Effects of *Nostoc* Biofertilizer on Germination and Seedling Growth of *Vigna mungo* (L.) Hepper in Laboratory Experiment

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Abstract

Experimental study was conducted to evaluate the biofertilizer effect of *Nostoc* on germination and seedling growth of *Vigna mungo* (L.) Hepper (black gram) at Yadanabon University during 2018 and 2019.Laboratory experiments were conducted using Completely Randomized Design (CRD) with 3 replications. In this experiment, *Vigna mungo* (L.) Hepper seeds were treated with different concentrations of *Nostoc* suspension (1 gl^{-1}, 2 gl^{-1}, 3gl^{-1}, 4gl^{-1} and 5 gl^{-1}) within 7 DAS. The results showed that *Nostoc* suspension 3gl^{-1} produced the best percentage of germination and maximum mean values of seedling growth. *Nostoc* suspension could give a potential algal biofertilizer on *Vigna mungo* (L.) Hepper in laboratory experiment.

Keywords :Biofertilizer, *Nostoc*, black gram

Introduction

Vigna mungo (L.) Hepper (Matpe) appears to have originated in India. It is an important grain legume in India, Pakistan, Myanmar and some parts in South East Asia, parts of Africa and America. In Myanmar, pulses are one of the most crops with good export potential. These crops cover the 25% of total cultivated land and contribute the 64% of the total agricultural product of the export income. The agricultural conditions of Myanmar are favourable for growing a wide range of crops. In lower Myanmar, *Vigna mungo* (L.) Hepper and green gram are mainly as a second crop after harvesting of monsoon rice. Bago, Yangon, Ayeyarwaddy regions contribute about 90% of the total area under *Vigna mungo* (L.) Hepper. (Thein Han *et al*. 2001).

Chemical fertilizer has led to reduction in the crop yield and resulted in imbalance of nutrients in the soil, which has adverse effect on soil health. (Sheriff *et al.,* 2015) Various inorganic fertilizers are used for agriculture for high yield purposes but it affects the soil fertility and living organisms. Chemical fertilizers are very costly and it produced environmental pollution (nitrogen, phosphorous and potassium) (Vaithiyanathan and Sundaramoorthy, 2015).

The use of biofertilizer, in preference to chemical fertilizers, offers economic and ecological benefits by way of soil health and fertility to farmers. Biofertilizers add nutrients through the natural processes of nitrogen fixation, solubilizing phosphorus and stimulating plant growth through the synthesis of growth promoting substances. Biofertilizers can be expected to reduce the use of chemical fertilizers and pesticides (Bloemberg *et al*. 2000).

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In the present work, the effect of *Nostoc* biofertilizer on *Vigna mungo* (L.) Hepper has been studied. The aims and objectives of this study were to find the effect of germation and seedling growth of *Vigna mungo* (L.) Hepper by using *Nostoc suspension* and to investigate the proper amount of *Nostoc biofertilizer* by applying seed treatments on *Vigna mungo* (L.) Hepper.

Materials and Methods

Laboratory experiments were conducted at the Department of Botany, Yadanabon University during 2018 and 2019. The biofertilizer, *Nostoc* was obtained from Zeycho market, Mandalay. The seeds of *Vigna mungo* (L.) Hepper was obtained from Myanma Agricultural Service (MAS), Mandalay Region.

The experimental design was laid out by Completely Randomized Design (CRD) with five replications which were repeated three times at the same condition. The plastic petridish (16.2 cm in diameter and 4.5 cm in height) and tissue paper (16 cm in diameter) were used in these studies. In this experiment, one liter of water is added into the different weight of *Nostoc* powder (1 g, 2 g, 3 g, 4 g and 5 g). It took about 24 hours. Therefore, different concentrations of *Nostoc suspension* were obtained. *Vigna mungo* (L.) Hepper seeds were soaked in different concentrations of *Nostoc suspension* for 24 hours. The control was soaked in water at the same time.

After preparing, twenty–five uniform seeds were placed on tissue paper lined petridish according to different concentrations and control. Each petridish was regularly watered with 10 ml daily. Germination percentage that was counted on shoot and root length (cm) were measured on 7 days after sowing. Total germination was presented as a percentage.

Percentage germination was recorded for every 24 hours after doing the treatment up to 72 hours. Percentage of germination was measured according Achakzai (2009) and it was expressed in terms of percentage (%).

$$\text{Germination percent} = \frac{\text{Number of seeds germinated}}{\text{Total number of sown seeds}} \times 100$$

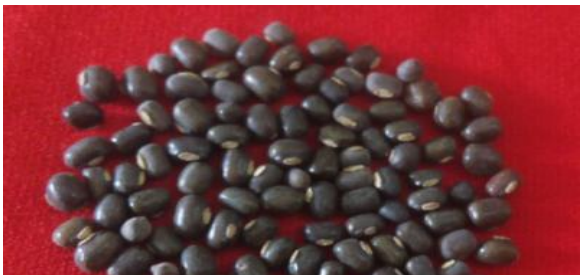

Figure 1. Preparation and experimental Layout

Result

In this study, *Vigna mungo* (L.)Hepper seeds were treated with different concentrations of *Nostoc* suspension and control. At 1 DAS, mean germination percentage of T_1, T_2, T_3, T_4, T_5 and control were 64.53 %, 66.13%, 73.33 %, 69.66 %, 68.53 % and 63.73 % respectively.

