



## Full Length Research Article

### NUTRIENT MANAGEMENT THROUGH ORGANIC IN GYMNEMA (*GYMNEMASYLVESTRE*)

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#### ABSTRACT

Gymnema (*Gymnemasyvestre* R. Br.) is one such plant having very much value for its hypoglycemic properties. The plant acquired its importance due to its efficiency in controlling blood glucose level in insulin dependent diabetes mellitus patients and also due to its action in enhancing endogenous insulin level. Realizing the importance of this plant and also to meet the demand of the drug companies it has become necessary to grow this crop on a commercial scale. As gymnema is a medicinal plant, more emphasis has to be given to orient the production 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 manure and organic growth stimulants, it could result 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 coirpith along with soil and foliar application of humic acid on growth, yield and quality of gymnema. The experiment was laid out in a Randomized Block Design with thirteen treatments replicated thrice. The experiment results reveal that the growth and yield parameters such as number of laterals/vine, number of leaves/laterals, leaf area, single leaf weight, hundred leaves weight, fresh and dry yield/plant were found to be maximum in the treatment which received vermicompost @ 1kg +root isolate of Azospirillum + Humic acid 0.2% foliar spray. It was also noticed that the same treatment had recorded the maximum chlorophyll fluorescence, soluble protein content, crude recovery and gymnemic acid. Taking into consideration of the above results, we could enhance the foliage yield of gymnema through organic means.

**Key words:** Gymnema, Humic Acid, Azospirillum, Vermicompost.

#### INTRODUCTION

Gymnema (*Gymnemasyvestre* R. Br.) is one such plant having very much value for its hypoglycemic properties. The plant acquired its importance due to its efficiency in controlling blood glucose level in insulin dependent diabetes mellitus patients and also due to its action in enhancing endogenous insulin level. Realizing the importance of this plant and also to meet the demand of the drug companies it has become necessary to grow this crop on a commercial scale. As gymnema is a medicinal plant, more emphasis has to be given to orient the production 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 manure and organic growth stimulants, it could result 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 coirpith along with soil and foliar application of humic acid on growth, yield and quality of gymnema.

#### MATERIAL AND METHODS

A field experiment was conducted to confirm the effect of organic manures, Azospirillum and Humic acid on growth and leaf yield of gymnema in open field' during the year 2006.

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The rooted cuttings were planted in the pits of 45 x 45 x 45 cm size. Before planting pits are filled with organic inputs and the field soil in the ratio of 1:1. The experiment was carried out in randomized, block design with three replications. The treatment combination consist of two different organic manures viz., vermicompost @ 1 kg and decomposed coir pith @ 5 kg/plant Azospirillum root isolation plus humic acid at 3 different rates viz., 0.1, 0.2 and 0.3 % in two different application methods viz., soil and foliar application along with a control. Observations on various biometric characters representing plant growth and yield were done Statistical analysis for experiment was carried out as recommended by Pause and Sukhatme (1967).

#### RESULTS 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 judicious use of one (or) more organic sources, like vermicompost, coirpith, pressmud, FYM, biofertilizers like Azospirillum 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 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.

## Effect of organics, Azospirillum and Humic acid on growth characters of gymnema

Treatments	Number Of laterals/ vine	Number Of leaves/ laterals	Leaf Area (cm <sup>2</sup> )	100 leaves weight (g)	Fresh Leaf yield (kg)	Dry Leaf yield (kg)
T <sub>1</sub> VC 1 Kg + ARI+HA 0.1% (SA)	38.78	110.51	14.73	37.88	3.06	2.12
T <sub>2</sub> DCP 5 Kg + ARI+ HA 0.1% (SA)	37.32	107.44	14.12	36.72	2.84	2.01
T <sub>3</sub> VC 1 Kg + ARI+ HA 0.2% (SA)	44.62	98.23	17.17	41.36	3.94	2.56
T <sub>4</sub> DCP 5 Kg + ARI+ HA 0.2% (SA)	41.70	122.79	16.56	42.62	3.72	2.45
T <sub>5</sub> VC 1 Kg + ARI+HA 0.3% (SA)	32.94	119.72	12.29	33.24	2.18	1.68
T <sub>6</sub> DCP 5 Kg + ARI+ HA 0.3% (SA)	31.48	95.16	11.68	32.08	1.96	1.57
T <sub>7</sub> VC 1 Kg + ARI+HA 0.1% (FA)	43.16	113.58	15.34	39.04	3.28	2.23
T <sub>8</sub> DCP 5 Kg + ARI+ HA 0.1% (FA)	40.24	116.65	15.95	40.20	3.50	2.34
T <sub>9</sub> VC 1 Kg + ARI+HA 0.2% (FA)	47.54	128.93	18.39	44.84	4.38	2.78
T <sub>10</sub> DCP 5 Kg + ARI+ HA 0.2% (FA)	46.08	125.86	17.78	43.68	4.16	2.67
T <sub>11</sub> VC 1 Kg + ARI+ HA 0.3% (FA)	35.86	104.37	13.51	35.56	2.62	1.90
T <sub>12</sub> DCP 5 Kg + ARI+ HA 0.3% (FA)	34.40	101.30	12.90	34.40	2.40	1.79
T <sub>13</sub> Control	30.02	92.09	11.07	30.92	1.74	1.46
General mean	38.78	110.51	14.73	37.88	3.06	2.12
SED	0.59	1.42	0.19	0.47	0.08	0.04
CD (0.05%)	1.30	2.85	0.50	1.05	0.17	0.08

VC - Vermicompost, DCP - Decomposed coir pith, HA - Humic acid, ARI - Azospirillum root isolate, SA - Soil application, FA - Foliar application

