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Comparative Study of Biofertilizers and Chemical Fungicides on *Zea Mays* and *Glycine Max*

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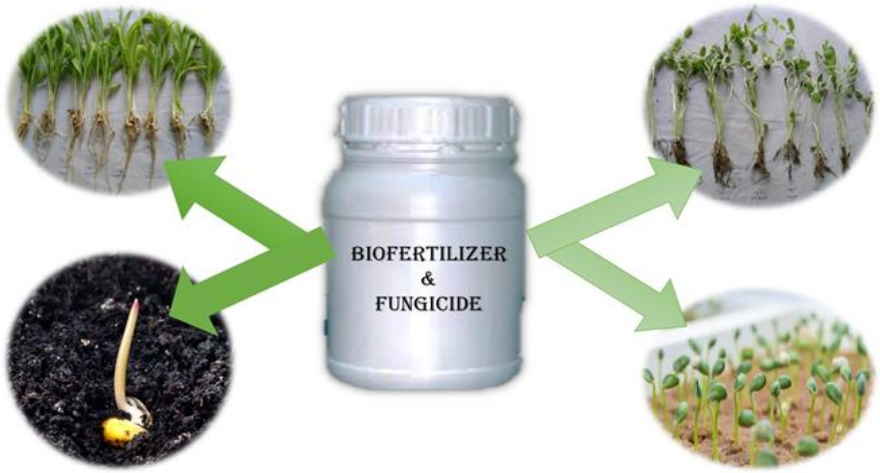
Abstract:- Agriculture is backbone of any developed country. Due to exploitation in population agriculture production is very sufficient amount so farmer are using chemical synthetic fertilizer which increase agricultural commodity but it become harmful to ecosystem and all diversity So we have to find the alternative ways that is biofertilizer. In this investigation we have study of effect of the biofertilizer on germination and seedling growth root shoot growth .of Soybean (*Glycine max*) & Maize (*Zea mays*) . Under the different treatment condition of biofertilizer 0.1%,0.5%,0.10%.0.25%.Which conclude that the germination and seedling growth it best in under the biofertilizer treatment condition. The biofertilizer is one of alternative ways of fertilizer which eco-friendly which best supplement of growth and development in agricultural crops

Keywords: *Biofertilizer, Fungicide, Germination ,Root Shoot Growth.*

Graphical Abstract :



I. INTRODUCTION

Agriculture is backbone of any country . Crops productivity is generally base on the seed germination and subsequent growth stages such as seedling growth that leads to economic loss of farmer and indirectly country economy (Firuzsalari, S. M et al, 2012).Food production and supply is important stream that can done by Agriculture .As compare population expanding the agriculture are is too short to food production area so that human had develops some techniques that minimum area large production in agriculture has done is by adding fertilizer in soil which enhance their fertility that nutrient amount which is responsible for the growth and development (Vance, C. P., et al, 2000 &Kawalekar, J. S. 2013)The coincident application of biofertilizer is frequently recommended firstly for improvingbiological, physical and chemical properties of soil (El-Habbasha, S. F et al 2007) Soil contained reserved amount of nutrient are present. But for plant growth and development require more amount of nutrient so sometime farmer have to face the economic losses . So that fertilizer designed in such way that that adds number of essential nutrient for growth and development but due to more quantity of synthetic fertilizer it adds more chemical into soil that make difficult to growth and development of crop .To avoid the loss soil and crop we have to use biofertilizer which is eco-friendly .(Chen, J. H. 2006). Use of chemical pesticide and fertilizerby the Indian farmer is more amount in the recent years due to which it leads to problems in plants as well as animal health serious problem disease and abnormalities also imbalance in ecosystem. So we need to find the alternative option which improve the soil fertility but which are eco-friendly that being a biofertilizer .In same way chemical pesticide ,fungicide, insecticide which also producing the impact on the plants of hazardous chemical substance which affects on growth and development of crops so that we needs to bio inputs in all this contents which become eco-friendly (Kawalekar, J. S. 2013) The production healthy food from agriculture is very less amount as compare to population increasing. So its impact on

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economy of country. We need the more food productivity in less time and low space .For that we need supply external growth nutrient for the growth and development of crop is become a faster. So plant nutrient is important and vital role of in Agriculture The Plant Nutrient come from biofertilizer. Nature and composition of each fertilizer is different. Biofertilizer have effect in improvement in growth nutrient of soil ultimately in plants growth and development which is eco-friendly (Chen, J. H. 2006) The effect of bio-fertilizer, phosphorus and foliar application of micronutrients on drymatter accumulation, yield, and phosphorus and zinc concentration of maize *(Zea mays* L)(Galavi, M., et 1l ,2011).

