Effects of *Nostoc* Biofertilizer on Plant Growth of *Vigna mungo* (L.) Hepper (black gram) in Pot Experiment

San San Aye[1], Moe Nge Nge[2], Khaing Hninsi[3]

Abstract

Experimental study was conducted to evaluate the biofertilizer effect of *Nostoc* on growth of *Vigna mungo* (L.) Hepper (black gram) at Yadanabon University during 2018 and 2019. Pot experiments were conducted using Completely Randomized Design (CRD) with 3 replications. In pot 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 91DAS. The results showed that *Nostoc* suspension 3gl^{-1} produced the maximum mean values of plant height, leaf number, total leaf area and total dry matter. *Nostoc* suspension could give a potential algal biofertilizer in agriculture for improving the crops growth, particularly in *Vigna mungo* (L.) Hepper.

Keywords : Biofertilizer, *Nostoc*, black gram

Introduction

Vigna mungo (L.) Hepper is grown three times a year. In fresh alluvial soil, *Vigna mungo* (L.) Hepper is sown as rainy season crop. If irrigation is available, it may be sown in January and February as a premonsoon crop and also in May and June. This crop is grown in Sagaing, Bago, Mandalay, Ayeyawady and Yangon Regions. In Sagaing and Mandalay Regions, it is sown as the mid-rain crop. Significant increase in area under *Vigna mungo* (L.) Hepper is observed in Ayeyawady, Bago and Yangon Regions. These regions contribute about 90% of the total area under *Vigna mungo* (L.) Hepper in Myanmar. It is normally cultivated as cash crop after rice under residual moisture condition (Thein Han *et al*., 2001).

Chemical fertilizers have toxic at higher doses. Biofertilizers have no toxic effects. Biofertilizer include algae biofertilizer and which is used all over the world to produce the better quality of plant growth, fruit yield and etc. The algal biofertilizer is very safely to soil condition, resistance to insects and climate condition (Wai Wai Mar, 2007).

Nobody have introduced the effect of *Nostoc* on growth of *Vigna mungo* (L.) Hepper (black gram).Thus, the present work, plant growth of *Vigna mungo* (L.) Hepper has been studied.The aims and objectives of this study are to find the effect of growth development of *Vigna mungo* (L.) Hepper by using *Nostoc* suspension and to investigate the effect of *Nostoc* biofertilizer by applying seed treaments on growth development of *Vigna mungo* (L.) Hepper.

Materials and Methods

The experiment was laid out the Botany Department, Yadanarbon University using Complete Randomized Design (CRD) with five treatments and five replication making 30 pots. *Vigna mungo* (L.) Hepper and *Nostoc* powder 1 gl^{-1}, 2 gl^{-1}, 3 gl^{-1}, 4 gl^{-1} and 5 gl^{-1} (w/v ratio) and control were used in these experiment. The seed were obtained from Myanma Agricultural Service (MAS) and polyethylene bags were used in pot experiments. The bag size was 18 cm in diameter and 34 cm depth. The soil used in this study was clay loam to sandy loam and the weight of soil each bag was 2 kg.

[1] Dr., Lecturer, Department of Botany, Yadanabon University
[2] Dr., Lecturer, Department of Botany, Yadanabon University
[3] M.Sc, Student, Department of Botany, Yadanabon University

Five seeds of *Vigna mungo* (L.) Hepper were swon per pot at 2 cm depth making total 150 seeds and later thinned to 3 stands per pot. Watering was done one liter per day to allow for luxuriant growth of the foliage. Harvesting some weeds was carried out anytime such plants were seen.

Plant height (cm) was measured at 2 weeks interval after planting at maturity. This was done by measuring the plant height of all plant at ground level to the tip of the highest leaves or apical leaves. Starting from 91 DAS, three consecutive plants were randomly collected. After that each plant was divided into roots, leaflets and stems. Only expanded lamina was considered as a leaf for leaf area measurement. Thus leaf length, maximum width of four representative leaflets, stem and root length were measured by a ruler.

The leaf area was determined by using the formula.

Leaf Area (cm^2) = Leaf length × Leaf Breadth × Adjustment factor (K).

