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FLOWERING AND ROOT GROWTH RESPONSE IN AFRICAN MARIGOLD (*Tagetus erecta* L.) cv. PUSA BASANTHI GAINDA AS INFLUENCED BY NUTRIENTS AND *PIRIFORMOSPORA INDICA* (PGPRE)

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ABSTRACT

The present investigation on African marigold (Tagetus erecta L.) cv. Pusa Basanthi Gainda was conducted during Rabi season of 2016-2017 under agro-climatic condition of College of Horticulture, Anantharajupeta, Y.S.R Kadapa Dist. (Dr. Y.S.R.H.U). The experiment was conducted to study the influence of nutrients and Piriformospora indica on flowering and root of African marigold. The investigation was designed in Randomized Block Design, replicated thrice with 9 treatments. The results revealed that, the treatment combination i.e. 75% RDF + Piriformospora indica inoculated to seeds (T2) took minimum duration to full flowering (59.55 days), recorded maximum flower diameter (9.27 cm), fresh weight of total flowers plant-1 (394.47 g-1) and highest yield (29.06 t ha-1). Plants receiving 50 % RDF + Piriformospora indica inoculated to seeds (T3) produced higher number of flowers plant-1 (53.62). Among root attributes, significantly longer root (19.21 cm), higher root count (127.33), maximum root volume (39.33 m3) and root colonization of Piriformospora indica (75.09 per cent) were recorded in plants treated with 75% RDF + Piriformospora indica inoculated to seeds (T2).

INTRODUCTION

Marigold is a free blooming ornamental crop and used as a loose flower that is gaining popularity on account of its easy culture, wide adaptability, and increasing demand in National and International flower trade (Ahmad *et al.,* 2011). It is the most important traditional flower crop of India. It is one of the most important commercial flower crop grown all over the world and in India as well, accounting for more than half of the Nation's loose flower production (Raghava, 2000).In India, marigold is grown on commercial scale in about 56.04 thousand hectares with a production of 9.15 thousand MT. Andhra Pradesh is one of the leading states with an extent of 5.55 thousand ha area and annual flower production of 43.10 thousand MT (Anonymous, 2015-16).

Nutrients are essential elements required by the plants for growth and development. Nitrogen is an essential part of nucleic acid and plays a vital role in promoting the plant growth. Similarly, an adequate supply of phosphorus is associated with rapid and vigorous start to plant, helping to establish seedling quickly, stimulates flowering and decrease lodging tendency of plant since phosphorus is a constituent of chlorophyll and is involved in many physiological processes including cell division, development of meristematic tissue, photosynthesis, metabolism of carbohydrates, fats and proteins (Acharya and Dashara, 2004). In addition, Moreira *et al*., (2010) illustrated that phosphorus and nitrogen are the most limiting factors for plant growth and also required for AMF and Rhizobia symbiosis. Nitrogen, P and K also plays many different roles in plants for photosynthesis, regulates the opening and closing of stomata. Potassium triggers activation of enzymes and is essential for production of Adenosine Triphosphate (ATP). Even though marigold cultivated on a large scale, its nutrient requirements have not been assessed for Rayalaseema region of Andhra Pradesh. In the absence of precise recommendations, the growers are following nutrient schedules of their own, which results in improper nutrition to the crop. This ends up with improper balance in plants and is considered to be a major factor contributing to low yields which poses a serious problem in flower production. Hence, the nutrient supply should be adjusted to the specific requirements of the plants during various stages of growth to attain maximum level of yields.