Biofertilizer is made up of with helps of living microbes .Biofertilizer are most important group of microbes are nitrogen fixing bacteria, potassium solubilizing, phosphate solubilizing bacteria,*Rhizobium spp, Azospirillium*spp etc. The use of biofertilizer that's help to increase in nutrient to host plant. When applied to their seeds plant surface or soil by colonizing rhizosphere of plant. Biofertilizer are most cost effective as compare to chemical fertilizer. Bacterial biofertilizers are plant growth-promoting rhizobacteria that are applied in the field topromote crop growth and reduce the need for chemical fertilizers. It promote plant growth inmany ways, including nitrogen fixation, phosphorus dissolution, secretion of chelating substancessuch as siderophores; cyanide and extracellular polysaccharide; and plant hormones such as indoleacetic acid (Beneduzi, A et al, 2012 &Shen, F. T et al 2019) .The effect of Plant Growth Promoting Rhizobacteria on seed germination ,seedling growth and yield of grown maize were evaluate three experiment .In this experiment bacterial strain *of P .putida ,P. flurence,A.lipoferum, A.barsilense* during experiment has conclude that effect of PGPRS enhance the germination of seed, seedling length, root length and shoot length vigour index significantly affected (Nezarat, S. et al 2009) .Plant growth promoting rhizobacteria (PGPR) are used generally used for the biofertilizer preparation that produce affect on the plant growth development ultimately and yield has been reported (Noumavo, P. A et al, 2013).*Azospirillum, Pseudomonas and Azotobacter* strains couldaffect seed germination and seedling growth has been reported (Kamran, S et al, 2010). Their was an experiment was conducted that plant grown in chamber where chickpea are grown in plastic cups containing soil and mixed with isolates of PGPRto investigate the effect of PGPR on the growth of chickpea plant. Isolates of PGPR induced production of planthormones (indole acetic acid), phosphate solubilization and ammonia production to enhanced plant growth. Mostof isolates resulted in a significant increase in shoot length, root length and dry matter production of shoot androot of chickpea seedlings(Yadav, J.,et al, 2010).Although protection of seeds and seedlings from pests and disease organisms is theprime aim of seed treatment, secondary affects on the germination and growth are more likely to occur from seed treatments as well as from accumulated residues resulting from repeated use of pesticides In recent year the use of pesticide revealed the problem we have to face (Dhanamanjuri, W et al. 2013) Some commonly used pesticide is Neon and Chloropyrifos having effect on the germination and plant growth. In the present study, the effect of over application of two commonly used pesticides (Neon and Chloropyrifos) was evaluated on the germination, seedling vigor and photosynthetic pigments in brinjal(Nikam et al, 2020). Their was one report is available that tells that in relation to treatment of the seeds *Cicer arietinum and Zea mays* with various concentrations of fungicides. Effect of fungicides((i.e.Captan,Bavistin, Domarck, Blitox and Sitara) on the seed germination, growth andbiomass production of Cicer arietinum and Zea mays were observed in vitro.(Dhanamanjuri, W et al. 2013). The fungicide (namely kitazin, hexaconazole and carbendazim) shows the toxicological impact on plant growth has been reported that the biological, chemical and morpho-anatomical changes of peas .when fungicide treated with plants that caused a slow gradual reduction in growth symbiosis and yields of peas, which, however, varied appreciably among species and concentrations of the three fungicides. Of the three fungicides, carbendazim had the most lethal effect, in which it delayed seed germination and also diminished the overall pea growth.(Shahid, M et al, 2018).The phytotoxicity of phytotoxicity of silver nanoparticles (AgNPs) on an important crop plant Pennisetum glaucum The silver nanoparticles (AgNPs) were synthesized using aqueous leaf extracts of Cassia auriculata (Family: Leguminosae)(Parveen, A., et al 2015)Soybena(*Glycine max)* from family Fabaceae and Maize (*Zea mays*) from family Poaceae biofertilizer and fungicide action we have study

