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Investigation on the Effectiveness of Zinc Sulphate and Biofertilizer on Mustard Plant

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Abstract —The present work was conducted to find out the effect of biofertilizer formulated with four species of *bacteria* (two species of Azotobacter and two species of Lysobacter) and zinc sulphate. Field experiments with mustard plant were conducted to study the effectiveness of soil application of zinc sulphate and biofertilizer at 0, 10, 20, 30, 40, 50 days after sowing. Plant height and condition of plant was found to be increased significantly using a mixture of biofertilizer and zinc sulphate than other treatments after 40 days sowing. Three treatments were also used in this field experiment such as bacteria only, zinc sulphate only and mixture of biofertilizer and zinc sulphate. The treatment using a mixture of zinc sulphate and biofertilizer had the best yield (4688.008 kg/ha) within 50 days of sowing and performed better than other treatments. Field experiment using zinc sulphate only was second best yield (3380.75Kg/ha) and biofertilizer only treatment gave (2639.04kg/ha).

Keywords—biofertilizer, zinc sulphate, mustard plant, bacteria

I. Introduction

MYANMAR has agro-based economy. To improve yield and quality of economically important crops and other plants are, therefore, very important. Up to recent year, chemical fertilizers are used for high yield of crops. However, the use of chemical based fertilizer and plant protectors give rise to negative environmental effects including water and soil pollution and imbalance biodiversity [1]. Therefore, chemical fertilizers and pesticides are very costly and quite out of for health hazards to human and other flora and all over the world including Myanmar. To avoid these side effects and to provide socioeconomic and ecological benefits biofertilizer is commonly refer to as the fertilizer that contains living microorganisms and it is expected that their activities will influence the soil ecosystem and produce supplementary substance for the plants [2]. Biofertilizers are very attractive, safe and ecofriendly. In Myanmar, biofertilizers including effective microbes are already in use or are being under trial. Micronutrients are very important to plant health and contribute greatly to yield, which is the main concern for much of the agricultural industry. One of the most important micronutrient is zinc (Zn). Zinc deficient soil can be found throughout the world and are normally associated with low soil organic matter and a soil pH higher than 7.0. Zinc deficiencies are corrected in most cases by applying a granular Zn fertilizer. Historically, zinc sulfate ($ZnSO_4$) has been the Zn source of choice. Growth of winter crops in the soils is adversely affected due to reduction in zinc availability at low temperatures [3].

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Although zinc can be applied through foliage as an emergency measure, greatest yields are obtained when it is applied to the soil [4, 5, 6]. Soil application of zinc is normally made at the seeding of crop. Sometimes because the amount applied is less than that required and sometimes because of abnormally low soil temperatures; deficiency of zinc appears during the crop growth. Deficiency of zinc can also appear after seeding of the crop in soils with high phosphorus contents [7, 8, 9]. Zinc sulphate improves phosphorus utilization and regulates plant growth and increase leaf size, promotes silking, hastens maturity and contributes to test weight [10]. Myanmar name of mustard is Mon nyin. It is also known as mustard green, spinach, leaf mustard and white mustard which is quick to mature, easy to grow and cold season vegetable for green or salad. Mustard has high in vitamin A and C [11].

II. Materials And Methods

In this research, the material and method used to achieve the general objectives, which are to evaluate the growth promoting, to reduce zinc deficiency effect and to get high yield of fresh weight of mustard using zinc sulphate and biofertilizer.

A. Experimental Site

A study was carried out in field trial at Ela in Leiway Township. Field experiment was conducted during November to January mustard season of 2010-2011.

B. Experimental Soil

A field experiment conducted to evaluate the effect of biofertilizer and zinc sulphate. The experimental design of the field was randomized complete block design (RCB), which was carried out with replicates and the trial area was 0.04 ha (0.1 acre).

C. Plant Materials

Land preparation for experimental mustard was made before sowing. Normally, seed grains were drilled manually in furrows. The sowing depth is 2-3 cm and the row spacing is 23-25cm.

