International Journal Of

Recent Scientific Research

ISSN: 0976-3031

Volume: 7(5) May -2016

EFFECT OF TRICHODERMA ENRICHED BIOFERTILIZERS ON MORPHOLOGICAL PARAMETERS AND NPK CONTENT OF *KAEMPFERIA GALANGA* AND *COSTUSIGNEUS* L. N.E.br

Varsha J., Uzma Amin and Savitha M Murthy

THE OFFICIAL PUBLICATION OF
INTERNATIONAL JOURNAL OF RECENT SCIENTIFIC RESEARCH (IJRSR)
http://www.recentscientific.com/ recentscientific@gmail.com

ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 7, Issue, 5, pp. 10768-10771, May, 2016

International Journal of Recent Scientific Research

Research Article

EFFECT OF TRICHODERMA ENRICHED BIOFERTILIZERS ON MORPHOLOGICAL PARAMETERS AND NPK CONTENT OF *KAEMPFERIA GALANGA* AND *COSTUSIGNEUS* L. N.E.br

Varsha J., Uzma Amin and Savitha M Murthy

Department of Botany, Mount Carmel College, Bengaluru, India

ARTICLE INFO

Article History:

Received 19th February, 2016
Received in revised form 12th March, 2016
Accepted 26th April, 2016
Published online 28th May, 2016

Keywords:

Trichoderma, rhizobacteria, biofertilizer, NPK, biomass

ABSTRACT

A pot culture experiment was conducted in botanical garden of Mount Carmel College, Bengaluru, India, to study the effect of *Trichoderma* and in combination with other biofertlizers and on morphological parameters and NPK content of *Kaempferiagalanga* and *Costusigneus*. The results showed that mixture of rhizobacteria along with *Trichoderma* showed better result. NPK content also increased in the plants inoculated with mixture of biofertilizers compared to *Trichoderma* alone. All growth parameters like plant height, number of leaves and biomass showed better result in the mixture inoculated plants. Application of the *Trichoderma* alone or in combination exhibited in general a considerable improvement in above bio nutrient parameters as compared to their respective control. *Kaempferia galanga* was better compared to *Costusigneus* in growth as well as in NPK content.

INTRODUCTION

Medicinal and aromatic plants represent an important source of income in agriculture section of national economy in many countries. Plants are the source of raw materials for the medicines manufactured under various systems of Pharmacology.

The existence of life on earth is favoured by the cycyling of biological elements wherein the complex biological systems after their decay are converted to simpler forms. These cycles like carbon, sulphur, phosphorous and nitrogen are essential for bilogy and the role played by micro organisms in these cycles is important.

Inorganic fertilizer plays a significant role in environmental pollution. Among the inorganic fertilizers, nitrogen fertilizer increases denitrification, resulting in elevated emission of nitrous oxide (N_2O) to the atmosphere resulting in global warming (Smith *et al.,* 2008). The application of nitrogen fertilizers may deplete soil organic carbon in the long run (Khan *et al.,* 2007).

Instead, biofertilizers prevent depletion of the organic matter and also increases yield and reduce environmental pollution (Miaand Shamsuddin, 2010). Biofertilizers are live formulations of micro organisms that are ready to be used and improve the quality and the health of soil. Nitrogenous

biofertilzers harvest atmospheric nitrogen and convert into ammonical form which is made available to plants or is released in soil. Phosphate biofertilizers solubilise the fixed forms of phosphorous present in soil and made available for the use of plants. They naturally activate the micro organisms found in the soil restoring the soils natural fertility and protecting it against drought and stimulate plant growth. Use of biofertilizers is one of the important components of integrated nutrient management as they are cost effective and renewable source of plant nutrients to supplement the chemical fertilizer for sustainable agriculture.

The asymbioticdiazotrophic bacteria belong to the genera like *Azotobacter, Azospirillum, Pseudomonas* are able to exert positive effect on plants by producing and secreting plant growth regulators and by supplying biologically fixed nitrogen. *Trichoderma*, afungi genus are biocontrol agents that are successfully used as biopesticides. Several species of *Trichoderma* are reported to produce secondary metabolites with antibiotic activity (Reino *et al.,* 2008). It also promote growth, improves crop yield, increase nutrient availability and enhance disease resistance.