II. MATERIAL METHOD

The experimental analysis we have select two plants Soybean/Soyabean (*Glycine max*),from familyFabaceae ,Maize, Corn (*Zea Mays*) from family Poaceae. That can be used for the study seed germination and seed vigour index (root and shoot length) against fertilizer and fungicide. So we have to take healthy seed of this plants which was properly surface sterilized by using sterilized with 2 % sodium hypo chloride (Dhanamanjuri, W et al 2020).The solution of biofertilizer and fungicide of different concentration is prepare respectively 0.5%, 0.50%.0.75%,100% of each and treated to plant material. The biofertilizer use are Biotech kit, Nitrobact and fungicide Bavistin are used . The fertilizer are produce by using microbial culture of which helps on nitrogen fixation in soil and make soil fertile. The fungicide bavistin are used for the control the fungus growth on the plants For the analysis we have to select split plotexperiment based on randomized complete blocks design (RCBD) (Galavi, M., et 1l ,2011).The overall experiment are shown in Table no 1 biofertilizer and fungicide treatment and experiment details are explain such as which type of crop, treatment of fertilizer and fungicide how design to experiment ,spacing between the crop , time require to see result and sample volume per plot are explain in it. Seed germination percentage are calculated by using the germinated seed and the seedling growth can measure by using the ratio of shoot and root growth

Figures:

Fig 1 : - Biofertilizer applied to Maize

Fig 2 : - Seeds of Zea mays(Maize) sown

Fig 3: - Germinated seeds of maize on 5th Day

Fig 4:-Maize Seedlings on 10th Day

Fig 5: - Comparison between Control(left) and 1.25gm Biotech Kit(Right)

Fig 6: - Germinated seeds of maize on 5th Day

Fig 7 : - Seeds of Glycine max(Soyabean) sown

Fig 8: - Germinated seeds of Soyabean on 5th Day

Fig 9 : - Soyabean Seedlings on 10th Day

Fig 10 : - Comparison between Control(left) and 1.25gm Biotech Kit(Right)

Fig 11 : -Comparison between control(Left) and 0.5ml Nitrobact(Right)

III. RESULT DISCUSSION

We have done the analysis of the of biofertilizer like biotech kit and nitrobact and fungicide like bavistin on plant growth and development in terms of germination and plant vigour root shoot length . Treatment analysis was done on two commercial plants Soybean *(Glycine max)* and maize *(Zea mays).* All this mutagen prepare in different concentration on experimental plant such as 0.25% ,0.50%, 0.75%.1%,1.25%,1.50% along with control condition. The overall result of experiment of as shown in (Table no : 2). That shows that different concentration are treated respectively tray no T1,T2,T3,T4,T5,T6,T7,T8 which being treated as different concentration of biofertilizer and fungicide they shows result maize plant are highest germination percentage 100%(50/50 seed germinate) in T3,T4 under the treatment of biotech kit 0.75gm and biotech kit 1 gm while lowest germination show in the T7 ,T1 in control and bavistin treatment as shown in (Graph no 2)The treatment biofertilizer and fungicide treatment on germination of soybean as shown in (Table no 2)and (Graph no :3)the effect of biofertilizer and fungicide on germination that explain T3,T4 shows the 100% germination under the treatment of biotech (0.75gm and 1gm). The effect of pesticide like Captan,Carbendazim, Tetraconazole, Hexaconazole and Copperoxychloride on the germination of *Cicer arietinum* it was observed gave 100%germination in all the concentrations viz, 1 ppm, 10 ppm,50 ppm and 100 ppm of Captan and Carbendazimfungicide. And the concentrations 50 and 100 ppm ofTetraconazole showed the highest inhibitory effect on thegermination while in *Zea mays* effect was observed Bavistin (1 ppm) having 96.66% germination followed byCarbendazim 10 ppm and 1 ppm of Captan fungicidesrespectively having 90.00% germination. and 1ppmconcentration of Tetraconazole showed the highestinhibitory effect (i.e. 23.33%) followed by 100 ppm giving26.66% germination. (Dhanamanjuri, W.et al,.2013) Carbendazim at 3000 µg kg−1 maximally reduced the germination, SVI, size of roots and shoots and total dry matter accumulation in roots, shoots and whole plants distinctly by 40%, 84%, 72%, 73%, 68%, 75% and 73% ($p \leq 0.05$), respectively.(Shahid, M et al, 2018) The maize seedling growth effect of biofertilizer and fungicide are highest length of root at 5^{th} day are produced by T4 biotech (1gm) that is 11.8cmand lowest are T1 at control condition 6.1cm. while root at 10^{th} day highest growth seen in treatment of Biotech (1.25gm) is 17.8cm in T5 while in lowest in T8 under treatment Nitrobact (0.5ml) is 8.9cm.The growth of shoot at 5^{th} day highest in T3 is 9.2cm under treatment biotech (0.75gm) and minimum growth of shoot is T1 under the treatment of control 4.1cm has been shown in (Table no 2)and (Graph no1) The effect of biofertilizer and fungicide on root growth at 5^{th} day is highest in T8 7,7 cm under the nitrobact (0.5ml) while lowest in the T1 under the control condition is 2.7cm . At the 10th days growth of root shows highest in T6 is 8.4cm under the treatment biotech