D. Treatment Application

The field experiment design was used in 0.04 ha. Each plot was replicate in a completely randomized design and three different kinds of treatment as follows:
(i) Biofertilizer (20L/ha) were mixed with zinc sulphate (50g/ha) T_1, (ii) Zinc sulphate only (50g/ha) T_2 and (iii) Biofertilizer only (20L/ha) T_3. Control plot, without fertilizer T_0, was left. Biofertilizer was formulated with two species of

Azotobacter and two species of Lysobacter at biotechnology department, Kyauk-se Technological University.

E. Crop management

After 20 days seedling, Plants were transplanted each plot.

F. Determination of plant growth parameters

The data were recorded eleven plants for each plot at 10 days intervals after 20 days sowing. Plant growth parameters measured were plant height, number of leaves per plant, fresh weight per plant.

G. Data Analysis

Recorded growth average parameter of plant height, leave number and fresh weight were shown in figure significance differently.

III. Results and Discussions

Total viable counts of bacteria were carried out at 10 days intervals starting from 20 days after sowing. The results show that the total soil bacteria count of individual treatment. They are presented in Table 1.

TABLE I
TOTAL VIABLE COUNT OF BACTERIA (cfu/ml) AFTER TREATED

Days after sowing	T_0	T_1	T_2	T_3
20	1.2×10^6	4.0×10^6	7.2×10^6	8.8×10^5
30	8.4×10^5	7.2×10^8	1.2×10^6	9.6×10^8
40	4.0×10^5	4.0×10^9	5.2×10^5	4.4×10^9
50	8.0×10^5	9.6×10^8	1.2×10^4	1.2×10^9

Field trial data for mustard plant growth and yield were recorded at 10days intervals and analyzed 20 days to 50 days cultivation. Plant growth parameters at 50 days cultivation show that among the treatment tested, T_1 was the best for plant height, average fresh weight and yield (4688.008kg/ha). T_2 was second best and T_3 was the last (3380.75Kg/ha)and (2639.04Kg/ha) respectively. These data were shown in Table 2 to 4 and Figure 1 and 2.

TABLE II
AVERAGE PLANT HEIGHT (cm) PER PLANT 50 DAYS CULTIVATION OF MUSTARD

Days after sowing	T_0	T_1	T_2	T_3
20	-	-	-	-
30	11.52	11.90	12.27	11.72
40	15.66	23.09	20.45	17.27
50	22.91	31.64	26	24.90

TABLE III
AVERAGE FRESH WEIGHTS PER PLANT PER TREATMENT AFTER 50 DAYS SOWING

Treatment	Average fresh weight (gm) per plant
T_0	30.92
T_1	90.38
T_2	65.18
T_3	50.88

TABLE IV
YIELD OF FRESH WEIGHT (Kg/ha) AFTER HARVESTING

Treatment	Fresh weight Yield (Kg/ha)
T_0	1562.32
T_1	4688.01
T_2	3380.75
T_3	2639.04