At 2 DAS, mean germination percentage of T_1, T_2, T_3, T_4, T_5 and control were 80.80%, 83.46 %, 89.60 %, 85.86 %, 82.93 % and 78.13 % respectively. Mean germination percentage of T_1, T_2, T_3, T_4, T_5 and control were found 92.80%, 93.60%, 97.86 %, 93.86 %, 91.73 % and 83.46 % respectively at 3 DAS.

According to these results, the best germination percentage, shoot and root length of *Vigna mungo* (L.) Hepper seeds were found in *Nostoc* suspension $3gl^{-1}$ treatment. It was germinated 97.86 % but their control was 83.46 % on 3 DAS (Table 1 and Figure 2).

The mean shoot length of *Vigna mungo* (L.) Hepper seed was treated with *Nostoc* suspension T_1, T_2, T_3, T_4, T_5 that were found 8.34 cm, 9.26 cm, 12.70 cm, 10.30 cm, 10.05 cm and their control was 7.56 cm. Among them, the mean shoot length of *Vigna mungo* (L.) Hepper seeds was treated withT_3 was12.70 cm, but 7.56 cm in control.(Table 2 and Figure 3)

At *Nostoc* suspension T_1, T_2, T_3, T_4, T_5 on mean root length was found 2.74 cm, 2.90 cm, 3.34 cm, 2.52 cm, 2.30 cm and their control was 2.10 cm. From these results, the heighest root length of *Vigna mungo* (L.) Hepper seed was 3.34 cm at T_3 but the control was 2.10 cm (Table 2 and Figure 3).The germination percentage, the mean shoot and root length of *Vigna mungo* (L.) Hepper at T_3 (3 gl^{-1}) were higher than the other treatments and control.

The comparative study using the mean standard deviation (sd) of germination percentage, shoot length and root length with *Nostoc* suspension (1 gl^{-1}, 2 gl^{-1}, 3 gl^{-1}, 4gl^{-1} and 5 gl^{-1}) and its control were shown in Table 1,2 and Figure2, 3 and 4.

Table 1. Effects of *Nostoc* suspension on germination percentage of *Vigna mungo* (L.) Hepper (Laboratory experiment)

Figure 2. Effects of *Nostoc* suspension on germination percentage of *Vigna mungo* (L.) Hepper (Laboratory experiment)

Control & Treatments	Mean germination % & ±sd		
	1 DAS	2 DAS	3 DAS
C (0 gl^{-1})	63.73 ± 2.571	78.13 ± 3.780	83.46 ± 4.233
T_1 (1 g l^{-1})	64.53 ± 2.809	80.80 ± 2.884	92.80± 5.245
T_2 (2 g l^{-1})	66.13 ± 3.230	83.46 ± 4.618	93.60± 2.884
T_3 (3 g l^{-1})	73.33 ± 2.440	89.60± 5.600	97.86±0.800
T_4 (4 g l^{-1})	69.66 ± 2.402	85.86 ± 5.326	93.86±3.233
T_5 (5 g l^{-1})	68.53 ± 2.809	82.93 ± 3.780	91.73±4.026