K = 0.65 (Watson 1958), (where as k is the coefficient to be derived).

Leaf, stems and roots from each treatment and control were weighed to get fresh weight and recorded. Then four representative leaflets, the rest of the leaves, stems and roots from each treatment and control were placed in labeled paper bags and dried until a constant dry weight was obtained.

Plant height, leaf number, total leaf area and total plant dry matter of *Vigna mungo* (L.) Hepper were recorded and calculated by using students 't' test (Jim *et al*., 1992).

Figure 1. *Vigna mungo* (L.) Hepper seeds were soaked in *Nostoc* suspension (1 gl^{-1}, 2 gl^{-1}, 3 gl^{-1}, 4 gl^{-1} and 5 gl^{-1}) and control

Result

Pot experiment were carried out with *Vigna mungo* (L.) Hepper to evaluate the effect of *Nostoc* suspension.The results of the effect of different concentrations of *Nostoc* suspension on plant height of *Vigna mungo* (L.) Hepper at 21, 35, 49, 63, 77 and 91 DAS were shown in Table 1 and Figure 1.

Table 1. Effects of *Nostoc* suspension on the plant height of *Vigna mungo* (L.) Hepper at 21, 35, 49, 63, 77 and 91 DAS (Pot experiment)

Control & treatments	Mean plant height (cm) & ± sd					
	21 DAS	35 DAS	49 DAS	63 DAS	77 DAS	91 DAS
C (0 gl^{-1})	5.83±1.429	7.15±1.785	13.73±3.143	18.96±2.143	19.88±2.305	20.88±2.397
T_1 (1 g l^{-1})	7.92±1.392	12.87±3.209	16.35±4.425	19.15±1.958	22.58±2.045	22.90±1.901
T_2 (2 g l^{-1})	8.92±0.490	13.30±3.916	16.57±3.727	20.52±2.812	23.31±2.806	24.22±2.959
T_3 (3 g l^{-1})	**15.58±1.219**	**16.74±2.082**	**19.74±2.323**	**24.32±2.955**	**27.56±2.857**	**28.42±3.718**
T_4 (4 g l^{-1})	11.43±1.909	12.30±2.804	16.68±2.967	23.21±3.341	22.84±3.022	23.12±3.248
T_5 (5 g l^{-1})	9.68±1.325	11.16±2.753	15.18±2.601	20.56±1.967	20.57±2.938	20.70±1.926

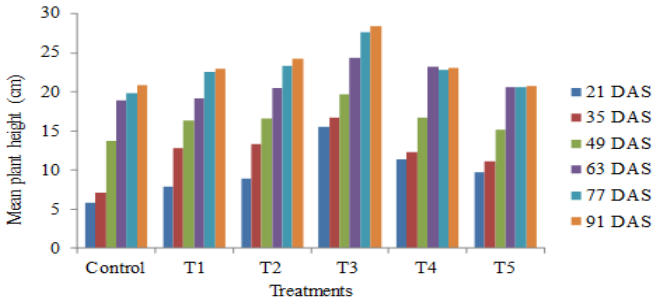

Figure 1. Effects of *Nostoc* suspension on mean plant height (cm) of *Vigna mungo* (L.) Hepper (Pot experiment)

From these results, mean plant height of *Nostoc* suspension 3 gl^{-1} were higher than control at 1% and 5 % significant level respectively at 21 DAS to 91 DAS.

Table 2. Effects of *Nostoc* suspension on the leaf number of *Vigna mungo* (L.) Hepper at 21, 35, 49, 63, 77 and 91 DAS (Pot experiment)

Control & Treatment	Mean leaf number & ± sd					
	21 DAS	35 DAS	49 DAS	63 DAS	77 DAS	91 DAS
C (0 gl^{-1})	7.26±1.792	14.86±2.722	24.2±4.246	28.53±3.962	32.73±4.758	30.53±4.138
T_1 (1 g l^{-1})	9.67±3.132	16.06±2.520	24.73±3.972	36.87±3.603	37.33±3.829	35.2±3.688
T_2 (2 g l^{-1})	10.07±3.172	16.86±3.986	26.73±4.978	35.93±6.296	39.13±6.116	34.93±6.386
T_3 (3 g l^{-1})	**15.20±3.931**	**19.70±1.511**	**32.86±7.249**	**42.87±5.489**	**43.13±5.579**	**37.13±3.833**
T_4 (4 g l^{-1})	12.07±3.494	17.67±2.664	26.4±5.054	33.6±5.816	36.2±4.427	32.33±5.341
T_5 (5 g l^{-1})	9.26±1.387	16.80±2.042	24.4±5.422	31.53±4.033	33.33±4.593	30.93±4.832

