EFFECT OF ORGANICS, AZOSPRILLUM AND HUMIC ACID ON GROWTH AND YIELD OF GYMNEMA (*Gymnema sylvestre R.Br*)

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ABSTRACT

The experiment on the effect of organics, Azospirillum (Root and soil isolate) and Humic acid on growth and leaf yield in Gymnema (Gymnema sylvestre R.Br) was carried out at the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar. There were totally 13 treatments viz., T_1- Vermicompost 1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.1% (soil application),T_2- Decomposed Coir pith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.1% (Soil application),T_3- Vermicompost 1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.2% (soil application),T_4- Decomposed Coirpith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.2% (Soil application),T_5- Vermicompost 1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.3% (soil application),T_6- Decomposed Coirpith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.3% (Soil application),T_7- Vermicompost 1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.1% (Foliar application),T_8- Decomposed Coirpith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.1% (Foliar application),T_9- Vermicompost 1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.2% (Foliar application),T_{10}- Decomposed Coirpith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.2% (Foliar application),T_{11}- Vermicompost 1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.3% (Foliar application),T_{12}- Decomposed Coirpith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.3% (Foliar application),T_{13}- Control (Native soil).There were established in the field and observed for certain growth characters like Plant height, Number of laterals /plant, Number of leaves/lateral, Leaf length (cm),Leaf breadth(cm),Leaf area(cm^2),Single leaf weight(gm.),100 Leaves weight(gm.),Fresh leaf yield/ plant(gm.) and dry leaf yield were recorded four months of planting. The Treatment, T_9- Vermicompost 1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.2% (Foliar application), recorded highest plant height (299.94), Number of laterals/plant (47.54), Number of leaves/lateral (128.93), Leaf length (7.79cm), Leaf breath (5.86cm), Leaf area (18.39cm^2), Single leaf weight (0.44gm.), 100 leaves weight (44.84gm.), Fresh leaves yield/plant (4.38kg.) and Dry leaves/plant(2.78kg.). This was followed by T_{10}- Decomposed Coirpith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.2% (Foliar application).

KEY WORDS: ***Gymnema sylvestre***, Organics, Azospirillum, Humic acid.

INTRODUCTION

Gymnema sylvestre R.Br Belongs to the family Aselepiadaceae. Gymnema is a woody perennial, vine like plant which climbs on bushes and trees. Gymnema having opposite, elliptic (or) ovate leaves and with small yellow flowers borne on umbellate cymes. It's found in Deccan Peninsula extending to the part of northern and western India. The leaves possess active principle with properties of reducing blood sugar and are used as an anti-diabetics agent in Indian systems of medicine. Leaves when chewed are reported to destroy the taste of sweet (or) bitter substances because of their Gymnemic acid content, which explains the Hindi name Gurmar- "Destroyer of sugar".

The great Indian physician, susruta, prescribed this plant as a destroyer of "Madumeha" (Glycosuria) and it's capable of curing urinary disorders. The leaves are used for stomach ailments Prasand et al., (2002). According to Ayurveda, Gymnema is bitter, acrid, cooling, tonic, alternative, anthelmintic, alexeritic.It cures eye complaints, burning sensation, biliousness, bronchitis, ulcers, and asthma etc., The Gymnema leaves were also used for stomach ailments, constipation, water retention and liver disease. Gymnema is the major botanicals being administered for those suffering from boosting insulin levels + controlling healthy blood sugar levels. Because Gymnema molecular structure similar to sugar, it blocks and inhibits a large percentage of sugar.

Gymnema can improve uptake of glucose into cells and prevent adrenaline from stimulating the liver to produce glucose, thereby reducing blood sugar levels. Water soluble acidic fraction of the Gymnema leaves (400mg/day) provides hypoglycernic actions. In type 2 diabetics, ongoing use for periods as long as 18-24 months has proven successful. Regular use of Gymnema leaf powder 3-4 gm., over a period of 3-4 months helped to reduce glycosuria (or) the appearance of carbohydrates in urine.