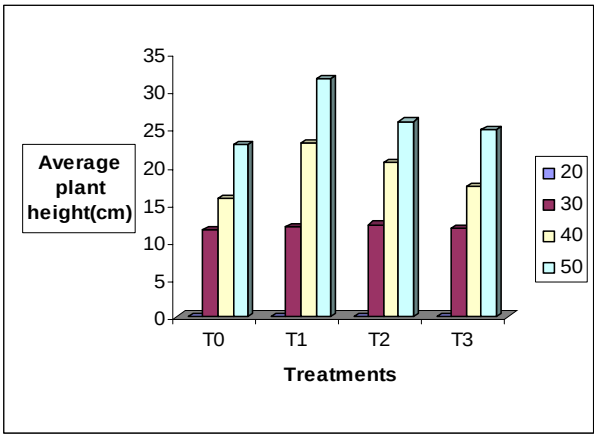

Fig. 1 Plant height (cm) of mustard plants on different treatment applications

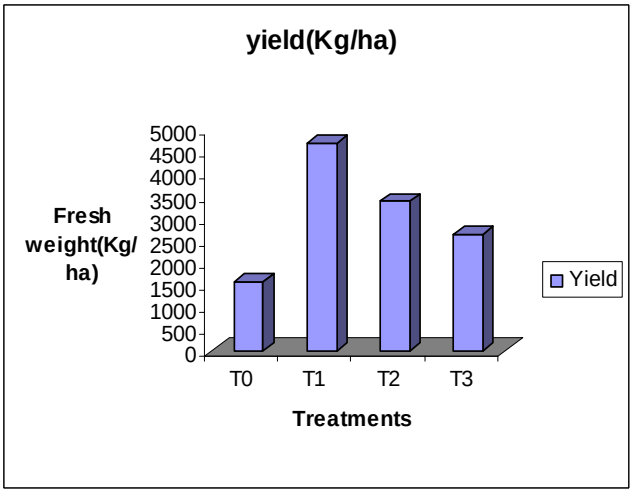

Fig. 2 Fresh weight yield (Kg/ha) of mustard plant after harvesting

IV. Conclusion

The present work showed that T_1 was the best result in all treatment. Using the mixture of biofertilizer and zinc sulphate gave the best result. Although zinc sulphate was chemical product, the younger leaves of zinc deficient plants initially became pallor green in red-brown pigmentation then formed on the margins of upper surfaces of the leaflets on these leaves and on the lower portion of the stems. As zinc deficiency became more acute leaflets became even lighter in colour, the red – brown pigmentation on the margin widen covering more of the upper surface of the leaf and stem elongation was reduced resulting in stunted plants. No specific necrotic symptoms were evident on zinc deficient plants. Biofertilizers may help solve such problem as increased salinity of the soil and chemical run-offs from the agricultural fields. Thus biofertilizers are important if we are to ensure a healthy future for the generation to come. Accroding to this research, Biofertilizer mixed with zinc sulphate should be used in agriculture.

References

[1] 106-E. Kamla Nagar, National Instute of Industrial Research. *The Complete Techonology Book on Biofertilizer and Organic Farming*,Delhi-,India, 110007,1999.

[2] P.V.Toan, et al., *Biological Nitrogen Fixation Research and Application*,Vietnam,Ministry of Agriculture and Rural Development,Vietnam Agricultural Science Institute, VAST 2000.

[3] A.Bauer and WL.Lindsay, *TheEeffect soil temperature on the availability of Indigenous soil zinc* .Soil Soc Amer Proc 29:413-420,1965.

[4] J.C.Katyal, *Relative efficiences of micronutrient sources*, Fert News23:39-48, 1980.

[5] B.D. Shama and J.C. Katyal, *Evaluation of amounts , methods and sources of zinc application to wheat in flood plain soils.* J Agric Sci Camb 196:41-44,1986.

[6] B.D. Shama, P.N. Takkar and U.S. Sadana , *Evaluation of levels and methods of zinc application to rice in sodic* .Fert Res3:161-167,1982.

[7] J.C. Katyal and B.D. Shama , *Role of micronutrients in crop production.* Fert News 24:33-50 ,1979.

[8] L.A.Rudgers, J.L.Dineterio, F.M. Paulson and R.Ellis , Jr, *Interaction among atrazine, temperature and phosphrous-induced zinc deficiency in corn*.Soil Sci Soc Amer Proc34:240-248,1970.

[9] F.C.Viet, *Zinc deficiency in soil plant system. Zinc Metabolism*90-128.*ChemicalAbstract*67(71814)1986.Soil and Fert1340,1966.

[10] F.Gary, Zimmer. *Trace Minerals*: Beyond NPK vol 40.No.12 December , 2010.

[11] Wai Mon , *Biofertilizer preparation with NPK fertilizer and their application on mustard plant on pot trial*, Myanmar ,2003.