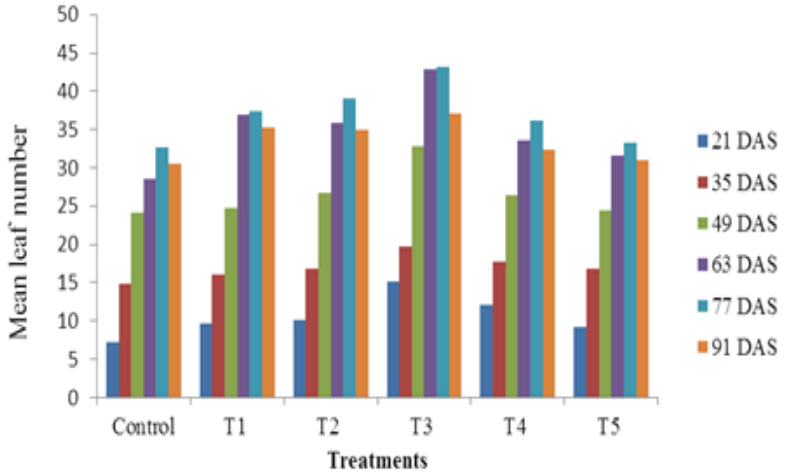

Figure 2. Effects of *Nostoc* suspension on mean leaf number of *Vigna mungo* (L.) Hepper at 21,35, 49, 63,77 and 91 DAS (Pot experiment)

Table 2 and Figure 2 shown that the effect of *Nostoc* suspension on leaf numbers of *Vigna mungo* (L.) Hepper. From these results, *Nostoc* suspension 3gl^{-1} on mean leaf number of *Vigna mungo* (L.) Hepper were higher than control at 1% and 5% significant level respectively at 21 DAS to 91 DAS.

Table 3. Effects of *Nostoc* suspension on total leaf area and total plant dry matter of *Vigna mungo* (L.) Hepper at 91 DAS (Pot experiment)

Control & treatments	Mean & ± sd	
	Total leaf area (cm^2 per plant)	Total plant dry matter (g per plant)
C (0 gl^{-1})	218.28 ± 8.888	6.948 ± 0.609
T_1 (1 g l^{-1})	265.13 ± 1.853	7.707 ± 0.305
T_2 (2 g l^{-1})	341.32 ± 8.269	8.529 ± 0.362
T_3 (3 g l^{-1})	**369.05 ± 7.256**	**9.977 ± 0.383**
T_4 (4 g l^{-1})	256.20 ± 1.146	8.511 ± 0.881
T_5 (5 g l^{-1})	227.63 ± 6.263	7.478 ± 0.486

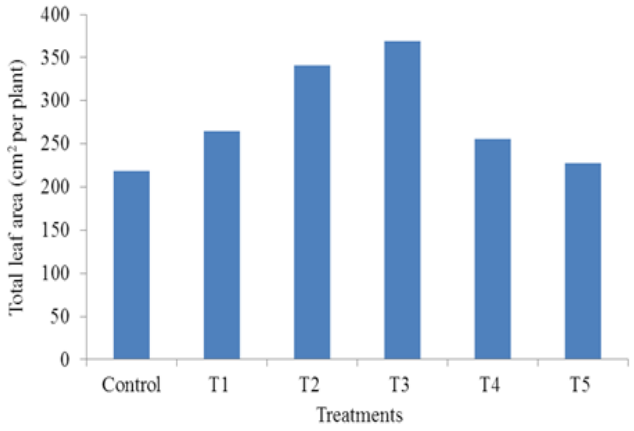

Figure 3. Effects of *Nostoc* suspension on total leaf area of *Vigna mungo* (L.) Hepper at 91 DAS (Pot experiment)