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(1.50 gm) while lowest T1 is 4.8cm under the control condition The effect of biofertilizer and fungicide on shoot at 5th day maximum in T8 is 14.6cm under the treatment of nitrobact (0.5ml) while lowest in T 1 is 7.25cm under the treatment. After the 10th day they shows the highest growth of shoot is in T6 is 8.4cm under the treatment is biotech kit (1,50 gm) while in the lowest T1 is 4.8cm under the treatment of control condition as shown in (Table no 2 and Graph no 4) All this effect we can observe in Fig 1-11 effect of biofertilizer and fungicide on the maize and soybean The effect of PGPR of root dry mass variation on the different treatment of PGPR on chickpea plants that have investigate that the isolateBHUPSB02 produced the highest root dry weight (7.5 mgplant–1) followed by BHUPSB04 (7.3 mg plant–1), BHUPSB13(6.5mg plant–1) and BHUPSB17 (6.3 mg plant–1) incomparison to control and other isolates. While in the shoot highestshoot length 15.6 cm plant–1 was recorded in treatment of*P. putida* BHUPSB04 isolate followed by statistically at parvalues due to BHUPSB02 (14.5 cmplant–1). *B. subtilis* BHUPSB13, *P. polymyxa* BHUPSB17 and*B.* isolates *P. aeruginosa boronophillus* BHUPSB19 showed significantly highershoot length over control. (Yadav J, et al, 2010)

Table no 1 : Biofertilizer and chemical fungicide applied on seed sampleExperimental detail

1	**Crop**	**Maize*(Zea mays)***
	Experimental design	Randomized block design
	Treatment	8
	Tray size	45cmx30cm
	Spacing	5cmx4cm
	Fertilizer	Biotech kit ,Nitrobact ,Bavistin
	Duration of result	One month
	Sample volume seed	50gm /tray
2	**Crop**	**Soyabean (*Glycin max)***
	Experimental design	Randomized block design
	Treatment	8
	Tray size	45cmx30cm
	Spacing	5cmx4cm
	Fertilizer	Biotech kit , Nitrobact ,Bavistin
	Duration of result	One month
	Sample volume of seed	50 gm / tray

Table 2 : - Effect of Biofertilizer on Germination Performance of seeds of maize(***Zea mays)*** recorded on 5th and 10th Day

Tr. no	**Seed sown per tray**	**Germinated seedtray**	**Treatment**	**Shoot length 5th day**	**Root length 5th day**	**Shoot length 10th days**	**Root length 10th days**	**No of root 5th days**	**No of root 10th days**
T1.	50	46	Control	4.1cm	6.1cm	9cm	10.2cm	4	4
T2.	50	49	Biotech kit(0.5gm)	7.8cm	9.9cm	11.3cm	15cm	5	6
T3.	50	50	Biotech kit(0.75gm)	9.2cm	9.4cm	10.7cm	11.3cm	5	6
T4.	50	50	Biotech kit(1gm)	6.8cm	11.8cm	11.1cm	14.8cm	6	7
T5.	50	48	Biotechkit(1.25gm)	6.7cm	9cm	11.8cm	17.8cm	6	7
T6.	50	48	Biotech kit(1.50 gm)	6.3cm	5.8cm	11.05cm	13.1cm	5	6
T7.	50	46	Bavistin(0.05 gm)	5.8cm	7.3cm	9.11cm	11.5cm	5	6
T8.	50	48	Nitrobact(0.5ml)	4.7cm	6.2cm	11.3cm	8.9cm	6	7