Kaempferia galanga belongs to Zingiberaceae family commonly known as aromatic ginger or sand ginger. It consists of dark brown rounded rhizome. The major active principle includes cineol, borneol, camphene, kaempferol, kaenpferide, etc. The rhizome of plants which contain essential oils have been used in Chinese medicine as a decoction or powder treating indigestion, cold, abdominal pains, head ache and tooth ache. The decoction and sap of leaves may have hallucinogenic

Corresponding author: **Savitha M Murthy*
Department of Botany, Mount Carmel College, Bengaluru, India

properties, which may be due to unidentified chemical components of the plants essential oil fraction.

Costusigneus (Insulin plant) commonly called as spiral flag belongs to the family Costaceae. It is herbaceous plant, grows very quickly and the propagation is by stem cutting. It needs sunshine but it also grows in slightly shady areas. The major active principle of this plant is Insulin like Protein (ILP). Its leaves help to build up insulin in the human body so called as Insulin plant. It is now accepted and used widely as an Ayurvedic Medicinal herb. In traditional medicine, it is also used to promote longetivity. Treats rash, reduces fever, treats asthma, bronchitis and to eliminate intestinal worms. The plant is used as an ingredient in cosmetic.

In this study, effect of *Trichoderma* and mixture of rhizobacteria with *Trichoderma*on the morphology and NPK content of the two plants *Kaempferia galanga* and *Costusigneus*were observed.

MATERIALS AND METHODS

The plant saplings *Kaempferia galanga* and *Costusigneus* were collected from GKVK, University of Agricultural Sciences, Bengaluru. The biofertilizers like *Trichoderma*and mixture of rhzobacteria like *Azotobacter, Azospirillum, Pseudomonas* and *Trichoderma* were collected from Indian Institute of Horticulture, Hessaraghatta, Bengaluru. The study was carried out in a randomized complete block design (RCBD) with two treatments in three replications.

The biofertilizers were inoculated to the pots after 15 DAP (days after planting) at interval from 30, 60 and 90 DAP. Without biofertilizer served as control. Morphological parameters of the two plants were recorded. Plant height (from the base of the plant to the canopy) was measured on 30, 60 and 90 DAP. The data recorded for 3 plants for each treatment were analyzed statistically. The biomass of the plants was determined by drying the plant materials at 60oC for 72 hrs in hot air oven at 90 DAP.

The leaf samples were collected after inoculation at an interval of 30, 60 and 90 days and were in hot air oven at 60^{o}C for 72 hrs. For nitrogen estimation, samples were digested in sulphuric acid and estimated by Kjeldhal method. Phosphorous and potassium, the samples were digested in di-acid (nitric and perchloric acid). Phosphorous was determined by vanadomolybdate yellow colour method on spectrophotometer while leaf potassium in the extract was measured with flame photometer.

Statistical analysis

Data analysis was done by using SPSS software. The ANOVA test was used to determine significant ($P<0.05$) treatment effect and DMRT to determine significant difference between individual means.

RESULTS AND DISCUSSION

Vegetative growth: Vegetative growth suchas plant height, number of leaves per plant was significantly influenced by the application of *Trichoderma* alone or in combination with rhizobacteria (Table 1). The maximum plant height, number of leaves were recorded in *K. galanga* and *C. ignaeus* treated with mixture compared to *Trichoderma* alone. *K. galanga* showed better response than *C. ignaeus*. The impact of scenario of *Trichoderma* enriched biofertilizers in *Kampferia* was to some extent different from the *Costus*. The plant height of *K. galanga* was lowest in *Trichoderma* inoculated plants (25cms). *Trichoderma* enriched biofertilizers significantly increased the plant height (38.92cms). Similarly there was a significant difference in the plant height of *C. ignaeus* which showed highest plant height (38.02 cms) in *Trichoderma* enriched biofertilizers and (27.90cms) in *Trichoderma* treated plants. But, both the plants have showed highest plant height in mixture, but there was no significant difference.

Trichoderma species increases nutrient uptake through enhanced root growth or promoted availability of necessary nutrients leading to growth of plants by increasing the rate of growth. (Molla *et al.,* 2012). *Trichoderma* alone did not increase the plant height, number of leaves per plant in *K. galanga* and *C. ignaeus* compared to *Trichoderma* enriched biofertilizers. There was a significant difference in plant height in biofertilizers inoculated plants than control. *Kampferia* has shown better response compared to *Costus*.