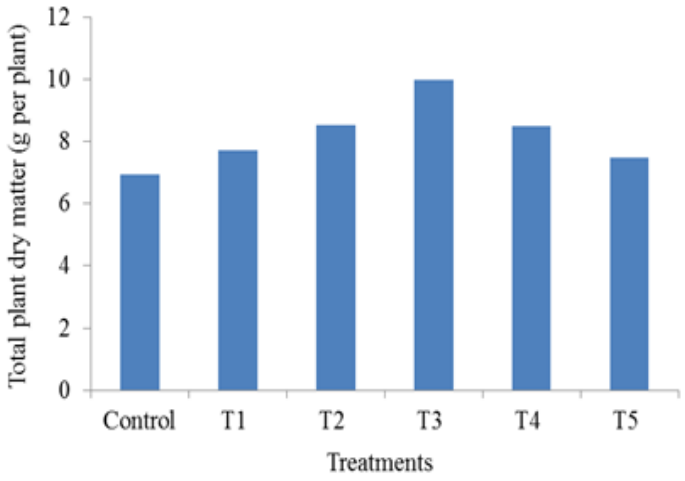

Figure 4. Effects of *Nostoc* suspension on total plant dry matter (g per plant) of *Vigna mungo* (L.) Hepper at 91 DAS (Pot experiment)

The result of the effect of *Nostoc* suspension 3 gl^{-1} on total leaf area of *Vigna mungo* (L.) Hepper was the highest (369.05 cm^2 per plant) and that of control was the lowest (218.28 cm^2 per plant) at harvest. Thus, total leaf area was statistically significant in *Nostoc* treatments than control at 1% and 5% level (Table 3 and Figure 3).

The effect of *Nostoc* suspension on total plant dry matter of *Vigna mungo* (L.) Hepper at harvest (91 DAS) was better than other treatments and control. The data given in Table 3 and Figure 4 revealed that *Nostoc* suspension $3gl^{-1}$ was 9.977 g per plant but control was 6.948 g per plant. Total plant dry matter was statistically significant in *Nostoc* treatments than control at 1% and 5% level.

Figure 4. Plant growth of *Vigna mungo* (L.) Hepper treated with *Nostoc* biofertilizer (Pot experiment)

Discussion and Conclusion

Pot experiments were carried out to evaluate the biofertilizer effects of *Nostoc* suspension on *Vigna mungo* (L.) Hepper. From these results, *Nostoc* suspension $3gl^{-1}$ was the best treatment for *Vigna mungo* (L.) Hepper. Effect of *Nostoc* suspension $3gl^{-1}$ on mean plant height was 36% higher than control (28.42 cm - 20.88 cm) and mean leaf number was 21% higher than control (37.13- 30.53) at 91 DAS. These result revealed that proper treatment of *Nostoc* suspension improved the plant height and leaf number.

Shwe Yee Win Maung Maung (2014) observed that 4 gl^{-1} treatment of *Nostoc* suspension was the best for germination and seedling growth of okra. The present finding was not agreed with above author. However agreed with Swe Myint Moe (2013), she reported that $3gl^{-1}$ of *Nostoc* suspension gave highly significant results for tomato compared to other treatments and control.

All treatments of total leaf area and total plant dry matter were higher than control at 1% and 5% significant level respectively at 91 DAS.

The result of the present studies indicated that the mean total leaf area of *Vigna mungo* (L.) Hepper with *Nostoc* suspension T_3 ($3gl^{-1}$) was 69% higher than control (369.05 cm^2per plant- 218.28 cm^2 per plant) . And also promote the mean total dry matter on *Vigna mungo* (L.) Hepper with *Nostoc* suspension $3gl^{-1}$. It was 43% higher than control (9.977g per plant - 6.948 g per plant).

The results of the present studies indicated that The optimum amount of *Nostoc* biofertilizer increase the plant growth of *Vigna mungo* (L.) Hepper in pot experiment. It can be concluded that *Nostoc* biomass could give a potential for improving the growth of *Vigna mungo* (L.) Hepper.

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