Piriformospora indica AM fungi – like fungus, showed prominent positive influence on a wide range of plants of agriculture, forestry and flori-horticultural importance. Fungus

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has a wide host range of monocots and dicots including legumes, terrestrial orchids (*Dactylorhiza maculata*) and members of the bryophytes (*Aneura pinguis*). The fungus showed potential as an agent for biological control of disease against soil-borne root pathogens. ^{32}P experiments suggest that this fungus is important for phosphorus acquisition by the roots, especially in the arid and semi-arid regions. Mycelium could utilize a wide variety of inorganic and organic phosphate chemicals and produced acid phosphatases at the tip of the hyphae (Singh *et al*., 2003a,b). However, very little experimental work has been done on the nutritional requirements of marigold particularly nitrogen, phosphorus, potassium and in combination with *Piriformospora indica* (PGPRE) in this important flowering crop under the tropical conditions of semi-arid zone of Southern Andhra Pradesh. Because of the absence of relevant information on these aspects, the present investigation was conceived and conducted with N, P and K (RDF) at different levels along with *Piriformospora indica* (PGPRE) to arrive at a feasible nutrient schedule under the prevailing agro-climatic conditions of the Rayalaseema zone in Andhra Pradesh.

MATERIALS AND METHODS

The present investigation on African marigold (*Tagetus erecta* L.) cv. Pusa Basanthi Gainda was conducted during Rabi season of 2016-2017 under agro-climatic condition of College of Horticulture, Anantharajupeta, Y.S.R Kadapa Dist (Dr. Y.S.R.H.U). The experiment was conducted to study the influence of nutrients and *Piriformospora indica* on flowering and physiology of African marigold (*Tagetus erecta* L.) cv. Pusa Basanthi Gainda. The investigation was laid out in Randomized Block Design, replicated thrice. The experiment consisting of 9 treatments *viz.,* T_1- 100 % RDF + *Piriformospora indica* inoculated to seeds, T_2 - 75% RDF + *Piriformospora indica* inoculated to seeds, T_3- 50 % RDF + *Piriformospora indica* inoculated to seeds, T_4- 100 % RDF + *Piriformospora indica* inoculated to seedling roots at the time of transplanting, T_5- 75% RDF + *Piriformospora indica* inoculated to seedling roots at the time of transplanting, T_6-50 % RDF + *Piriformospora indica* inoculated to seedling roots at the time of transplanting, T_7-75% RDF + *Piriformospora indica* inoculated before transplanting, T_8- 75% RDF + *Piriformospora indica* inoculated after pinching (40 days after transplanting), T_9-Control.

After ploughing and digging, the land was brought to fine tilth. All weeds were completely removed from the field. All the stubbles of previous crop were removed from the field and burnt. The required numbers of plots (27) were prepared of size (2.00 m x 2.40 m) with bunds of 30 cm between plots. The length of experimental field is 25.20 m and width was 7.50 m. Well decomposed farmyard manure was applied uniformly to all the experimental plots at 25 t ha^{-1} and mixed well. Nitrogen (200 kg ha^{-1}), phosphorus (80 kg ha^{-1}) and potassium (80 kg ha^{-1}) (as per Dr.Y.S.R.H.U, Andhra Pradesh recommendation) were applied. The entire quantity of phosphorus and potash and 50 per cent of nitrogen were applied as basal dose and remaining 50 per cent nitrogen was applied as a top dressing at three weeks after transplanting in the main field. As per the treatments, initially some seeds were sown separately in the nursery without PGPRE treatment (for control and other treatments purpose) and again few seeds were treated with PGPRE (*Piriformospora indica*) (for treating 1 kg seed, require 200-250 g *Piriformospora indica*. Moist the seeds with 5 per cent jaggery (gur) in water solution and then add and mix *Piriformospora indica* culture powder. The gur (jaggery) solution makes the seed sticky and helps in coating of seeds with the PGPRE powder) and then seed is sown separately in another nursery.