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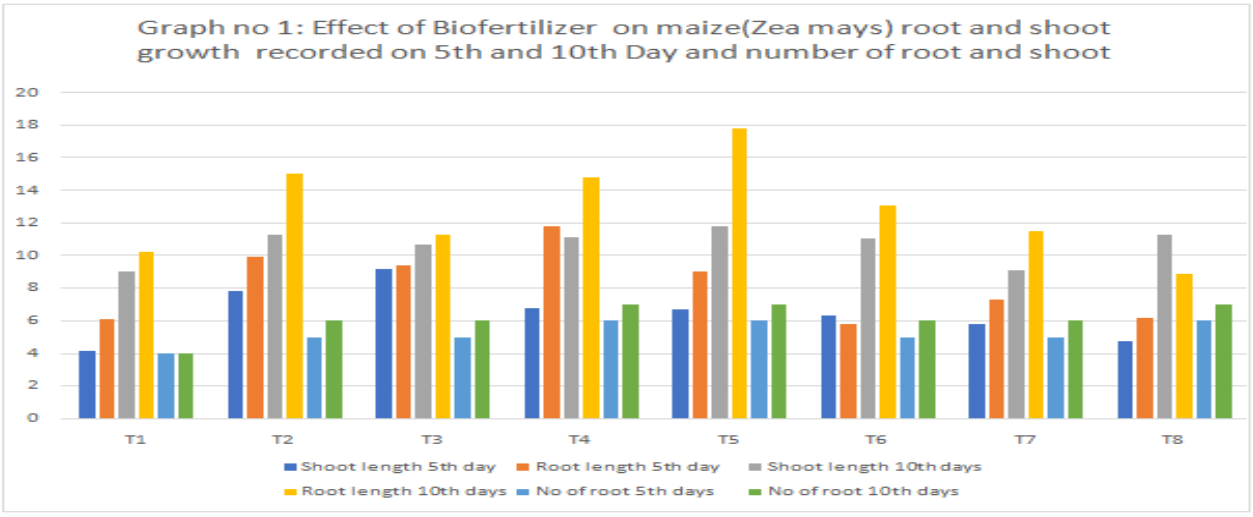
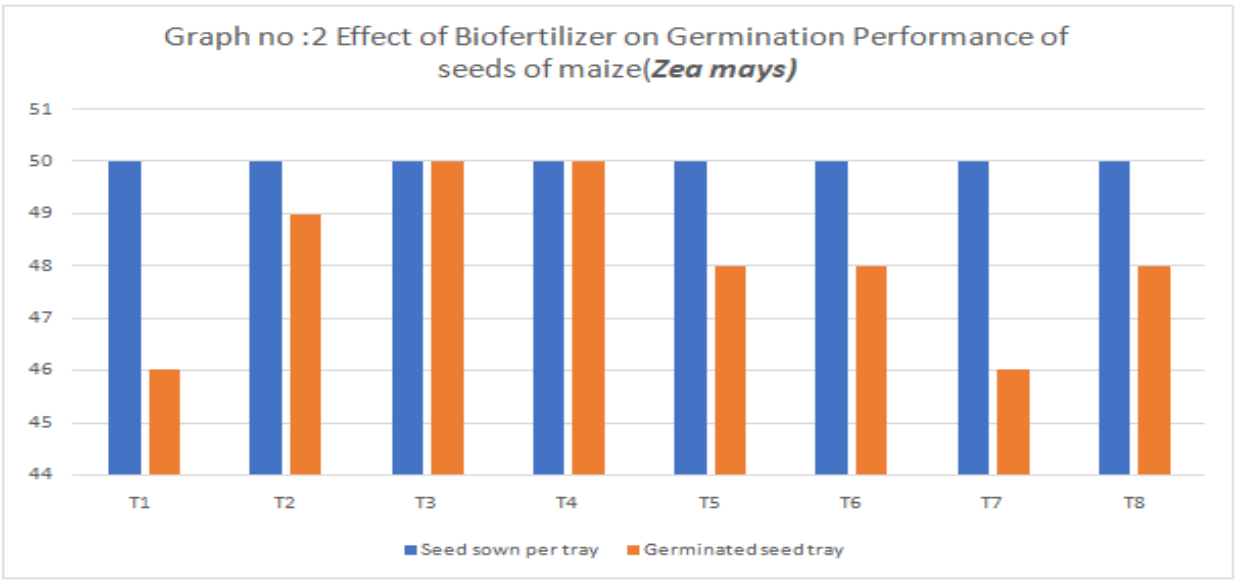
Table 3 : - Effect of Biofertilizer on Germination Performance of seeds of Soyabean(***Glycine max)*** recorded on 5th and 10th Day.