The number of leaves per plant was significantly lower in sole application of *Trichoderma* and control. But the *Trichoderma* enriched biofertilizers significantly increased the number of leaves per plant in both the plants (Table 1).

Plant growth stimulation by *Trichoderma* species and other microbes has been reported in several crops such as bean (Inbar *et al.,* 1994) and tomato (Ozbay *et al.,* 2004). In the present study, it was clearly observed that the mixture of biofertilizers supplemented with *Trichoderma* had positive impact on growth and yield of kampferia galanga and Cotusignaeus. Enhanced growth response of several plants such as maize (Bjorkman *et al.,* 1994) and cucumber (Kleifeld and Chet, 1992) were also noticed by the application of *Trichoderma* species and other biofertilizers (Datta *et al.,* 2009; Lee at al., 2008).

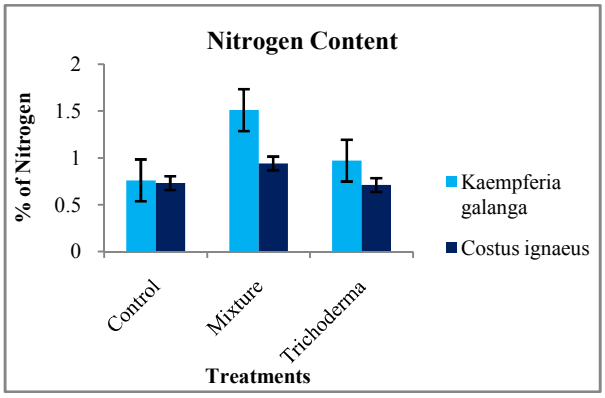
The increased plant growth by *Trichoderma* may be due to production of secondary metabolites which may act as an auxin like compound. The increased nutrient uptake through enhanced root growth or promoted availability of necessary nutrients leading to growth of the plants (Harman *et al.,* 2006). It reduces the concentration of substances in soil that are inhibitory to plant growth (Wang *et al.,* 2000; Windham *et al.,* 1986). Thus, one or several mechanisms may be involved in regulation of growth of *K. galanga* and *C. ignaeus* by *Trichoderma* alone or enriched with biofertilizers.

Total biomass yield: The results (Table 1) showed that the amount of fresh biomass yield has been found to be increased progressively irrespective of treatments over control. However, the highest was seen in the plants treated with mixture of biofertilizers (38.49g). It was observed that the plants with *Trichoderma* treated and mxture treated significantly increased the biomass of the plants. It is recommended to apply with Biofertilizers for the beneficial effects on the environment. This will prevent pollution in excessive amount (Abbasniayzare *et al.,* 2012).

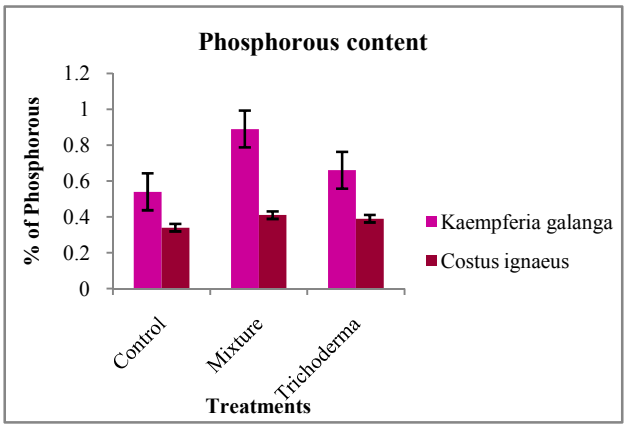
Table 1 Effect of *Trichoderma* and Mixture of Biofertilizers on vegetative growth in *Kampferia galanga* and *Costusignaeus*

	Plant height (cms)			Number of leaves /plant			Total biomass (%)		
	Control	Mixture	*Trichoderma*	Control	Mixture	*Trichoderma*	Control	Mixture	*Trichoderma*
Kampferia galanga	32.38	38.92	25	36	47.14	44.44	31.31	38.49	32.41
Costusignaeus	12.13	38.02	27.90	16.66	39.28	35.14	28.84	35.49	31.48

Nutrient content: Nitrogen: The data on the effect of biofertilizers on *Kaempferia* and *Costus* showed that leaf N content varied from 0.29% to 1.5% (Fig. 1). The maximum N content was in *K. galangal* compared to the *Costusigneus* when treated with mixture of biofertilizers. The N content was more in *K. galanga* plant treated with mixture compared to the *C. ignaeus* plant treated with the same.