Thirty-days-old healthy seedlings of uniform growth were transplanted. Transplanting was done in the evening during *rabi* season of 2016 and light irrigation was given immediately after planting. For root inoculation, prepared a slurry/ thick solution by mixing *Piriformospora indica* formulation with plain water. Dip the roots in solution overnight and plant them in the next day, the quantity of solution should be sufficient enough to cover with *Piriformospora indica* solution. Solution is prepared by mixing 75-100 g *Piriformospora indica* in 100 ml water. Immediately after transplanting, a light irrigation was given to the crop for better establishment of the seedlings in the field. *Piriformospora indica* was also applied after pinching (40 days after transplanting). For 1 sq.m area, 100 g *Piriformospora indica* was used before transplanting and at the time of pinching. Necessary plant protection measures were followed to prevent pest incidence. At initial stages of growth, chlorpyriphos @ 2-3 ml $litre^{-1}$ of water was sprayed to control *Spodoptera litura,* while no disease incidence was noticed during investigation period.

For recording observations, five plants were selected per each plot at random and were labelled properly by indicating treatments. The method proposed by Giovannetti and Mosse (1980) was followed for assessment of root colonization of *Piriformospora indica*. The data were analyzed using the procedure outlined by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Number of Days for Full Flowering

The data furnished in table 1 recorded on influence of RDF in combination with *Piriformospora indica* on number of days for full flowering responded significantly to all the treatments. R*esults showed that, flowering was advanced in* 75% RDF + *Piriformospora indica* inoculated to seeds *(T_2) (59.55 days) which was on par with T_1 (59.71 days) and T_4 (60.67 days).* This might be due to the altered C:N ratio which helped in balanced management of vegetative as well as reproductive phases and promote early flowering. This was in accordance with the reports of Swaroop *et al*. (2007), Rathi *et al.* (2003) and Naik (2015) in marigold.

Flower diameter

Data on diameter of flower differed significantly due to the influence of nutrients and Piriformospora indica *in African marigold cv. Pusa Basanthi Gainda (table 1). Significantly maximum flower diameter was recorded when the marigold seeds are treated with the input* 75% RDF + *Piriformospora indica* inoculated to seeds *(T_2) (9.27 cm) which was on par with T_3 (9.19 cm) and T_1 (8.82 cm).*

Maximum flower diameter in the nutrient combination T_2 might be due to the fact that nitrogen and phosphorus being the most important constituent of proteins, amino acids, enzymes and co-enzymes are responsible for cell division and elongation. Similarly, phosphorus is associated with phosphorylation and production of ATP, a compound required to maintain equilibrium between biochemical and 50 enzymatic reactions in the plant, which might have resulted in increased flower diameter. The increased flower diameter with nitrogen application could be explained in the light of the fact that balanced application of nitrogen resulted in increased carbohydrate assimilation leading to increased vegetative growth. These carbohydrates once translocated to productive organs undergo hydrolysis and get converted into the reducing sugars which ultimately helped in increasing flower diameter. *Piriformospora indica* application also increased the flower diameter due to root growth which helped in better root development resulting in more absorption of water and mineral nutrients from soil and ultimately the flower diameter improved. The present finding corroborates with the reports of Chauhan and Kumar (2007), Pushkar *et al*. (2011) and Joshi *et al.* (2013) in marigold.

Total Number of Flowers plant^{-1}

The information made available in table 1 indicated that significance response of marigold plants to different nutrient treatments was individually and in combination. It is clear from the data (table 1) that all the treatments resulted in significant increase in number of flowers plant^{-1}. Significantly higher number of flowers plant^{-1} was recorded in *50 % RDF + Piriformospora indica inoculated to seeds* (T_3) (53.62) which was on par with T_2 (53.29) which was followed by T_1 (49.44). This could be attributed to a higher C/N ratio and increased plant metabolism. The increased vegetative growth and balanced C/N ratio could lead to increased synthesis of carbohydrate which ultimately promoted greater flowering. Similar results were also reported by Singh et al. (2015) in marigold cv. Pusa Narangi Gainda.