MATERIALS AND METHODS

The experiment on the effect of organics, Azospirillum (Root and soil isolate) and Humic acid on growth and l yield in Gymnema (Gymnema sylvestre R.Br) was carried out at the Department of Horticulture, Faculty Agriculture, Annamalai University, Annamalai Nagar. The experiment was carried out in the principles of Randomi block design. There were totally 13 treatments viz., T_1-Vermicompost 1Kg + *Azospirillum* (RI) 10 g/plant + Hu acid 0.1% (soil application),T_2- Decomposed Coir pith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0. (Soil application),T_3-Vermicompost 1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.2% (soil application), Decomposed Coirpith5kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.2% (Soil application), Vermicompost1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.3% (soil application),T_6-Decomposed Coirpi kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.3% (Soil application),T_7-Vermicompost1Kg + *Azospirillum* (10 g/plant + Humic acid 0.1% (Foliar application),T_8-Decomposed Coirpith5 kg + *Azospirillum* (RI) 10 g/plan Humic acid 0.1% (Foliar application),T_9-Vermicompost1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0. (Foliar application),T_{10}- Decomposed Coirpith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.2% (Fo application),T_{11}-Vermicompost1Kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.3% (Foliar application),T Decomposed Coirpith 5 kg + *Azospirillum* (RI) 10 g/plant + Humic acid 0.3% (Foliar application),T_{13}-Con (Native soil).

RESULT AND DISCUSSION

Production of medicinal plants under organic farming offers much scope for diversification in Indian agriculture and to increase the income of enthusiastic entrepreneurs. A judicial use of one (or) more organic sources like vermicompost, Coirpith, pressmud, FYM, biofertilizers like Azosprillum could improve the soil fertility on a long term basis. Recently application of organic growth stimulants viz., humic acid either as foliar spray (or) soil application in Horticulture crops also has shown tremendous improvement in growth, yield and quality. As Gymnema is a medicinal plant more emphasis has to be given to orient the production of chemical residue free Gymnema for local consumption as well as for export under organic farming system. If it is possible to obtain reasonably high yield combined with good quality Gymnema by the use of organic manures and organic growth stimulants it could result in increasing the export market thereby increasing foreign exchange earning of our nation. With this view the present investigation was designed to study the effect of vermicompost and composted coir pith along with soil and foliar application of humic acid on growth, yield and quality of Gymnema.

Growth characters

Growth attributes are considered to be important factor to judge the vigour and yield of a crop. In the present experiment growth characters were differentially influenced by the organic nutrients. Application of humic acid in soil as well as in foliar form has significantly influenced the plant height at various growth

stages in gymnema. Among the various treatment tested the treatment which received a application of decomposed Coirpith @ 5 kg plant^{-1} + root isolate of Azosprillum inoculation + humic acid 0.2% as foliar spray increase the plant height to the maximum of 310.47 cm at 120 DAP. This was followed by combined application of vermicompost @ 1 kg + root isolate of Azosprillum inoculation + humic acid 0.2% foliar spray and decomposed coir pith @ 1 kg/plant + root isolate of Azosprillum inoculate + humic acid 0.2% as soil application, whereas the plant height was least in control. Increased plant height due to application of coir pith compost along with Azosprillum in parsley (Petroselinum crispum) was reported by Saraswathi *et al*. (2003), in turmeric by Krishnamurthy *et al*. (2002). Further addition of humic substances tends to increase the respiration rate metabolism and growth of plant as reported by Schnitzer (1991). In tomato Dhanasekaran and Bhuvaneswari (2005) reported that addition of humic substances increased the plant height. The number of laterals/vine and number of leaves/lateral were also found to have influenced by various treatments. The treatments which received the combined application of vermicompost @ 1 kg/plant + Azosprillum root isolate inoculation + humic acid 0.2% as foliar spray (T_9) recorded the highest number of laterals/vine (47.54) at 120 DAP and number of leaves/lateral (128.93 at 120 DAP), were as the least number of laterals/vine (30.02 at 120 DAP) and number of leaves/laterals (92.09 at 120 DAP) was recorded in the control (Fig.8a). The increase in the number of laterals could be attributed to sufficient quantity of nutrient flow in the plants treated with vermicompost thereby; the auxillary bud could have been stimulated, leading to increase in number of laterals as reported by Kale *et al*. (1987). The same treatment had also recorded the maximum leaf length, leaf breadth and leaf area, this may be due to that vermicompost acted as a good medium for growth and development of microbes in the soil and made the nutrients available for plant uptake (Kale *et al*., 1987) and thus increased the leaf yield. The increase in the plant growth character was due to the hormones produced by Azosprillum which were mainly responsible to the cell division and cell elongation. It is presumed that a uniform dosage of vermicompost and Azosprillum might play a pivotal role in promoting growth vigour and biomass of the plant. The high level of response of crop to humic acid and azosprillum combination towards plant growth might be because humates contains small quantities of polyphenolic compounds some of which provide auxin like activity (O'Donnell, 1973).