Tr. no	Seed sown per tray	Germinated seed /tray	Treatment	Shoot length 5th day	Root length 5th day	Shoot length 10th days	Root length 10th days	No of root 5th days	No of root 10th days
T1.	50	46	control	7.25cm	2.7cm	9.4cm	4.8cm	4	6
T2.	50	49	Biotech kit(0.5gm)	10.6cm	3cm	15.8cm	6.8cm	6	11
T3.	50	50	Biotech kit(0.75 gm)	11.75cm	4cm	13.42cm	6.2cm	7	13
T4.	50	50	Biotech kit(1 gm)	9cm	6.2cm	16.4cm	5.4cm	8	13
T5.	50	48	Biotech kit(1.25 gm)	12.8cm	4.1cm	17cm	7.3cm	5	12
T6.	50	48	Biotech kit(1.50 gm)	13.2cm	6.2cm	16.2cm	8.4cm	6	13
T7.	50	46	Bavistin(0.05 gm)	9.8cm	3.42cm	14.8cm	7.3cm	4	10
T8.	50	48	Nitrobact(0.5 ml)	14.6cm	7.7cm	17cm	7.2cm	6	12

Graph:





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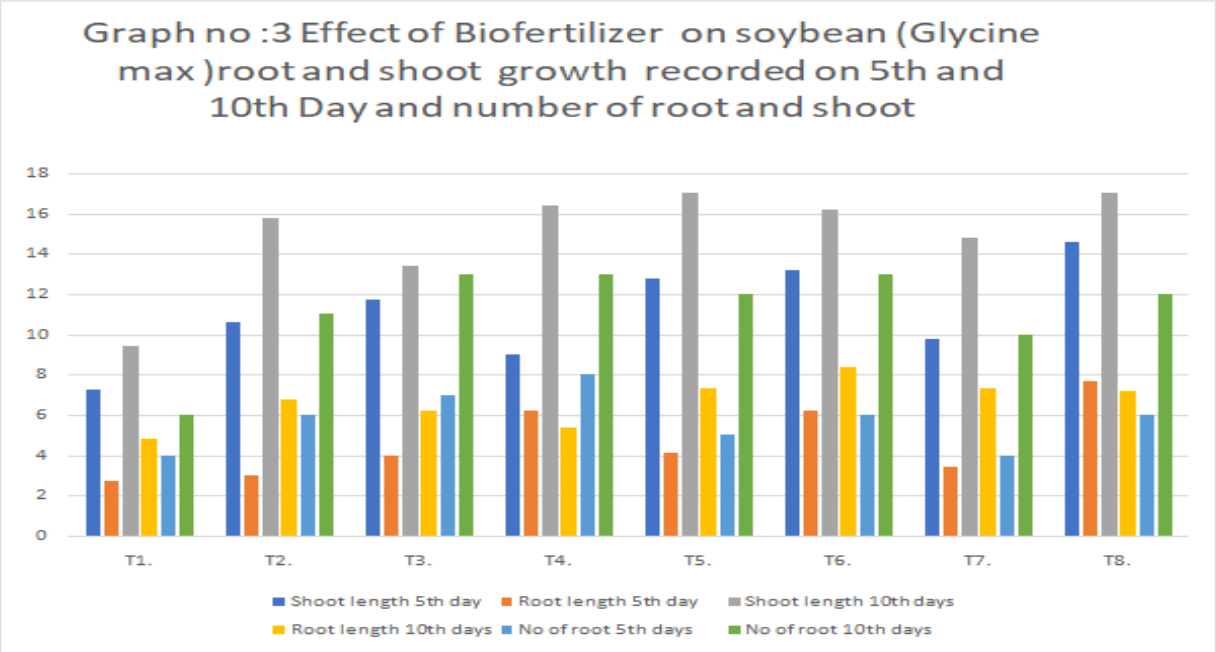

