

# AGRO-MORPHOLOGICAL STUDIES ON EFFECT OF ORGANIC MANURES AND BIOINOCULANTS ON VEGETATIVE AND YIELD ATTRIBUTES OF GYMNEMA (*GYMNEMA SYLVESTRE* R.BR)

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## KEYWORDS

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## ABSTRACT

A field experiment was conducted to study the influence of organic manures and bio-inoculants on vegetative and yield attributes of gymnema (*Gymnema sylvestre* R.Br). The experiment was laid out in Randomized Block Design with nine treatments. The study showed significant differences among the treatments. Among treatment combination Vermicompost (1 kg) + Consortium Bio fertilizers @10 g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray, recorded maximum plant height (78.25 and 203.35 cm), No. of laterals/ plant (46.52) at all stages of plant growth. With respect to yield, application of Vermicompost(1 kg) + Consortium Bio fertilizers+ Humic acid @ 0.2 % foliar spray was found to be best for fresh leaf yield plant<sup>-1</sup> (926.23 g) and dry leaf yield plant<sup>-1</sup> (601.58 g) and minimum was noticed in control. Thus, it can be concluded from the findings that application Vermicompost(1 kg) + Consortium Bio fertilizers+ Humic acid @ 0.2 % foliar spray can be recommended for commercial cultivation of Gymnema.

## INTRODUCTION

*Gymnema sylvestre* (Retz) Schult is a perennial herb which belongs to family Asclepiadaceae, found in several parts of India. It is utilized as a potent drug in traditional (Folk, Ayurvedic, Homeopathy and Siddha ) medicine Mitra *et al.*, 1996). The total saponin fraction of the leaves, commonly known as " Gymnemic acid " has an anti sweetening effect (Suttisri *et al.*, 1995) and was shown to be able to inhibit glucose absorption in the small intestine and to suppress elevated glucose levels in blood following the administration of sucrose in rats (Shimizu *et al.*, 1997).

*G. sylvestre* is known to contain triterpenic saponin and pesticidal properties in leaves (Jaipal *et al.*, 2014). The Consortium bio fertilizers can influence plant growth directly through the production of phytohormones and indirectly through nitrogen fixation and production of bio-control agents against soil-borne phytopathogens (Glick, 2003). In recent years, humic substances have been shown to increase yields tropical crops and other crops (Hayes, 1997). More recently, workers have reported increases in the growth of crops grown in planting media amended with humic acids that were extracted from vermicompost (Arancon *et al.*, 2003). These reports hypothesized that plant growth hormones may become adsorbed on to humic fractions so the plant growth response

is a combined hormonal/humic one. By using inorganic fertilizers, one can get higher yield but indiscriminate use of chemical fertilizers has adverse and ill effects on the soil structure, environment, flora and fauna. Recently, there is fall in mineral fertilizers consumption due to unprecedented hike in price of fertilizers and also soil and water pollution has aggravated the problem of soil health. The increasing costs of fertilizers prevent their use by poor farmers (Adhikary and Gantayet, 2012). Therefore, nowadays attention is shifted towards the alternate sources *i.e.*, organic manures and bioinoculants. However, the use of inorganic fertilizers alone may cause problems for human health and the environment (Arisha *et al.*, 2003). Organic manure can serve as alternative practice to mineral fertilizers (Naeem *et al.*, 2006) for improving soil structure (Dauda *et al.*, 2008) and microbial biomass (Suresh *et al.*, 2004). Application of compost and bio-fertilizers to improve soil structure, fertility and consequently development and productivity of gymnema plants has received little attention. Keeping in view the importance of organic manures and bioinoculants, the present investigation was undertaken to find out the effect of organic manures and bioinoculants on vegetative and yield parameters of gymnema (*Gymnema sylvestre* R.Br).

## MATERIALS AND METHODS

The field experiment was conducted at the Department of Horticulture, Annamalai University, Tamil Nadu, India. The experiment was laid out in a Randomized Block Design (RBD) with three replications. There were nine treatments *i.e.* T<sub>1</sub>: Vermicompost (1 kg) + *Azospirillum*@10g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray; T<sub>2</sub>: Decomposed coir pith (1 kg) + *Azospirillum*@10g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray; T<sub>3</sub>: Vermicompost (1 kg) + *Phosphobacteria* @10g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray; T<sub>4</sub>: Decomposed coir pith (1 kg) + *Phosphobacteria* @10g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray; T<sub>5</sub>: Vermicompost (1 kg) + VAM @10g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray; T<sub>6</sub>: Decomposed coir pith (1 kg) + VAM @10g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray; T<sub>7</sub>: Vermicompost (1 kg) + Consortium Bio fertilizers @10 g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray; T<sub>8</sub>: Decomposed coir pith (1 kg) + Consortium Bio fertilizers@10g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray; T<sub>9</sub>: Control. Uniform sized healthy rooted cuttings of gymnema were planted @ 1 plant per pot in the cement pots of 2 X 1.5 foot size filled with orchard soil. The plants were irrigated once in a week depending upon the soil moisture availability. Observations on morphological parameters like plant height (cm), No. of laterals/plant, No. of leaves/laterals and yield parameters like fresh and dry leaf weight at different stages of plant growth such as 30, 60, 90 and 120 days after transplanting were recorded and analysed statistically (Panse and Sukhatme, 1967).