Yield and quality characters

Yield and yield components are the important characters which may decide the yield even though they are genetically controlled; it is also influenced by the availability of nutrients to the crop (Sweet *et al*., 1974). The most favourable effect on yield attributes viz., single leaf weight (0.44 g), hundred leaf weight (44.84 g), fresh leaf yield/plant (4.38 kg) and dry leaf yield/plant (2.78 kg) were observed in the treatment which received the combined application of vermicompost @ 1 kg/plant + root isolate of *Azospirillum* inoculation + humic acid 0.2% as foliar spray (Fig.8b). This was followed by the treatment T_{10} and T_3 for these traits. The least value for this trait was recorded in control. It may be due to steady and adequate supply of nutrients from vermicompost with *Azospirillum* which resulted in better absorption of nutrients and subsequent utilization of growth promoting assimilated from the source to sink leading to great production of yield and yield components as reported by Kannan *et al*. (2006). The probable reason might also be due to improvement of plant, number of laterals and number of leaves/lateral. It also indicates that the adequate uptake and proper translocation of nutrients resulting in its influence on desirable character on leaves ultimately resulting in better yield. The yield increase obtained in plants inoculated with *Azospirillum* could be attributed to the effect of growth hormones like IAA, cytokinin produced by *Azospirillum* (Fallik *et al*., 1989), Vitamin B_{12} (Sankaran, 1960), auxin (Naumova *et al*., 1962), gibberellin (Barea *et al*., 1976). The better nutrient absorption by the plants due to the humic acid application might have augmented the green fodder yields as described by Moriyama (1992). Increased yield due to combined application of vermicompost and humic acid was reported by Balaguru (2006) in Ambrette, Velayutham (2005) in

Hybanthus enneaspermus and Arulnithi (2007) in *Aloe vera*. The phytohormones produced by *Azospirillum* also stimulate root growth and induce changes in root morphology, which in turn improve the assimilation of nutrients and the yield (Sumner, 1990). In the present investigation, biochemical attributes were studied to assess the chlorophyll fluorescence, soluble protein content, total phenols, crude extract recovery, crude recovery percentage and Gymnemic acid content of Gymnema (Fig9). The result revealed that application of vermicompost @ 1 kg/plant + root isolate of *Azospirillum* inoculation + humic acid 0.2% as foliar spray had recorded the maximum chlorophyll fluorescence (0.902 Fv/Fm), soluble protein content (162.77 mg g^{-1}), gymnemic acid content (826.69 mg g^{-1} dry weight), crude extract recovery percentage (66.27) and low in total phenols. Similar findings in quality parameters were reported by Venukuri Bali reddy (2004) and Arul nithi (2007) in Aloe, Velayutham (2005) in *Hybanthus enneaspermus* and Balaguru (2006) in ambrette.

Higher levels of vermicompost and humic acid had positive influence on nitrogen uptake. Added vermicompost not only acted as source of nutrients, but also had influenced their availability. Uptake of nitrogen due to humic acid was also reported in tomato (Ibadov *et al*., 1983). Humic substances stimulate the content and uptake of nitrogen in solution culture. Increases in P uptake due to application of organic manure have been reported by Sen *et al*. (1996) in yam, Kannan (2004) in tomato. Humic acid at 0.2% foliar spray recorded the maximum phosphorus uptake. Among the combinations, vermicompost 1 kg $plant^{-1}$ + inoculation of *Azospirillum* root isolate + Humic acid 0.2% foliar spray showed maximum value. This was in line with the findings of Guminski *et al*. (1983). They found that humic substances stimulate the uptake of phosphorus in tomato.

