INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

INFLUNCE OF BIO-INOCULANTS UNDER GRADED LEVELS OF FERTILIZER ON GROWTH, YIELD AND QUALITY OF MAKOI *(Solanum nigrum* L.*)*

Raju, B., Mohana Chandra, C. N., Sreeramu, B.S., Farooqi, A .A. & Chandre Gowda, M.
Department of Horticulture, University of Agricultural Sciences, GKVK, Bangalore - 560 065

ABSTRACT
The field experiment was conducted to study the response of Makoi (*Solanum nigrum* L) to bio-inoculants under graded levels of fertilizers, at the Sanjeevini Vatika, Division of Horticulture, University of Agricultural Sciences, Bangalore. The experiment consisted of twelve treatments with three levels each of N and P (50, 75 and 100%) with a constant dose of K (50 kg ha:') along with different bio fertilizer, (Azotobacter, Azospirillum and Aspergillus) in combination. The experiment was laid out by adopting randomized complete block design with three replications. Application of 75% NP + K + Azotobacter + Aspergillus + FYM recorded significantly superior values for plant height (91.3 cm), number of leaves (500.3), number of branches (35.1), plant spread (8374.26 cm2), leaf area (5417 cm2) per plant, yield of fresh whole herbage (38.56 t ha-1against 15.15 l ha-1 in control) and alkaloid content (O.51 %w/w against 0.17% w / w in control) which was followed by' 75% NP + K + Azospirillum + Aspergilluss + FYM and 100% NPK + FYM.

KEY WORDS: Makoi, Azotobacter, Azospirillum, Aspergillus, FYM, NPK.

INTRODUCTION

Makoi (*Solanum nigrurm* L) is a newly emerging medicinal crop of the family Solanaceae. The leaves, green berries as well as the whole plan t arc medicinally important. The leaves contain the glyco-alkaloids, solarnargine and solasonine. Immature green berries contain solasonine, solamargine. µ- solamargine and b solarnargine. The total alkaloid content of the leaf and berry is 0.431 and 0.101 per cent, respectively (Varshney and Sharma, 1965): The leaves have diuretic, antiseptic and anti dysenteric properties, used in wounds, sores, malaria, dropsy, cardalgia and gripe. The herbal infusion is used as an enema in infants having the stomach upsets and anthrax pustules. Freshly prepared extract of the plant serves as an antidote to opium poisoning and for the cirrhosis of liver. The modern and intensive agriculture methods are not only costly, but also cause soil and water pollution. Thus, by considering the recent concept of eco-friendly technology, application of biofertilizer in combination with inorganic fertilizer, substitute the above need in many crops. The biofertilizer are the primary active strains of micro organisms. They are used either to fix atmospheric nitrogen or to solubilize plant nutrients like phosphates or otherwise stimulate the plant growth through synthesis of growth promoting substances. Among the bio fertilizers, Azotobacter, Azospirillum and Phosphorous Solubllizing Fungi (PSF) are commonly used. Azotobacter is a free living nitrogen fixing bacterium, whereas, Azospirillum is an associate nitrogen fixing bacterium. Phosporous solubilizing fungi help to solubilize insoluble inorganic phosphate such rock phosphate, tricalcium phosphate, iron and aluminium phosphates. Thus keeping above facts in view, the present study was undertaken to study response of makoi to bio inoculants under graded levels of fertilizers.

MATERIALS & METHODS

The field experiment was conducted ill Sanjeevini vatika, GKVK, Bangalore during 2002-03. The experimental site was located at 12° 51 N altitude, 77° 35 E longitude and 930 m above mean sea level. The soil was red sandy loam with a pH of 6.9, 0.45 per cent organic carbon, 102.33, 30.20 and 120 kg per hectare of available N, P2O5 and K20 respectively. The experiment consisted of twelve treatments with three levels each of nitrogen and ph0sphorus (50, 75, and 100%) with constant dose of K (50 kg ha-1) along with different combinations of bio fertilizers such as Azotobacter, Azospirillum and Aspergillus. A common dose of FYM at 10 t ha-1 was applied to all the treatments. The experiment was laid out by adapting randomized complete block design with three replications. The seeds pre soaked in 500 ppm GA3 solution for 12 hours to overcome internal dormancy were sown in raised nursery beds. Thirty days old saplings were planted at 60 x 45 cm spacing, the chemical fertilizers like urea, single super phosphate and muriate of potash were used as a source of NPK, whereas. lignite based Azotobacter, Azospirituun and Aspergillus obtained from the Department of Agricultural Micro biology, University of Agricultural Sciences. Bangalore were applied. Irrigation and inter cultural operations were takenup timely. Harvesting was done after 90 days. Observations on various biometric parameters were made at regular intervals and the means were computed. The total alkaloid content in the dry herb was estimated by using the procedure prescribed by Guseua et al. (1965) and Harborne (1973).

RESULTS & DISCUSSION

Influence of bio fertilizers on growth parameters.