## RESULTS AND DISCUSSION

### Growth parameters

In the present study, provide clear evidence for some biological mechanism by which vermicompost, biofertilizer application in consortia and humic acid can produce significant increases in overall plant growth and productivity, independent of nutrient availability. The results revealed that, application of vermicompost (1 kg) + Consortium Bio fertilizers @10 g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray resulted in significant increase in plant height, number of laterals and number of leaves/laterals in all the four stages of crop growth. Data pertaining to application of organic manures and bioinoculants on vegetative attributes of gymnema are presented in Table 1. Perusal of data in Table 1 clearly showed that various plant growth parameters were significantly influenced by the various treatments. Application of vermicompost (1 kg) +

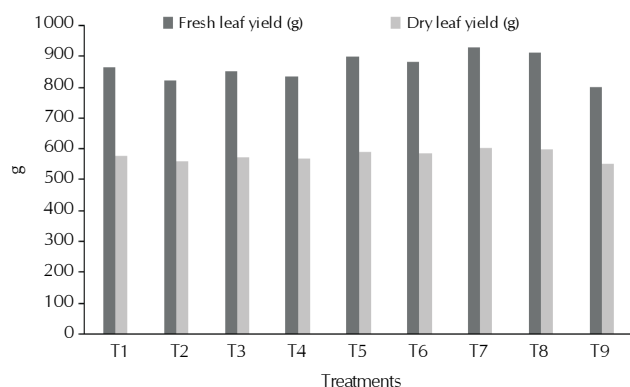
Consortium Bio fertilizers @10 g plant<sup>-1</sup> + Humic acid 0.2 % foliar spray, recorded highest plant height (78.25, 120.35, 165.35 and 203.35 cm) number of laterals (21.04, 25.21, 34.20 and 46.52) and number of leaves (46.10, 58.23, 65.14 and 83.19) at 30, 60, 90 and 120 days after transplanting whereas all parameters were recorded minimum in control. The improved growth might be due to better soil physical condition, prolonged availability of macro and micro nutrients to crop during entire growing season. Humic acid (HA) is a promising natural resource to be used as an alternative for fertilizers to increase crop production (Nikbakht *et al.*, 2008). Humic substances (HS) have beneficial effects on plant growth, nutrient uptake, root development, yield, seed germination and plant photosynthesis (Nardi *et al.*, 2002). The beneficial effect of vermicompost on these parameters might be due to its contribution in supplying additional plant nutrients and increasing availability of native soil nutrients with increased microbial activity. These results are in close agreement with that of (Khiriya *et al.*, 2001) and (Jat *et al.*, 2006). Increase in vegetative growth may be due to better flow of various macro and micro-nutrients along with plant growth substances into the plant system in the plots applied with vermicompost, consortium Bio fertilizers and Humic acid. The superiority in plant growth due to inoculating with biofertilizer (N-free living bacteria + Phosphorus dissolving bacteria) is in agreement with the results obtained by Alian (2005) using *Azospirillum*, *Azotobacter* and *Bacillus*. It seems vermicompost via stimulating bacterial activity in soil and the effect of bacteria themselves on root growth and development resulted in plant growth enhancement and plant dry matter. Regarding the influence of vermicompost and bacteria on nutrient availability and plant nutrient uptake (*i.e.* Mn, Fe), they resulted in chlorophyll enhancement in plant and increase plant height as well (Mohammad *et al.*, 2013) in basil. The application of vermicompost might have enhanced the population of desired microbes in the root zone during the early stage of infection. The earliness of bud initiation in consortium bio fertilizers inoculated plants may be ascribed to easy uptake of nutrients and simultaneous transport of growth promoting substances like cytokinin to the axillary buds, resulting in breakage of apical dominance. Ultimately, this has resulted in a better sink for faster mobilization of photosynthates and early transformation of plant parts from vegetative to reproductive phase. According to Megala and Elango (2014) reported that, Consortium Bio fertilizers recorded the maximum height, chlorophyll and protein content in Glory lily. Humic acid is