Higher levels of vermicompost and humic acid had recorded higher potassium uptake. Potassium uptake was positively influenced by higher level of nutrients. Humic acid at 0.2% foliar spray increased the potassium uptake in many crops. This was in concordance with the results of Sunitha (2003) in bhendi.

Hence it has been confirmed from the study that the potential medicinal plant, Gymnema (*Gymnema sylvestre*) can be cultivated through organic means for higher productivity for the benefit of diabetic patients.

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Treatments	Plant height (cm)	No.of laterals /plant	No. of leaves /lateral	Leaf length (cm)	Leaf breath (cm)	Leaf area (cm^2)	Single leaf weight (gm.)	100 leaves weight (gm.)	Fresh leaf yield /plant(kg)	Dry leaf yield /plant (kg)
T_1 VC 1 Kg + ARI+ HA 0.1% (SA)	247.24	38.78	110.51	6.53	5.02	14.73	0.37	37.88	3.06	2.12
T_2 DCP 5 Kg + ARI+ HA 0.1% (SA)	236.76	37.32	107.44	6.32	4.88	14.12	0.36	36.72	2.84	2.01
T_3 VC 1 Kg + ARI+ HA 0.2% (SA)	268.88	44.62	98.23	7.37	5.58	17.17	0.41	41.36	3.94	2.56
T_4 DCP 5 Kg + ARI+ HA 0.2% (SA)	279.41	41.70	122.79	7.16	5.44	16.56	0.42	42.62	3.72	2.45
T_5 VC 1 Kg + ARI+ HA 0.3% (SA)	205.17	32.94	119.72	5.69	4.46	12.29	0.33	33.24	2.18	1.68
T_6 DCP 5 Kg + ARI+ HA 0.3% (SA)	194.64	31.48	95.16	5.48	4.32	11.68	0.32	32.08	1.96	1.57

T_7 VC 1 Kg + ARI+ HA 0.1% (FA)	257.82	43.16	113.58	6.74	5.16	15.34	0.39	39.04	3.28	2.23
T_8 DCP 5 Kg + ARI+ HA 0.1% (FA)	268.35	40.24	116.65	6.95	5.30	15.95	0.40	40.20	3.50	2.34
T_9 VC 1 Kg + ARI+ HA 0.2% (FA)	299.94	47.54	128.93	7.79	5.86	18.39	0.44	44.84	4.38	2.78
T_{10} DCP 5 Kg + ARI+ HA 0.2% (FA)	310.47	46.08	125.86	7.58	5.72	17.78	0.43	43.68	4.16	2.67
T_{11} VC 1 Kg + ARI+ HA 0.3% (FA)	226.23	35.86	104.37	6.11	4.74	13.51	0.35	35.56	2.62	1.90
T_{12} DCP 5 Kg + ARI+ HA 0.3% (FA)	215.70	34.40	101.30	5.90	4.60	12.90	0.34	34.40	2.40	1.79
T_{13} Control	184.11	30.02	92.09	5.27	4.18	11.07	0.30	30.92	1.74	1.46
General mean	247.28	38.78	110.51	6.53	5.02	14.73	0.37	37.88	3.06	2.12
SED	5.07	0.59	1.42	0.06	0.05	0.19	0.005	0.47	0.08	0.04
CD (0.05%)	10.29	1.30	2.85	0.16	0.11	0.50	0.01	1.05	0.17	0.08

REFERENCES

Arulnithi, T.2007. Influence of Humic acid on Aloe (*Aloe vera*). **M.Sc (Ag.) Hort., Thesis**, Department of Horticulture, Annamalai University, Annamalainagar.

Barea, J.M., E.Navane and E.Montoya. 1976. Production of plant growth regulators by rhizosphere phosphate solubilising bacteria. **J. Appl. Bacteriol., 40**: 129-134.

Balaguru, K. 2006. Influence of organic inputs along with humic acid on the growth and yield of ambrette (*Abelmoschus moschatus*). **M.Sc. (Ag.) Thesis**. Department of Horticulture, Annamalai University, Annamalainagar.