Fresh Weight of total Flowers plant^{-1}

The results recorded on the fresh weight of total flowers plant^{-1} in response to the various nutrient treatments are furnished in table 2. The information presented in the table 2 has clearly demonstrated the significant influence of various treatments on the fresh weight of the total flowers plant^{-1}. The treatment *75% RDF + Piriformospora indica inoculated to seeds* (T_2) resulted in highest fresh weight of total flowers plant^{-1} (394.47 g) which was followed by T_1 (262.08 g) and T_3 (207.99 g) which differ significantly with each other and independent from all other treatments. Since there was an increase in weight of single flower plant^{-1} due to increase in uptake of plant nutrients, it has inturn resulted in fresh weight of total flowers plant^{-1}. These results are in accordance with the findings of Kaushik *et al.* (2013) in African marigold, Sultana *et al.* (2015) in Zinnia.

Flower Yield (T ha^{-1})

The data corresponding to this attribute was presented in table 1. A perusal of the data in the table 1 indicated that marigold flower yield recorded was highest in 75% RDF + *Piriformospora indica* inoculated to seeds *(T_2) (29.06 t ha^{-1}) and identified significantly superior, which was followed by T_3 (26.66 t ha^{-1}) which was on par with T_1 (26.39 t ha^{-1}), T_5 (26.32 t ha^{-1}), T_6 (25.49 t ha^{-1}), T_8 (25.43 t ha^{-1}), T_7 (25.42 t ha^{-1}) and T_4 (25.30 t ha^{-1}).*

The above findings with respect to flower attributes due to increased supply of major plant nutrients, which are required in larger quantities for the growth and development of plants. The application of nitrogen at optimum level attributed to acceleration in development of growth and reproductive phases. Moreover, higher content of nitrogen might have accelerated protein synthesis, thus promoting earlier floral primordial development. Thus, results are in conformity with the findings of Acharya and Dashora (2004) in African marigold. The increase in phosphorus is also found to be involved in the initiation of flower primordial formation leading to increase in size and number of flowers in African marigold. These results are in close agreement with the findings of Singh *et al*. (2015) in marigold.

Length of the root

Analysis of data corresponding to length of root is presented in table 2. Root length varied significantly among various treatments tried. Significantly longest root (19.21 cm) was recorded in 75% RDF + *Piriformospora indica* inoculated to seeds *(T_2) which was on par with T_4 (18.37 cm), T_1 (16.93 cm) and T_5 (16.92 cm).* The reason might be due to that the *P. indica* made the P available to the plants which in turn increase the length of the roots. *It might also due to the root endophyte inoculation which has the potential to add nitrogen and phosphorus to crop growth through associative symbiosis and increased production of growth hormones like NAA, GA and cytokinins (Varma* et al*., 1999; Singh* et al., *2000). These phytohormones might have caused morphological change in length of roots, thereby causing an increase in uptake of nutrients resulting in better growth. P. indica* colonized maize plants showed an increased biomass production, root length and root number compared to the non-colonized plants (Kumar *et al*., 2014).

Number of Roots Plant^{-1}

The data recorded on number of roots plant^{-1} as influenced by different treatments is presented in table 2 indicated that the number of roots of African marigold cv. Pusa Basanthi Gainda plants was significantly influenced by different dosages of RDF and Piriformospora indica*.*

Among various plant growth promoters tried, significantly higher root count plant^{-1} was recorded in 75% RDF + *Piriformospora indica* inoculated to seeds *(T_2) (127.33) which was on par with T_1 (113.95), T_3 (109.53) and T_5 (108.89).* The phosphorus nutrient in the early stages of growth is beneficial for producing more number of roots plant^{-1}. The plants having higher number of shoots and beneficial effects of *P. indica* which enhanced the better root system which in turn helps in rapid growth of the plant and ultimately plants are having maximum number of roots plant^{-1}. These results are in conformity with the findings of Dhinesh *et al*. (2015); Naik and Kumar (2015) in *Dendrobium* cv. Earsakul. The earlier results in the present investigation indicated that plant height, number of leaves and plant biomass were high in plants which received the treatment T_2. Hence in the same corollary, this result could be explained that the plant growth promoter T_2 resulted in

production of higher number of roots plant^{-1}. Further, it was found that *P. indica* produces auxin IAA which is known for its stimulatory role in plant root growth (Sirrenberg *et al.,* 2013). *P.indica* has been reported to interfere with ethylene signaling in plants where, it promotes the plant root growth (Khatabi *et al.,* 2013).