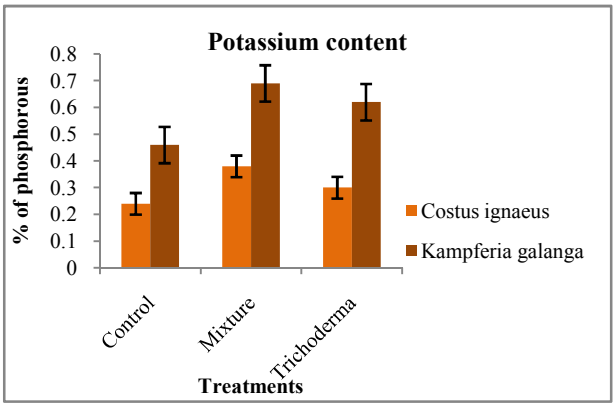


Phosphorous content: The results (Fig 2) showed the amount of P content was recorded highest in mixture compared to *Trichoderma* alone. However, *K. galanga* showed more P content than *C. ignaeus*. And also in Costus there was no significant difference in the P content.



Potassium content: The amount of K content in plants increased in the mixture and *K. galanga* showed better K content than *C. ignaeus* (Fig. 3). In this study nutrient content was found to be higher in plants fertilized with biofertilizer alone or in combination with other biofertilizers.

Nitrogen is one of the major plant nutrient encouraging cell division and the development tissue. Phosphorous and potassium plays important role in most metabolic processes (Shaheen *et al.,* 2013). Free living N_2 fixing bacteria like *Azotobacter, Azospirillum* were found to have not only the ability to fix N_2 but also the ability to release phytohormones similar to GA_3 and IAA, which could stimulate plant growth, absorption of nutrients and photosynthesis (Fayez *et al.,* 1985).



Phosphate dissolving bacteria secrete an organic acid which leads to a transfer of fixed phosphate to available phosphate. This may increase growth of roots in the soil that can take up phosphrous. Gad (2001) reported that N, P and K in leaves of *Foeniculumvulgare* and *Anethumgraveolens* were increased by applying biofertilizers.

The synergistic benefits of the dual inoculation on *K. galanga* and *C. ignaeus* obviously improved the vegetative growth, biomass and nutrition assimilation of the host plants (Vafadar *et al.,* 2014). The improved growth of the dual symbiotic plants is in agreement with the previous study carried out by Hemavathi *et al.,* (2006), who reported improved growth and biomass yield of *Ocimumbasilicum* that was inoculated with *G. fasciculatum* and PGPR. Vaanthkumar (2003) also reported that combined inoculation of *Azospirillum* and PSB produced synergistic effect, resulting in increased root length, shoot length and stem girth in solanceous crop plants.

CONCLUSION

Biofertilizers are ecofriendly safe. The application of biofertilizers in combination and alone has taken in the present study. The results showed in combination with *Trichoderma* showed better result compared when treated alone. Effective biofertilizers reduces not only the load of chemical fertilizers in crop production but also minimizes the pollution by excessive use of latter.

References

Abbasniayzare, S. K., Sedghathoor, S. and Dahkaei, M.N.P. 2012. Effect of biofertilizers application on growth parameters of Spathiphyllum illusion. American – Eurasian J. Agric. Environ. Sci., 12(5): 669-673.

Bjorkman, T., Price, H.C., Harman, G.E., Ballerstein, J. and Nielsen, P. 1994. Improved performance of shrunken 2 sweet corn using *Trichoderma* harzianum as a bioprotectant. Hort. Sci., 29: 471.

Dattaa, J.K., Banerjee, A., SahaSikadar, M., Gupta, S. and Mondal, N.K. 2009. Impact of combined exposure of chemical fertilizer, biofertilizers and compost on growth, physiology and productivity of Brassica

campestris in old alluvial soil. J. Environ, Biol., 30: 797 – 800.