**Table 1: Effect of organic manures and bioinoculants on vegetative attributes of *Gymnema sylvestre***

Treatments	Plant height (cm)				Number of laterals plant <sup>-1</sup>				Number of leaves laterals <sup>-1</sup>			
	30 DAP	60 DAP	90DAP	120 DAP*	30 DAP	60DAP	90DAP	120DAP*	30 DAP	60DAP	90DAP	120DAP*
T <sub>1</sub>	67.24	106.91	149.97	187.02	18.29	21.12	29.28	34.15	40.56	50.31	56.70	72.98
T <sub>2</sub>	59.01	96.73	138.44	174.84	16.22	18.05	25.57	33.63	36.17	44.37	50.34	65.31
T <sub>3</sub>	64.50	103.49	146.13	182.96	17.61	20.10	28.05	37.32	39.10	48.34	54.59	70.41
T <sub>4</sub>	61.78	100.11	142.28	178.89	16.92	19.07	26.82	35.48	37.64	46.35	52.47	67.86
T <sub>5</sub>	75.50	116.98	161.50	195.10	19.67	23.16	31.75	42.83	43.18	54.27	60.93	78.10
T <sub>6</sub>	70.00	110.27	153.82	191.11	18.97	22.12	30.52	40.99	42.03	52.29	58.82	75.54
T <sub>7</sub>	78.25	120.35	165.35	203.35	21.04	25.21	34.20	46.52	46.10	58.23	65.14	83.19
T <sub>8</sub>	72.75	113.63	157.66	199.27	20.36	24.19	32.97	44.67	44.65	56.26	63.05	80.64
T <sub>9</sub>	53.62	90.25	131.18	167.12	15.09	16.32	23.49	30.18	33.21	40.26	46.38	60.56
SE <sub>D</sub>	1.33	1.63	1.86	1.96	0.31	0.48	0.55	0.87	0.61	0.93	1.01	1.22
CD(p = 0.05)	2.69	3.28	3.74	3.98	0.63	0.96	1.11	1.75	1.23	1.87	2.03	2.45

**Table 2: Effect of organic manures and bioinoculants on yield attributes of *Gymnema sylvestre***

Treatments	Single leaf weight (g)	100 leaf weight (g)
T <sub>1</sub>	0.30	38.15
T <sub>2</sub>	0.21	34.05
T <sub>3</sub>	0.27	35.45
T <sub>4</sub>	0.24	36.85
T <sub>5</sub>	0.37	41.45
T <sub>6</sub>	0.34	39.65
T <sub>7</sub>	0.43	43.95
T <sub>8</sub>	0.40	42.45
T <sub>9</sub>	0.24	31.96
SEd	0.01	0.66
CD (p = 0.05)	0.02	1.32

**Figure 1: Effect of organic inputs on Fresh leaf yield (g) and dry leaf yield (g) plant<sup>-1</sup> in *Gymnema sylvestre***

also especially important because of its ability to chelate micronutrients increasing their bio-availability. Humic acid stimulates microbial activity by providing the indigenous microbes with a carbon source for food, thus encouraging their growth and activity. Addition of humic substances tends to increase the respiration rate, metabolism and growth of plant as reported by Umesh *et al.*, (2007) in *Solanum nigrum*, Meena *et al.* (2007) in fenugreek. The results of the present study are in accordance with the findings of Prasad *et al.*, (2007) in senna, chrysanthemum (Mamta Bohra and Ajitkumar, 2014) and Limonium (Gayathri *et al.*, 2004).

#### Yield parameters

Yield is a complex phenomenon which is influenced by both genetic as well as environmental factors. Perusal of data in Table 2 clearly showed that various plant growth parameters were significantly influenced by the various treatments. With regards to yield, application of vermicompost (1 kg) + Consortium Bio fertilizers + Humic acid 0.2 % foliar spray gave maximum single leaf weight (0.43g), hundred leaf weight (43.95g). Fig.1. clearly showed that fresh leaf yield (926.23g) and dry leaf yield (601.58 g) and minimum in control. Bhalla *et al.*, (2006) too suggested that secretions of plant growth promoting substances such as auxins, gibberellins and cytokinins by the bacteria seem to be responsible for these beneficial effects in plants inoculated with consortium of biofertilizers. The increased growth of PGPR inoculated plants might also be due to the higher N accumulation by bacterial N<sub>2</sub> fixation and better root growth, which in turn would have

promoted the greater uptake of water and nutrients. Our results are in line with the findings of many other scientists in fenugreek (Verma *et al.*, 2014). Combination application of Biofertilizers (*Azotobacter*, *Bacillus* and *phosphobacteria*) on leaf are might be attribute to its efficiency in supplying the growing plants with biologically fixed nitrogen, dissolved immobilized phosphorus and produced phytohormones, which could simulate nutrients absorption as well as photosynthesis process which increased leaf yield (Hewedy, 1999). In addition, Samane *et al.*, (2014) observed an increase in chlorophyll density and leaf area of sweet basil. Biological fertilizers are materials which include different micro creatures which have the ability to convert main nutrition elements from unavailable form to available form during biological processes (Rokhzadi *et al.*, 2008). The overall the results of this research was suggested that combined application of vermicompost, humic acid and bio fertilizers containing bacterial and fungal, alone and mixing together, have a positive effect on development growth, fresh leaf yield and dry leaf yield in gymnema. According to necessity production of this plants in agronomy ecosystems on the one hand and need attention to medicinal plant cultivation in low input systems, appear bio fertilizer are suitable alternative for chemical fertilizers in production medicinal plants.

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