of water at the same time. We will measure a variety of characteristics of the plant to determine the effects of the water source pH on the plants.

Moisture content(OvenDry Method)

The release free water and absorbed/adsorbed moisture on heating at varying temperatures. The method determines total water. The treatments given as control MC1, MC2, and MC3 are 18, 16 and 14 % moisture content respectively.

ProcedureWeigh 2 gm of the ground prepared sample in clean pre-weighed, dry weighing bottle or glass petridish. Heat in an oven for about 5 hours at 100°C ± 1 °C. Cool in the desiccators and weigh. Report percentage loss in weight as moisture at particular temperature used.

Calculations

Moisture % = $\frac{100\,(B-C)}{B.A.}$

Where A = weight of empty bottle

B = weight of bottle with material before drying.

C = weight of bottle with material after drying.

Results and Discussion

From the experiment in set I pH 2, 4, and 6 that is the lower scale pH having the appearance of wilt and burnt leaves. The low soil pH may have reduced biomass production by interfering with plant nutrition and by probably increasing plant diseases problem (Mohebbi and Mahler, 2008). Microorganisms in the soil aid plant growth by forming symbiotic relationships with roots, aiding in nutrient absorption. These relationships can be affected by low soil pH. In legumes, nodules were not produced at low pH levels lower than 5.0 (Ronen,2007). A high concentration of H+ ions (low pH) in the soil can also lead to nutrient deficiencies.

In set II, the range of pH is 7.1 to 7.9 in this range germination status were not affected by soil pH. The nodulation of roots by *Rhizobium* affected by pH with highest numbers of nodules observed in pH 7.3. Plants tested in neutral range (pH 7) showed the best results for health, nodule formations and growth and field production as well. Neutral soils, in particular, favor the growth of such microorganism which is responsible for the conversion of organic forms of nitrogen, phosphorus and sulphur into inorganic forms which can be easily absorbed by plants (Buresh et al, 1980).

Set III showed plants on the higher end of the pH scale 8, 10, 12 and 14 failed to thrive. There were deformities of fruit, lack of pigmentation and discoloration of plants parts specially leaves. They died during the course of experiment. Photosynthetic bacteria also grow best at neutral to slightly alkaline pH (Okuda and Kobayashi, 1963)

Moisture content

This study investigated the effects of different moisture contents on soil strength. Composition within the soil depth studied was relatively uniform. Sandy loam or loamy sand soils are prone to crust formation and compaction which lead to unfavorable soil hydro-physical properties especially when it is done at very low or very high moisture content (Shittu et al, 2017). In present investigation the moisture content was found to be suitable MC2 16% for *Phaseolus aureus* (Fig. 1).

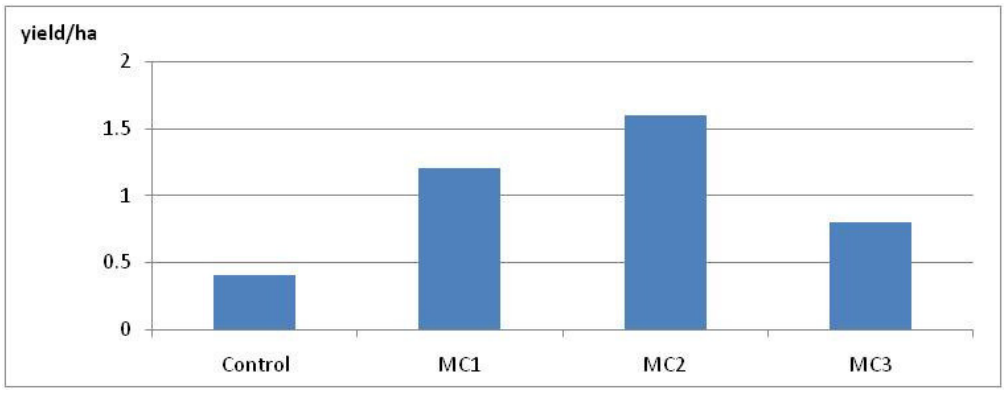

Figure -1 Effect of Moisture content on grain yield of *Phaseolus aureus*

Conclusion

In the present study, it has been shown that the appreciable improvement in growth characters and production of *Phaseolus* plant at pH 7.3 and moisture content of soil about 16% is desirable.

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