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Effect of Nitrogen and *Azotobacter* in Growth and Development of Chilly

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Abstract

Inorganic fertilizers alone cannot sustain high levels of productivity. It may cause deterioration of soil environment leading to low productivity. An investigation was carried out to develop integrated nutrient management technology for fruit yield of Chilly (*Capsicum frutescens L.*). The experiment was conducted at IAAS farm, Lamjung in 2014. The experiment was laid out in a completely randomized block design with three replications and having nine treatments viz., N1A1, N1A2, N1A3, N2A1, N2A2, N2A3, N3A1, N3A2 and N3A3. The combinations of nitrogen and *Azotobacter* is indicated by N & A with respective way of treatments where N1, N2 and N3 indicate Control (without addition of extra nitrogen), 50 kg/ha and 100 kg/ha nitrogen respectively and A1, A2 and A3 indicate control (without inoculation of *Azotobacter*), soil inoculation and seedling inoculation respectively. The best combination for the overall growth and development of Chilly as found from the conclusions was found to be N3A3 which is the treatment combination of 100 kg/ha nitrogen and seedling inoculation of *Azotobacter*.

Keywords: Productivity; Nitrogen; *Azotobacter*; Inoculation

Introduction

Chilly (*Capsicum annum L.*) is one of the most important crops belonging to the family Solanaceae. It is produced in a large quantity in our country which could be grown in many parts of the lands. Continuous use of inorganic fertilizers has resulted in ecological imbalance with consequent ill effect on soil health and environment [1,2]. To maintain long term soil health and productivity there is a need for an integrated nutrient management through manures and bio-fertilizers apart from costly chemical fertilizers for better yield of the crop [3]. Among the nitrogen fixing culture, *Azotobacter* is considered to be an associate symbiotic facultative group which colonize the surface and interior of roots and this kind of association is considered as the starting point of most ongoing biological nitrogen fixing programs with non-legume plants worldwide. *Azotobacter* also provides nitrogen, but also synthesizes growth promoting hormones such as IAA, GA. *Azotobacter* directly benefits plants improving root and shoot development and increases the yield of crops by mineral uptake through roots [4]. Hence, the experiment was undertaken to study effects on growth and development of Chilly.

Materials and Methods

The experiment was conducted on the upland of Lamjung Campus for the entire growing season of Chilly. The land was thoroughly prepared by spades after application of sufficient irrigation to make soil tillable. The clods were completely removed to provide a fine, friable soil for proper growth and development of plants. Later the seedlings were transplanted along with the respective treatments (control, nitrogen dose and *Azotobacter* inoculation). Nitrogen was used in 3 treatments viz. Control, 50 kg/ha and 100 kg/ha whereas *Azotobacter* was used as Control, Inoculated in soil and Inoculated in seedling. The dose of nitrogen was provided few weeks after transplanting around the plant. The randomized block design was used to plant the seedlings in the field with a perspective layout. 20 plants were planted in a single experiment plot (with research done in 25 such plots) from where six plants from the middle were selected for the data collection. Those plants were marked for recording the data pertaining to growth and yield related parameters.

Result and Discussion

First flowering

The most effective treatment for the first flowering was found to be the N1A2 i.e., Control of nitrogen and Soil inoculation of Azotobatcer which produced first flower in 26 DAT whereas the most ineffective treatment for early flowering was found to be N3A1 i.e., 100 kg/ha nitrogen dose and control of Azotobatcer which produced first flower in 61 DAT.

50% flowering

The most effective treatment for 50% flowering was found to be the N3A3 i.e., nitrogen dose of 100 kg/ha and seedling inoculation of Azotobatcer which produced 50% flowers in 31 DAT whereas the most ineffective treatment for 50% flowering was found to be N3A1 i.e., 100 kg/ha nitrogen dose and control of Azotobatcer which produced 50% flower in 65 DAT.