Root Volume

The observation recorded on the root volume due to the influence of various nutrients along with Piriformospora indica *was presented in the table 2.*

A critical examination of the data revealed that, the highest root volume was recorded in 75% RDF + *Piriformospora indica* inoculated to seeds (*T_2) (39.33 m^3) and found significantly superior, which was followed by T_3 (27.66 m^3) and this was on par with T_1 (26.60 m^3), T_7 (26.33 m^3), T_6 (25.60 m^3), T_5 (24.23 m^3) and T_8 (22.66 m^3).* The treatment 75% RDF + *Piriformospora indica* inoculated to seeds (T_2) recorded highest number of roots and root length plant^{-1} in the earlier finding and this might be the reason for highest root volume.

***Root colonization of* Piriformospora indica**

The data on this trait are presented in table 2. A critical examination of the data revealed that, significantly higher colonization of root was observed in 75% RDF + *Piriformospora indica* inoculated to seeds (*T_2) (75.09 per cent) which was on par with T_3 (74.40 per cent), T_1 (70.84 per cent) and T_4 (67.17 per cent).* Enhanced root production, root volume and root colonization of *P. indica* was observed in treatment combination involving *P. indica*. The positive influence of *P. indica* for the above root parameters was clearly evident from this study. In the present study, *P. indica* had a positive effect on root parameters, which confirm with the observation of Dhinesh *et al*. (2015) and Naik and Kumar (2015) in *Dendrobium*. Higher temperature is also the main reason for higher root colonization. It was reported that *P. indica* at higher temperature (25-35 ^{0}C) resulted in higher mycelia growth (Varma *et al*., 1999) and the higher temperature prevailing in the experimental site during the period of investigation (29.25 to 35.95 ^{0}C) might be the possible reason for higher root colonization in the host plants.

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Table 1 Effect of RDF and *Piriformospora indica* (PGPRE) on flowering parameters in African marigold cv. Pusa Basanthi Gainda

Treatments	No. of days for full flowering	Total no. of flowers plant^{-1}	Fresh wt. of total flowers plant^{-1} (g)	Flower diameter (cm)	Flower yield (t ha^{-1})
T_1-100% RDF + *Piriformospora indica* inoculated to seeds	59.71	49.44	262.08	8.82	26.39
T_2-75% RDF + *Piriformospora indica* inoculated to seeds	59.55	53.29	394.47	9.27	29.06
T_3-50% RDF + *Piriformospora indica* inoculated to seeds	62.05	53.62	207.99	9.19	26.66
T_4-100% RDF + *Piriformospora indica* inoculated to seedling roots at the time of transplanting	60.67	46.28	194.83	8.50	25.30
T_5-75 % RDF + *Piriformospora indica* inoculated to seedling roots at the time of transplanting	62.22	43.63	190.61	8.68	26.32
T_6-50 % RDF + *Piriformospora indica* inoculated to seedling roots at the time of transplanting	65.20	41.56	193.87	8.72	25.49
T_7-75 % RDF + *Piriformospora indica* inoculated before transplanting	66.43	38.35	186.34	8.47	25.42
T_8- 75 % RDF + *Piriformospora indica* after pinching (40 days after transplanting)	68.85	36.55	186.61	8.33	25.43
T_9- Control	69.92	31.82	175.28	7.97	23.61
SEM ±	0.43	0.92	2.58	0.15	0.48
CD (*P*= 0.05)	1.32	2.78	7.82	0.46	1.46

Table 2 Effect of RDF and *Piriformospora indica* (PGPRE) on root attributes in African marigold cv. Pusa Basanthi Gainda.

