Issues That Can Make The Planting Of Beans Easier

The Effect of Fertilizer on Bean Plant Growth Rate

All plants require nutrients for growth which include nitrogen, phosphorus, potassium, calcium, magnesium and sulfur. The major of these nutrients include nitrogen, potassium, and phosphorus (Ohshiro et al., 2016) These nutrients are found in the soil where they are absorbed through the roots. In most instances, the soil will only contain a certain number of nutrients. The plants therefore experience a deficit of some minerals which might either lead to low yields, stunted growth or no growth at all. In order to enrich the soil with missing nutrients and promote the growth of any plant species, fertilizers are added to the soil prior or during the growth of the plant. However, even with adequate administration of fertilizers, plants may fail to yield or grow as required due to other factors. According to Ohshiro et al. (2016), the quality, yield and growth of a plant is dependent on the nutrient status of the soil, type of the soil, and the management of the fertilizer. The combination and amount of nitrogen, iron, phosphorus, calcium, potassium sodium, magnesium, sulfur and pH significantly causes differentiation in the crop productivity and fertility of a soil type (Ohshiro et al., 2016). The management of fertilizers involves administering the proper combinations of fertilizers and fertilizer rates or concentrations to a specific type of soil and plant species.

Most fertilizers supply the soil with the three major nutrients: nitrogen, phosphorus and potassium. Nitrogen is responsible for the crop yield through influencing the formation of chlorophyll and photosynthetic efficiency. Potassium on the other hand acts as a catalyst to the plants growth while promoting the efficiency of nutrients uptake in plants. Phosphorus on the other hand promote the growth of the plant by enhancing the absorption of other nutrients. The combination of these nutrients in different fertilizer types therefore have varying impacts on the yield, quality and growth of the plant. According to Geisseler and Scow (2014), fertilizers tamper with the acidity (pH) of the soil which further affects the growth of the plant.

In this experiment, the question was: How does the different types of fertilizers affect the germination and growth rate of bean seeds (leguminosae)? The question is addressed through planting bean seeds in different fertilizers types and measuring the height of bean plants after five week of growth. The null hypothesis is that the different types of fertilizers produce similar height of the bean plants. The alternative hypothesis is that the different types of fertilizers will produce plants with different heights. In this experiment, it is predicted that the height of the bean plant will have varying heights caused by the different types of fertilizers.

Methods

The planting of the bean seeds took place in eight pots filled with moist potting soil to the brim. Among the eight pots, two pots served as the control sample while the other six were filled with soil treated with three different fertilizers: PA, N, and PH. The control pots had normal soil acidity (pH), normal soil moisture and normal soil nutrients. Two seeds were planted in the two control pots. The seeds were planted through pushing them with fingers into the soil at a depth of about one inch. Two pots were filled with soil having PA fertilizer, another two with soil having N fertilizers, and another two with soil having PH fertilizer. Just as in control pot, seeds were planted in all the other six pots in a similar manner.

The pots were then labelled using tapes and sharpies where the names, type of seed, treatment type and the date of planting were included. All the pots were then subjected to similar lighting conditions by placing them in a properly lit opening. Similarly, all the eight pots were subjected to equal quantities of water through constant water supply. The progress of the beans was checked and recorded once a week for five consecutive weeks. Once the heights were obtained, they were processed using ANOVA in Minitab to determine possible difference between them.

Results

After the fifth week, only the seed in one of the control pots had germinated. The seed germinated in the second week reaching a height of 2cm. The plant grew 5.2cm and produced leaves in the third week. Another shoot grew in the fourth week and the height increased to 16cm. In the fifth week, petals of the bean plant began to show and while the height reached 38cm. The total dry biomass of the plant was 1.357g. The primary and secondary shoot masses were 0.724g and 0.633g respectively.

The interval plot obtained from the Minitab output is shown in Figure 3. The ANOVA statistical test was not helpful since the F-value and the P-values were not available. It was impossible to obtain the P-value where only one height was recorded with the others being zero. This led to an inconclusive outcome prompting a review of the conditions that might have been involved in the experiment.

Discussion

The lack of conclusive results in the experiment indicated that the experiment faced serious issues which prevented the seeds to germinate. Among the issues include the concentration of the fertilizer, temperature, aeration and moisture. The unchecked concentration of fertilizer can alter the salinity of the soil (Dubetz, Smith, & Russell, 1959). In a research conducted by Dubetz, Smith and Russell (1959) alteration of the salinity of the soil could lead to osmotic pressure which would consequently kill the seed. Osmotic pressure is the pressure difference created between the roots of a plants and the soil. Excess fertilizer raises the salinity of the soil around the young underdeveloped root compared to the salinity in the root creating an osmotic gradient. Due to the osmotic gradient, water molecules are drawn from the root into the surrounding soil which are at a higher salinity. Drawing excessive water molecule from the roots to the soil eventually causes root burn. A root burn does not kill the growing seed immediately, however, it causes the seed to dehydrate, slow in growth and eventually die (Dubetz, Smith, & Russell, 1959).

In the experiment, water supply was constant throughout the five weeks. Constant water supply indicates that the seeds may be getting more than enough water which may have led to anaerobic conditions. Anaerobic conditions may occur when the water around the seed prevents the seed from getting enough oxygen. Seeds require high levels of oxygen to enable them to generate energy from the stored nutrients. Blockage of oxygen to the seed means that the nutrient conversion and metabolic processes are hindered denying crucial energy to the seed. Constant lack of energy to the growing seed eventually kills it.

Also, the seed might have been defective or old to the extent that their seed germination potential might have been destroyed. In the life time of a seed, it may encounter strong temperatures or injuries which might kill it. Other factor that might have affected the germination include the amount of light exposed to the seed. Some seeds germinate best in dark environments while others require strong light environments to germinate. The seeds were planted at a depth of one inch. In most seeds, germination is affected by the planting depth. The general rule for the planting depth is that seeds should not exceed a depth which longer than twice its diameter. Due to the massive germination failure in this experiment, the null hypothesis was neither rejected nor favored.