100% flowering

The most effective treatment for 100% flowering was found to be N1A2 (control of nitrogen and soil inoculation of *Azotobacter*) and N3A3 (100 kg/ha nitrogen dose and seedling inoculation of *Azotobacter*) which produced 100% flowers in 36 days whereas the most ineffective treatment for 100% flowering was found to be N3A1 (100 kg/ha nitrogen dose and control of *Azotobacter*) which produced 100% flowers in 71 days.

Plant height

The most effective treatment for plant height was found to be N3A3 (100 kg/ha nitrogen dose and seedling inoculation of *Azotobacter*) which produced 85 cm plant height whereas the least effective treatment for plant height was found to be N1A2 (control of nitrogen dose and soil inoculation of *Azotobacter*) which produced 55 cm plant height.

Stem diameter

The most effective treatment for stem diameter was found to be N3A3 (100 kg/ha nitrogen dose and seedling inoculation of *Azotobacter*) which produced stem diameter of 3.16 cm whereas the least effective treatment for stem diameter was found to be N2A1 (50 kg/ha nitrogen dose and control of *Azotobacter*) which produced stem diameter of 0.8 cm.

Fruit weight

The most effective treatment for fruit weight was found to be N3A3 (100 kg/ha nitrogen dose and seedling inoculation of *Azotobacter*) which produced fruit weight of 10.5 g whereas the least effective treatment for fruit weight was found to be N1A1 (control of nitrogen and control of *Azotobacter*) which produced 3 g fruit.

Fruit length

The most effective treatment for fruit length was found to be N3A3 (100 kg/ha nitrogen dose and seedling inoculation of *Azotobacter*) which produced 15 cm long fruit whereas the least effective treatment for fruit length was found to be N1A1 (control of nitrogen dose and *Azotobacter* inoculation) which produced fruit of 5 cm length.

Physiological weight loss

The most effective treatment for physiological weight loss was found to be N2A1 (50 kg/ha nitrogen dose and control of *Azotobacter*) and the weight loss was found to be 12% whereas the least effective treatment for physiological weight loss was found to be N3A3 (100 kg/ha nitrogen dose and seedling inoculation of *Azotobacter*) where the weight loss was found to be 50%.

Number of seeds/fruit

The most effective treatment for number of seeds/fruit was found to be N3A3 (100 kg/ha nitrogen dose and seedling inoculation of *Azotobacter*) which produced 150 seeds/fruit whereas the least effective treatment was found to be N1A2 (control of nitrogen and soil inoculation of *Azotobacter*) which produced 58 seeds/plant.

Final fruit yield

The most effective treatment for final fruit yield was found to be N1A3 (control of nitrogen dose and seedling inoculation of *Azotobacter*) which produced 1327 g of final fruit yield whereas the least effective treatment for final fruit yield was found to be N1A2 (control of nitrogen dose and soil inoculation of *Azotobacter*) which produced 176 g of final fruit yield.

Dry weight

The most effective treatment for the dry weight of fruits was found to be N3A3 (100 kg/ha nitrogen dose and seedling inoculation of *Azotobacter*) which produced dry weight of 20% whereas the least effective treatment for dry weight was found to be N1A1 (control of both nitrogen dose and *Azotobacter*) which produced dry weight of 7%.

Conclusion

To study the effect of nitrogen and *Azotobacter* application on the growth and development of Chilly, an experiment was carried out in IAAS farm where different treatments were carried out considering the basic assumptions of the research activity. The most effective treatment for majority of parameters was found to be N3A3 (100 kg/ha nitrogen dose and seedling inoculation of *Azotobacter*). The treatment N3A3 was effective for 50% flowering, plant height, stem diameter, fruit weight, fruit length, number of seeds/fruit and dry weight whereas the treatment N1A2 (control of nitrogen dose and soil inoculation of *Azotobacter*) was found to be effective for first flowering and 100% flowering. The treatment N1A3 (control of nitrogen dose and seedling inoculation of *Azotobacter*) was found to be effective for final fruit yield.

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