Treatments	Length of root (cm)	No. of roots plant^{-1}	Root volume (m^3)	Root colonization (%)
T_1 -100% RDF + *Piriformospora indica* inoculated to seeds	16.93	113.95	26.60	70.84
T_2-75% RDF + *Piriformospora indica* inoculated to seeds	19.21	127.33	39.33	75.09
T_3-50% RDF + *Piriformospora indica* inoculated to seeds	15.28	109.53	27.66	74.40
T_4-100% RDF + *Piriformospora indica* inoculated to seedling roots at the time of transplanting	18.37	99.53	19.90	67.17
T_5-75 % RDF + *Piriformospora indica* inoculated to seedling roots at the time of transplanting	16.92	108.89	24.23	61.78
T_6-50 % RDF + *Piriformospora indica* inoculated to seedling roots at the time of transplanting	16.21	102.40	25.60	63.21
T_7-75 % RDF + *Piriformospora indica* inoculated before transplanting	14.55	97.65	26.33	57.07
T_8- 75 % RDF + *Piriformospora indica* after pinching (40 days after transplanting)	14.05	96.53	22.66	57.76
T_9- Control	12.32	73.53	16.53	0.00
SEM ±	0.77	6.94	1.86	3.63
CD (*P*= 0.05)	2.33	20.98	5.63	10.97

References

Acharya, M. M. and Dashora, L. K. (2004). Response of graded levels of nitrogen and phosphorus on vegetative growth and flowering in African marigold (Tagetes erecta L.). Journal of Ornmental Horticulture, 7(2): 179-183.

Ahmad, I., Asif, M., Amjad, A. and Ahmad, S. (2011). Fertilization enhances growth, yield, and Xanthophyll contents of marigold. Turkey Journal of Agriculture, 35:

641-648.

Anonymous. National Horticulture Data Base. (2015-16). National Horticulture Board. Ministry of Agriculture, Government of India.

Chauhan, A. and Kumar, V. (2007). Effect of Graded levels of nitrogen and VAM on growth and flowering in calendula (Calendula officinalis L.) Journal of ornamental Horticulture. 10 (1): 61-63.

Dhinesh, D., Kumar, A., Naik, M.R., Kumar, P.S., Kumar, A.V.S. and Anith, K.N. (2015). Influence of Piriformospora indica on growth and flowering of Tropical Dendrobium Orchid. IJTA Serials Publications. 33 (2): 27-31.

Giovannetti, M. and Mosse, B. (1980). An evaluation of techniques for measuring vesicular- arbuscular mycorrhizal infection in roots, New Phytology. 8:489-500.

Joshi, N.S., Barad, A.V., and Pathak, D.M. (2013). Response of chrysanthemum verities to different levels of nitrogen, phosphorus, potash. *Journal of Chemicals Biology Physical Science Section* . 3(2): 1584-1593.

Kaushik, H., Singh, J.P., Braj, M., Rajbeer and Nathiram. (2013). Effect of inorganic fertilizer (nitrogen) and bio-fertilizer (Azospirillum) on growth and flowering in African marigold (Tagetes erecta L.) cv. Pusa Narangi Gainda. *International Journal of Agricultural Sciences*. 9(1): 189-192.

Khatabi, B., Molitor, A., Lindermayr, C., Durner, J., Wettstein, D.V., Kogel, K.H. and Schafer, P. (2013). Ethylene supports colonization of plant roots by the mutualistic fungus Piriformospora indica PLOS One doi /10.1371/ journal.pone.0035502.

Kumar, U. S., Bagde, S., Prasad, R. and Varma, A. (2014). Impact of culture filtrate of Piriformospora indica on biomass and biosynthesis of active ingredient aristolochic acid in Aristolochia elegans Mart. *International Journal of Biology*. 6(1): 1916-1920.