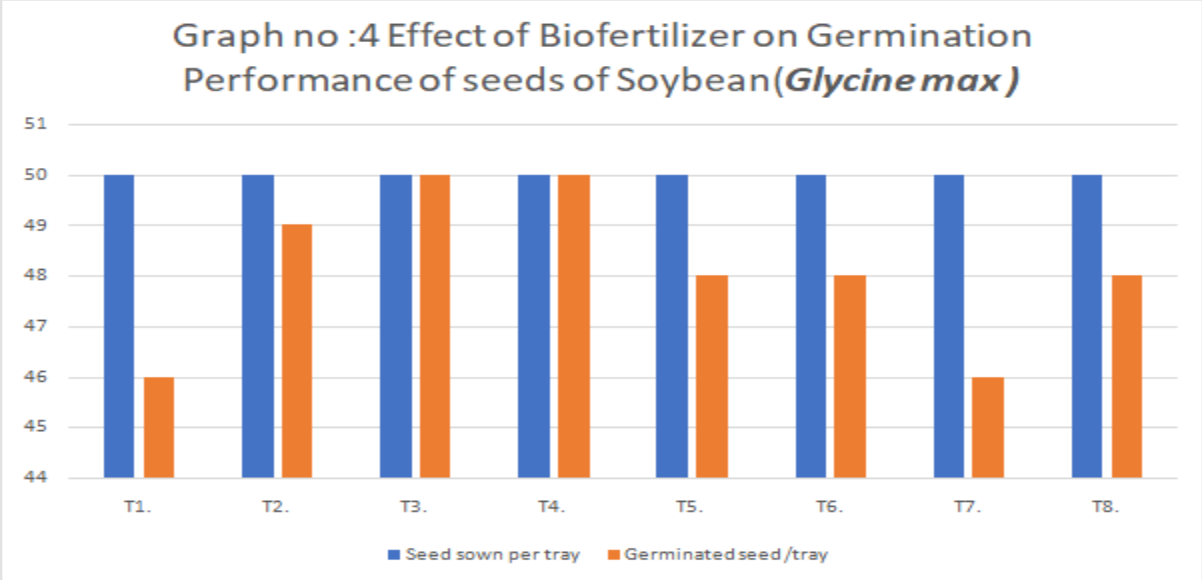

IV. CONCLUSION

In this investigation we have conclude that two plants soybean *(Glycine max)* and maize *(Zea mays)*that shows best germination and root and shoot growth under the treatment of biofertilizer and fungicide .Biofertilizer is more effective than chemical fertilizer to induce plant growth and yield production. Their effect has been exhibited through increasing plant height and growth and development of maize, soyabean production. The highest result was obtained from treatment with bio-fertilizer namely Biotech-kit , Nitrobacter and chemical fungicide(Bavistin). The experiment indicates that plants grown with Biofertilizer produced higher growth rates compared to the Chemical fertilizer.

REFERENCES

[1]. Beneduzi, A., Ambrosini, A., & Passaglia, L. M. (2012). Plant growth-promoting rhizobacteria (PGPR): their potential as antagonists and biocontrol agents. Genetics and molecular biology, 35(4), 1044-1051.

[2]. Biswas, B.C. Yadav, D.S., and Satish Maheshwari, 1985. Bio-fertilizers in Indian Agriculture. Fertilizer News 30(10): 20-28.

[3]. Bumandalai, O., &Tserennadmid, R. (2019). Effect of Chlorella vulgaris as a biofertilizer on germination of tomato and cucumber seeds. *International Journal of Aquatic Biology*, *7*(2), 95-99.

[4]. Chen, J. H. (2006, October). The combined use of chemical and organic fertilizers and/or biofertilizer for crop growth and soil fertility. In *International workshop on sustained management of the soil-*

rhizosphere system for efficient crop production and fertilizer use (Vol. 16, No. 20, pp. 1-11). Land Development Department Bangkok Thailand.

[5]. Dhanamanjuri, W., Thoudam, R., & Dutta, B. K. (2013). Effect of some pesticides (Fungicides) on the germination and growth of seeds/seedlings of some crop plants (ie Cicer arietinum and Zea Mays). Middle East J Sci Res, 17(5), 627-632.

[6]. El-Habbasha, S. F., Hozayn, M., & Khalafallah, M. A. (2007). Integration effect between phosphorus levels and bio-fertilizers on quality and quantity yield of faba bean (Vicia faba L.) in newly cultivated sandy soils. *Research Journal of Agriculture and Biological Sciences*, *3*(6), 966-971.

[7]. Firuzsalari, S. M., Mirshekari, B., &Khochebagh, S. B. (2012). Effect of seed inoculation with bio-fertilizer on germination and early growth of corn. *Int Res J App Basic Sci*, *3*, 1097-102.

[8]. Galavi, M., Yosefi, K., Ramrodi, M., & Mousavi, S. R. (2011). Effect of bio-phosphate and chemical phosphorus fertilizer accompanied with foliar application of micronutrients on yield, quality and phosphorus and zinc concentration of maize. *Journal of Agricultural Science*, *3*(4), 22.

[9]. Goel, A. K., Laura, R. D., Pathak, D. V., & Goel, A. (1999). Use of biofertilizers: Potential, constraints and future strategies-a review. *International Journal of Tropical Agriculture*, *17*(1/4), 1-18.

[10]. Hossain, M. M., Das, K. C., Yesmin, S., & Shahriar, S. (2016). Effect of plant growth promoting rhizobacteria (PGPR) in seed germination and root-shoot development of chickpea (Cicer arietinum L.) under different salinity condition. *Research in Agriculture Livestock and Fisheries*, *3*(1), 105-113.