Fayez, M., Eman, N.F. and Makboul, H.E. 1985.The possible use of N2 fixing Azospirillum as biofertilizers for wheat plants. Egypt. J. Microbiol., 20(2): 199 – 206.

Gad, W.M. 2001. Physiological studies on Foeniculumvulgare Mill. And Anethumgraveolens L. M.Sc., thesis, Faculty Agric. Kafr Sheikh, Tanta Univ. Egypt.

Haque, M.M., Ilias, G.N.M. and Molla, A.H. 2012. Impact of *Trichoderma* enriched biofertilizers on the growth and yield of mustard (Brassica rapa L.) and tomato (Solanumlycopersicon Mill.). The Agriculurists, 10(2): 109 – 119.

Harman, G.E., Howell, C.R., Viterbo, A, Chet, I and Lorito, M. 2004. *Trichoderma* species opportunistic, avirulent plant symbionts. Nat. Rev. Microbiol., 2: 43 – 56.

Hemavathi, V.N., Sivakumar, B.S., Suresh, C.K. and Earanna, N. 2006.Efffect of Glomusfasciculatum and plant growth promoting rhizobacteria on growth and yield of Ocimumbasilicam. Karnataka J. Agric. Sci., 19: 17 – 20.

Inbar, J., Abramsky, M., Cohen, D. and Chet, I. 1994. Plant growth enhancement and disease control by *Trichoderma* harzianum in vegetable seedlings grown under commercial conditions. European J. Pl. Pathol., 100: 337 – 346.

Kleifeld, O. and Chet, I. 1992. *Trichoderma* harzianum interaction with plants and effect on growth response. Plant Soil., 144: 267 – 272.

Lee, K.H., Koh, R.H. and Song, H.G. 2008.Enhancement of growth and yield of tomato by Rhodopseudomonas sp. under green house condition.J.Micobiol., 6: 641 – 646.

Mahfouz, S.A. and Sharaf-Eldin, M.A. 2007. Effect of mineral vs. biofertilizer on growth, yield and essential oil content of fennel (Foeniculumvulgare Mill.). Int. Agrophysics., 21: 361 – 366.

Molla, A.M., Haque, M.M., Haque, M.A. and Ilias, G.N.M. 2012.*Trichoderma* enriched biofertilizers enhances production and nutritional quality of tomato (Lycopersicanesculentum Mill.) and minimizes NPK fertilizer use. Agric. Res., 1(3): 265 – 272.

Ozbay, N., Newman, S.E. and Brown, W.M. 2004. The effect of the *Trichoderma* strains on the growth of tomato seedlings. ActaHorticulturae, 635: 131 – 135.

Shaheen, M.A., Sahar, M., Elwalab, A., Elmorsy, F.M. and Ahmed, A.S.S. 2013. Effect of organic and biofertilizers as a partial substitute for NPK mineral fertilizer on vegetative growth, leaf mineral content, yield and fruit quality of superior grape vine. J. Hort. Sci. Orn. Pl., 5(3): 151 – 159.

Vafadar, F., Amooaghaie, R. and Otroshy, M. 2014. Effects of plant growth promoting rhizobacteria and arbuscularmycorrhizal fungus on plant growth, stevoside, NPK and chlorophyll content of Stevia rebaudiana. J. Pl. Interactions., 9(1): 128 – 136.

Vasanthakumar, S.K. 2003. Studies on beneficial endorhizosphere bacteria in solanaceous crop plants. M.Sc., thesis, Dharwad, Karnataka, India.

Wang, C., Knill, E., Glick, B.R. and Defago, G. 2000. Effect of transferring 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase genes into Pseudomonas fluorescens strain CHAO and its gac A derivative CHA96 on their growth promoting and disease suppressive capacities. Can.J. Microbiol., 46: 898 – 907.

Windham, M.T., Elad, Y. and Baker, R. 1986. Mechanism for increased plant growth induced by *Trichoderma* spp. Phytopathol., 76: 518 – 521.

****

How to cite this article:

Varsha J., Uzma Amin and Savitha M Murthy., Effect of Trichoderma Enriched Biofertilizers on Morphological Parameters And Npk Content of Kaempferia Galanga And Costusignaeus. *Int J Recent Sci Res.* 7(5), pp. 10768-10771.

TSSN 0976-3031