Moreira, F.M.S., Carvalho, T.S.D. and Siqueira, J.O. (2010). Effect of fertilizers, lime and inoculation with Rhizobia and mycorrhizal fungi on the growth of four leguminous tree species in a low fertility soil. Biology and Fertil Soils. DOI 10.1007/s00374-010-0477-5.

Naik, M. R. (2015). Influence of nitrogen and phosphorus on flowering, N and P content of African marigold, Tagetes erecta L var. Cracker Jack. *International Journal of Farm Sciences*. 5(1): 42-50.

Naik, M.R. and Kumar, A. (2015). Growth and physiological response of Dendrobium cv. Earsakul in different growing condition. Plant Archives. 15(2): 853-861.

Panse, V.G. and Sukhatme, P.V. (1985). Statistical methods for agricultural workers, ICAR, New Delhi. 97-164.

Pushkar, N. C., Rathore, S. V. S. and Upadhyay, D. K. (2011). Response of chemical and biofertilizer on growth and yield of African marigold (Tagetes erecta L.) cv. Pusa Narangi Gainda. *The Asian Journal of Horticulture*. 3(1): 130-132.

Raghava, S. P. S. (2000). Marigold versatile crop with golden harvest. Floriculture Today, 4(11): 40-41.

Rathi, Soniya, Kumar, Vijay and Sindhu, S.S. (2003). Effect of different levels of nitrogen and methods of irrigation on yield and quality of marigold (Tagetes erecta L.). Proc. of 2nd International Congress of Plant Physiology. 8(12): 313.

Singh, L., Gurjar, P.K.S., Barholia, A.K., Haldar. A. and Shrivastava, A. (2015). Effect of Organic manures and inorganic fertilizers on growth and flowering, yield of marigold (Tagetus erecta L.) var. Pusa Narangi Gainda. Plant Archives. 15(2): 779-783.

Singh, A. N., Singh, A.R., Kumari, M., Kumar, S., Rai, M. K., Sharma, A. P. and Varma, A. (2003a). Biotechnological importance of Piriformospora indica Verma et al. a novel symbiotic mycorrhiza- like fungus: an overview. *Indian Journal of Biotechnology*. 2: 65-75.

Singh, A. N., Singh, A. R., Kumari, M., Kumar, S., Rai, M. K., Sharma, A. P. and Varma, A. (2003b). Unmassing the accessible treases of the hidden unexplored microbial world. In: Prasad, B.N. (ed.), Biotechnology in Sustainable Biodiversity and Food Security. Science Publishers, Enfield, NH. 101-124.

Singh, A., Sharma, J., Rexer, K. H., and Varma, A. (2000). Plant productivity determinants beyond minerals, water and light: Piriformospora indica - A revolutionary plant growth promoting fungus. Current Science. 79: 1548–1554.

Sirrenberg, A., Goebel, C., Grond, S., Czempinski, N. and Ratzinger, A. (2013). Piriformospora indica affects plant growth by auxin production. Physiology of Plant. 131: 581-589.

Sultana, S., Kashem, Md.A. and Mollah, A.K.M.M. (2015). Comparative Assessment of Cow manure, vermicompost and NPK fertilizers on the growth and production of Zinnia (Zinnia elegans). *Open Journal of Soil Science*. 5:193-198.

Swaroop, K., Raju, D.V.S. and Singh. K.P. (2007). Effect of nitrogen and phosphorus on growth, flowering and seed yield of African marigold, variety Pusa Narangi Gainda (Tagetes erecta L.). The Orissa Journal of Horticulture. 35(2): 15-20.

Varma, A., Verma, S., Sudha, Sahay, N., Buetehorn, B., and Franken, P. (1999). Piriformospora indica- a cultivable plant growth –promoting root endophyte with similarities to arbuscular mycorrhizal fungi. Applied and Environmental Microbiology. 65: 2741-2744.

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