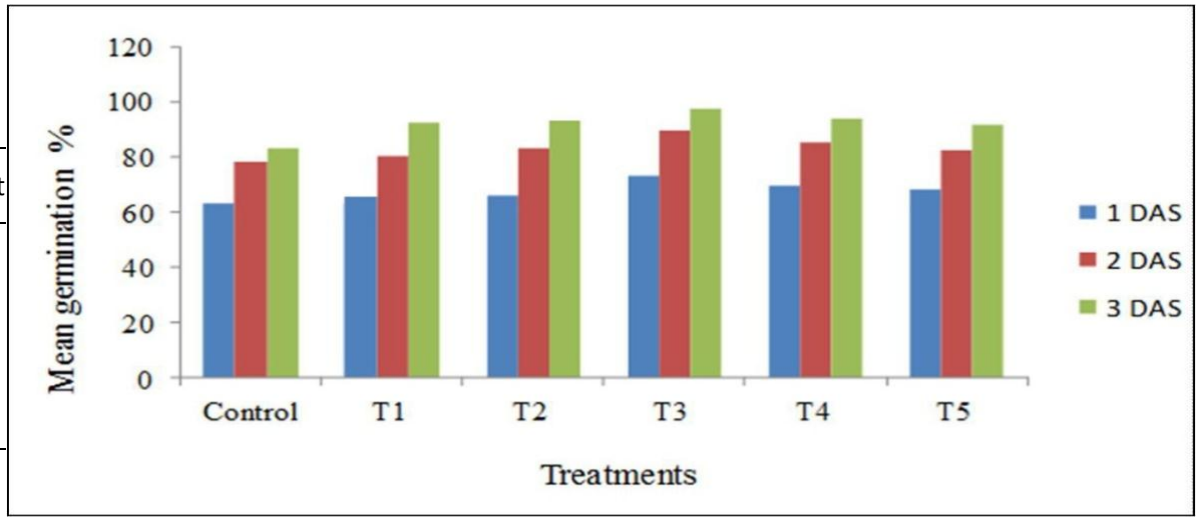

Table 2. Effects of *Nostoc* suspension on shoot and root length of *Vigna mungo*(L.) Hepper at 7 DAS (Laboratory experiment)

Figure 3. Effects of *Nostoc* suspension on shoot and root length (cm) of *Vigna mungo* (L.) Hepper (Laboratory experiment)

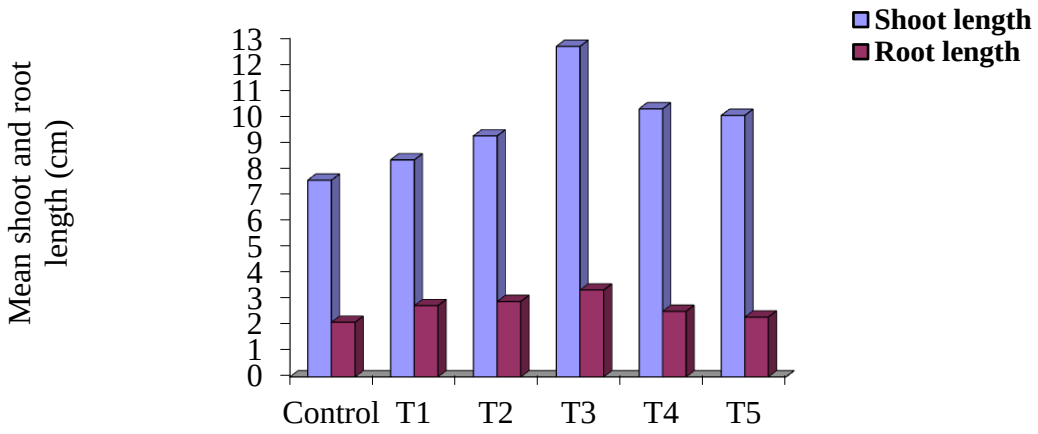

Figure 4. Germination and seedling growth of *Nostoc suspension* on *Vigna mungo* (L.) Hepper at 7 DAS in laboratory experiment

Discussion and Conclusion

Laboratory experiment was carried out to evaluate the biofertilizer effects of *Nostoc suspension* on *Vigna mungo* (L.) Hepper. From laboratory experiment,it was found that *Nostoc suspension* $3gl^{-1}$ was the best germination percentage and seedling growth for *Vigna mungo* (L.) Hepper.

At 3 DAS, *Nostoc* suspension $3gl^{-1}$ was found 97.86 % germinated and its control was found 83.46 % germinated. Thus effect of *Nostoc suspension* $3gl^{-1}$ on germination percentage was17 % higher than the control.

At 7 DAS, the mean shoot length of *Vigna mungo* (L.) Hepper treated with *Nostoc suspension* 3 $gl^{-1}$was 67% higher than the control (12.70 cm – 7.56 cm) (Table 3 and Figure 4) and the mean root length of *Nostoc suspension* 3 gl^{-1} on *Vigna mungo* (L.) Hepper was 59 % higher than the control (3.34 cm – 2.10 cm)(Table 3 and Figure 4). The present results showed that the use of *Nostoc suspension* was needed in small amount of *Nostoc* powder.

Tin Tin Maw (2012) presented that 4 gl^{-1}*Spirulina* suspensions was best germination and seedling growth on *Vigna mungo* (L.) Hepper. Shwe Yee Win Maung Maung (2014) observed that 4 gl^{-1} treatment of *Nostoc* suspension was the best germination and seedling growth of okra. The present finding was disagreed with above authors. However it was agreed with Swe Myint Moe (2013).She reported that $3gl^{-1}$ of *Nostoc* suspension gave highly significant results for tomato that compared to other treatments.

The present experiments showed that, *Nostoc suspension* fertilizer 3 gl^{-1} had the best germination percentage, shoot and root length of *Vigna mungo* (L.) Hepper.

The results of the present studies indicated that the optimum amount of *Nostoc biofertilizer* increase the germination and seedling growth of *Vigna mungo* (L.) Hepper in laboratory experiment.

It can be concluded that *Nostoc* biomass could give a potential for improving the germination and seedling growth of *Vigna mungo* (L.) Hepper.

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