[11]. Ibiene, A. A., Agogbua, J. U., Okonko, I. O., &Nwachi, G. N. (2012). Plant growth promoting rhizobacteria (PGPR) as biofertilizer: Effect on growth of Lycopersicum esculentus. *J. Am. Sci*, *8*(2), 318-324.

[12]. Kamran, S., Shazia, A., & Shahida, H. (2010). Growth responses of Helianthus annus to plant growth promoting Rhizobacteria used as a biofertilizers. International Journal of Agricultural Research, 5(11), 1048-1056.

[13]. Kawalekar, J. S. (2013). Role of biofertilizers and biopesticides for sustainable agriculture. *J Bio Innov*, *2*(3), 73-78.

[14]. Kumar, H., Dubey, R. C., & Maheshwari, D. K. (2011). Effect of plant growth promoting rhizobia on seed germination, growth promotion and suppression of Fusarium wilt of fenugreek (Trigonella foenum-graecum L.). *Crop Protection*, *30*(11), 1396-1403.

[15]. Li, R., He, J., Xie, H., Wang, W., Bose, S. K., Sun, Y., ... & Yin, H. (2019). Effects of chitosan nanoparticles on seed germination and seedling growth of wheat (Triticum aestivum L.). *International journal of biological macromolecules*, *126*, 91-100.

[16]. Nagananda, G. S., Das, A., Bhattacharya, S., & Kalpana, T. (2010). In vitro Studies on the Effects of Biofertilizers(Azotobacter and Rhizobium) on Seed Germination and Development of Trigonella foenum-graecum L. using a Novel Glass Marble containing Liquid Medium. *International Journal of Botany*, *6*(4), 394-403.

[17]. Nezarat, S., &Gholami, A. (2009). Screening plant growth promoting rhizobacteria for improving seed germination, seedling growth and yield of maize. *Pakistan journal of biological sciences*, *12*(1), 26.

[18]. Nikam, G., & Barwant, M. THE EFFECT OF COMMONLY USED PESTICIDE ON THE SEED GERMINATION, PLANT VIGOR AND PHOTOSYNTHETIC PIGMENT BRINJAL (SOLANUM MELONGENA L.).

[19]. Noumavo, P. A., Kochoni, E., Didagbé, Y. O., Adjanohoun, A., Allagbé, M., Sikirou, R., ... & Baba-Moussa, L. (2013). Effect of different plant growth promoting rhizobacteria on maize seed germination and seedling development. *American Journal of Plant Sciences*, *4*(5), 1013.

[20]. Parveen, A., & Rao, S. (2015). Effect of nanosilver on seed germination and seedling growth in Pennisetum glaucum. Journal of Cluster Science, 26(3), 693-701.

[21]. Shahid, M., Ahmed, B., Zaidi, A., & Khan, M. S. (2018). Toxicity of fungicides to Pisum sativum: a study of oxidative damage, growth suppression, cellular death and morpho-anatomical changes. RSC advances, 8(67), 38483-38498.

[22]. Shen, F. T., Yen, J. H., Liao, C. S., Chen, W. C., & Chao, Y. T. (2019). Screening of rice endophytic biofertilizers with fungicide tolerance and plant growth-promoting characteristics. *Sustainability*, *11*(4), 1133.

[23]. Singh, M. P., Kumar, P., Kumar, A., Kumar, R., Diwedi, A., Gangwar, S., ... &valkumar Sepat, N. (2016). EF FECT OF NPK WITH BIOFERTILIZERS ON GROWTH, YIELD AND NU TRI ENT UP TAKE OF WHEAT (TRITICUM AESTIVUM L.) IN WEST ERN UTTAR PRADESH CON DI TION.

[24]. Vance, C. P., Graham, P. H., & Allan, D. L. (2000). Biological nitrogen fixation: phosphorus-a critical future need?. In Nitrogen fixation: From molecules to crop productivity (pp. 509-514). Springer, Dordrecht.

[25]. Venkatashwarlu, B. (2008). Role of bio-fertilizers in organic farming: Organic farming in rain fed agriculture: Central institute for dry land agriculture. *Hyderabad. Pakistan. pp*, 85-95.

[26]. Wani, S. P., & Lee, K. K. (1995). Microorganisms as biological inputs for sustainable agriculture. *Organic Agriculture (Thampan PK ed.). Cochin, India: Peekay Tree Crops Development Foundation*, 39-76.

[27]. Yadav, J., Verma, J. P., & Tiwari, K. N. (2010). Effect of plant growth promoting rhizobacteria on seed germination and plant growth chickpea (Cicer arietinum L.) under in vitro conditions. In *Biological Forum* (Vol. 2, No. 2, pp. 15-18).