Dhanasekaran, K. and R.Bhuvaneswari. 2005. Effect of nutrient enriched humic acid on the growth and yield of tomato. **International J. Agrl. Sci. 1(**1): 80-83

Fallick, E., S.Sarig and Y.Okon. 1989. Morphology and physiology of plant roots associated with Azosprillum in: Azosprillum – plant associations (Y. Okon ed.). CRC press, Boca raton, pp: 77-86.

Guminski, S.J. Sulej and J.Glabiszewski. 1983. Influence of sodium humate on the uptake of some ions by tomato seedlings. **Acta Soc. Bot.Pol. 52:** 149-164

Ibadov, O.V., A.A.Bairnov, I.B. Mambekova and E.E.Rustamova, 1983. Effect of fertilizers and activated humic acid on growth, development and decorative quantities of some varieties of tulips in Aspheronka. **Chem. Abstr., 100**: 1997/2.

Kale, R.D., K.Bano, M.N. Sreenivas and D.J. Bagyaraj. 1987. Influence of worm cast (Vee Comp. EUAS 83) on the growth and mycorrhizae colonization of two ornamental plants. **South Indian Hort., 35**: 433-437.

Kannan, P. 2004. Studies on organic farming in tomato var. PKM-1. **M.Sc (Ag.) Thesis**, Agricultural college and Research Institute, TNAU.

Kannan, P., A.Saravanan and T.Balaji. (2006). Organic farming on tomato yield and quality. **Crop Res. 32**(2): 196-200.

Krishnamurthi, V.V., P.Manickasundaram, D.Tamilmani, K.Vaiyapuri and P.Gnanamurthy. 2002. Role of digested coirpith, zinc and iron on the yield of turmeric. National seminar on "Emerging Trends in Horticulture", Annamalai University. Pp. 141

Moriyama. H. 1992. Studies on physiological effects of humic substances. **Ph.D. Thesis**, **In:** Organic matter and rice. IRRI, Manila Phillippines.

Naumova, A.N., E.N. Mishustin and V.M. Maxienko. 1962. On the nature of action of bacterial fertilizers (Azotobacter and phosphonacteria) upon agricultural crops. **Bull. Acad. Sci. USSR, 5**: 709-717.

O'Donnell, R.W., 1973. The auxin like effect of humic preparations from leonardiete. **Soil Sci, 116**: 106-112.

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Prasad, P.L., G. Sathyanarayana Reddy and M. Rajkumar. 2007. Effect of organic manures with Azospirillum and inorganic fertilizer on growth of Senna (*Cassia angustifolia*). National Seminar on "Production, Processing and Marketing of Medicinal, Aromatic and Dye Yielding crops." Department of Medicinal and Aromatic plants, KRCCH, Arabavi, Karnataka, India. pp.6

Sankaran, A. 1960. Rhizosphere effects on soil microorganisms. **Ph.D Thesis**, PG. School, IARI, New Delhi.

Saraswathi, T, S.Prema, K.Rajamani and N.Kempuchetti. 2003. Standardization of organic manures based agrotechnique for parsley (*Petroselinum crispum* mill). In the abstracts of national seminar on production and utilization of medicinal plants held at Dept. of Horticulture, Annamalai Univ., 17-14 Nov.2003, p.64.

Schnitzer, M. 1991. Soil organic matter in the next 75 years. **Soil Sci., 151**(1)**:** 41-58.

Sen, H., P.K. Das and S.K.Mukhopadhyay. 1996. Response of yam to varying levels of FYM and NPK fertilization. **Haryana J.Hort. Sci., 25(2)**: 53-54.

Sweet, R.D., E.S. Mohammed and R.K.Brain. 1974. Critical period of crop weed competition studies in tomato. **Amer. Soc. Hort.Sci., 89**: 106-109.

Velayutham, P.M. 2005. Infleunce of organic nutrients and biofertilizers on the growth and yield of *Hybanthus enneaspermus*. **M.sc (Ag.) Thesis**, Annamalai University, Annamalainagar, Tamil Nadu.

Venukuri Bali Reddy. 2004. Influence of organic inputs on the growth and quality of gel inn Aloevera (L) **M.Sc(Ag.) Hort. Thesis**, Annamalai Univ., Annamalai nagar, Tamilnadu.