## Effect of organics, Azospirillum and Humic acid on biochemical characters of gymnema

Treatments	Chlorophyll Fluorescence (Fv/Fm)	Soluble Protein content (µg g <sup>-1</sup> leaf)	Crude. recovery percentage	Gymnemic acid content
T <sub>1</sub> VC 1 Kg+ ARI+ HA 0.1% (SA)	0.722	143.39	55.33 (52.29)	674.83
T <sub>2</sub> DCP 5 Kg + ARI+ HA 0.1 % (SA)	0.692	140.16	53.51 (51.28)	649.52
T <sub>3</sub> VC 1 Kg + ARI+ HA 0.2% (SA)	0.842	156.31	66.27 (58.60)	776.07
T <sub>4</sub> DCP 5, Kg + ARI+ HA 0.2% (SA)	0.812	153.08	48.04 (48.07)	650.76
T <sub>5</sub> VC 1 Kg + ARI+ HA 0.3% (SA)	0.602	130.47	58.98 (54.41)	573.59
T <sub>6</sub> DCP 5 Kg + ARI+ HA 0.3% (SA)	0.572	127.24	64.45 (57.56)	548.28
T <sub>7</sub> VC 1 Kg + ARI+ HA 0.1% (FA)	0.782	149.85	46.22 (46.98)	725.45
T <sub>8</sub> DCP 5 Kg + ARI+ HA 0.1 % (FA)	0.752	146.62	57.16 (53.37)	700.14
T <sub>9</sub> VC 1 Kg + ARI+ HA 0.2% (FA)	0.902	162.77	60.80 (55.45)	826.69
T <sub>10</sub> DCP 5 Kg+ ARI+ HA 0.2% (FA)	0.872	159.54	62.63 (56.51)	801.38
T <sub>11</sub> VC 1 Kg + ARI+ HA 0.3% (FA)	0.662	136.93	51.69(50.20)	624.21
T <sub>12</sub> DCP 5 Kg + ARI+ HA 0.3% (FA)	0.632	133.70	49.87 (49.14)	598.90
T <sub>13</sub> Control	0.542	124:01	44.40 (45.90)	522.97
General mean	0.722	143.39	52.29	674.83
SED	0.01	0.8	1.44	11.65
CD (0.05%)	0.02	1.60	2.89	23.31

VC - Vermicompost, DCP - Decomposed coir pith, HA - Humic acid, ARI - Azospirillum root isolate, SA - Soil application, FA - Foliar application

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<sup>1</sup> 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 decomposedcoirpith @ 1 kg/plant + root isolate of Azospirillum 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 Azospirillum inoculation + humic acid 0.2% foliar spray and decomposed coir pith @ 1 kg/plant + root isolate of Azospirillum inoculate + humic acid 0.2% as soil application, where as the plant height was least in control. Increased plant height due to application of coir pith compost along with Azospirillum in

parsley (*Petroselinumcrispum*) was reported by Saraswathiet *ah*, (2003) in turmeric by Krishnarnurthy *et ah*, (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 Bhuvanewari (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 + Azospirillum root isolate inoculation + humic acid 0.2% as foliar spray (T<sub>9</sub>) recorded the highest number of Taterals/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. The increase in the number of laterals could be attributed to sufficient quantity of nutrient flow in the plants treated with vermicompost thereby; the auxiliary bud could have been stimulated, leading to increase in number of laterals as reported by Kale *et ah*, 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 % 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 Azospirillum

which were mainly responsible to the cell division and cell elongation. It is presumed that a uniform dosage of vermicompost and *Azospirillum* 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 *azospirillum* 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 (43.82 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. This was followed by the treatment T<sub>0</sub> and T<sub>3</sub> 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<sub>12</sub> (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 *Hybanthusenneaspermus* and Arulnithi (2006) 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 thus 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*.

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), soluble protein content (162.77), gymnemic acid content (826.69), crude extract recovery (662.77), crude recovery percentage (66.27) and minimum total phenols (5295.24). Similar findings in quality parameters were reported by Venukuribalireddy (200<sup>^</sup>) and Arul nithi (2007) in *Aloe*, Velayutham (2005) in *Hybanthusenneaspermus* 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<sup>-1</sup> + 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 that the potential medicinal plant, *Gymnema (Gymnemasylvestre)* can be cultivated through organic means for the benefit of diabetic patients.

## REFERENCES

- Arulnithi, T. 2007. Influence of Humic acid on *Aloe (Aloe vera)*. M.Sc (Ag.) Hort., Thesis, Department of Horticulture, Annamalai University, Annamalainagar.
- Balaguru, K. 2006. Influence of organic inputs along with humic acid on the growth and yield of *ambrette (Abelmoschusmoschatus)*. M.Sc. (Ag.) 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.
- Fallick, E., S.Sarig and Y.Okon. 1989. Morphology and physiology of plant roots associated with *Azospirillum* in: *Azospirillum - plant associations* (Y. Okoned.). CRC press, Boca raton, pp: 77-86.
- Ibadov, O.V., A. A. Baimov, 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 digestedcoirpith, 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.
- Panse, V.G. and P.V. Sukhatme, 1967. Statistical methods for Agricultural Workers, II Edition, ICAR, New Delhi.
- 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 (*Petroselinumcrispum* mill). In the abstracts of national seminar on production and utilization of 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.
- Sumner, M.E. 1990. Crops response to Azospirillum inoculation. *Ad. Soil sci.*, 12: 53- 123.
- Sunitha, M. 2003. Effect of humic acid along with NPK on the yield and quality in bhendi. M.Sc (Ag.) Thesis, Annamalai University, Annamalainagar, Tamil Nadu
- 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. Influence of organic nutrients and biofertilizers on the growth and yield of *Hybanthusenneaspermus*. M.sc (Ag.) Thesis, Annamalai University, Annamalainagar, Tamil Nadu.

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