Inoculation of bio fertilizers influenced the morphological characters of plants, resulting in their improved growth and development (Table - 1). The combination of Azotobacter, PSF and FYM along with 75% NP' and full dose of K increased the plant height (19.26 cm) significantly compared to other treatments. This suggests that there is a possibility of reducing the usage of chemical fertilizers at least by 25% by using bio fertilizers which do not adversely effect the plant height. Similar results were reported by Shivalingappa (1998) in tuberose and Manonamain (1992) in gundumalli. The maximum (35.13) number of branches per plant were obtained in treatment combination of 75% NP and 100% K with Azotobacter, PSF and FYM. Increased number of branches per plant noticed in this treatment could be attributed to split application of nitrogen and activation of bioactive substances in plants due to the application of bio fertilizers which in turn would have increased the availability of nutrients. Similar observations were made by Sundharaiya et al., (2000) in Solanum khasianum. Plant-spread was also significantly increased by the application of bio fertilizers along with other chemical fertilizers. Among the different treatments tested, 75% NP and 100 % K with Azotobacter, PSF and FYM gave maximum plant spread (8374- 26 cm2). This can be attributed 10 the production of more number of branches which in turn have increased the plant spread. There was marked increase in the number of leaves due to various treatments. The maximum number were obtained in the treatment of 75% NP and 100% K along with Azotobacter, PSF and FYM (500.40) while, the minimum (160.20) was in control. Generally the plants which received higher dose of nutrients in combination with bio fertilizers produced the maximum number of leaves which could be mainly attributed to better growing conditions that prevailed in the vicinity of root zone due to the application of fungi and bacterium helping the plants to absorb more nutrients. This results confirm the findings Duraiswamy et al. (1981) in Digitalis lantana. The treatment combination of 75% NP and 100% K along with Azotobacter, PSF and FYM recorded the maximum leaf area (5417.06 cm2) and the minimum was in control. Application of bio fertilizers might have enhanced the availability of nitrogen, phosphorus and other nutrients along with the production of growth hormones like IAA, GA and cytokinins to cause the increase in the length and breadth of leaves leading to increased leaf area. Muniramappa et al. (1997) in kalmegh obtained similar results.

TABLE 1: Influence of Bio fertilizers on plant height, branches, plant spread, leaves and leaf area in Makoi

Treatments	Plant height (cm)	Number of branches per plant	Plant spread (cm^2)	No. of leaves per plant	Leaf area (cm^2 per plant)
T_1 – 100:50:50 NPK kg/ha + FYM (10 tha^{-1})	85.93	27.70	7268.53	416.33	4205.83
T_2 – 200 % FYM	73.43	15.16	3346.20	160.20	1185.76
T_3 – 75 % N+PK+Azoto.+ FYM	82.90	26.80	6715.20	333.20	4078.13
T_4 – 75 % N+PK+Azosp.+FYM	81.90	25.76	6331.53	319.46	3724.80
T_5 – 75 % P+NK+PSF+FYM	80.96	25.30	6086.66	306.26	3634.36
T_6 – 75 % NP+K+Azoto.+PSF+FYM	91.26	35.13	8374.26	500.40	5417.06
T_7 – 75 % NP+K+Azosp.+PSF+FYM	81.13	28.43	7886.33	463.13	4704.80
T_8 – 50 % N+PK+Azoto.+FYM	79.16	22.63	5302.20	259.20	2440.03
T_9 – 50 % N+PK+Azosp.+FYM	77.96	22.03	5218.40	235.46	2230.63
T_{10} – 50 % P+NK+PSF+FYM	74.93	16.63	4349.60	199.33	2024.80
T_{11} – 50 % NP+K+Azoto.+PSF+FYM	82.93	24.86	5815.00	279.66	3435.70
T_{12} – 50 % NP+K+Azosp.+PSF+FYM	79.76	23.93	5607.33	269.33	3234.03
F test	*	*	*	*	*
Sem $\pm$	1.13	0.64	349.501	26.73	245.94
C.D. (P=0.05)	3.32	1.89	25.12	78.41	721.36

* Significant at P = 0.05%

Influence of bio fertilizers on yield parameters.

The herbage and alkaloid yields are markedly dependent on the growth response throughout the life cycle of the crop. The crop puts up growth in the form of height, spread and number of branches as per the availability of nutrients. Significant differences were noticed with respect to the flowering. A treatment of 75% NP plus full dose of K along with *Azotobacter, Aspergillus* and FYM took the maximum number of days (33) for 50% flowering compared to control (30 days) simi1ar results were obtained by Amrithnlingam and Balakrishnan (1998) in chilli. The treatment combination of 75% NP plus full dose of K along with *Azotobacter and Aspergillus* and FYM recorded significantly maximum fresh herbage yield per plant (992.33g) and per hectare (36.74 t) and correspondingly the dry herbage yield per plant (208.18g) and per hectare (7.68 t). By the application of bio fertilizers it was possible to get an increased fresh herbage yield of around 40% compared to the control (table 2). This might be due to enhanced availability of nutrients and synthesis of some growth regulators which in turn might have contributed to the better growth and yield. Similar observations were made by Muniramappa et al. (1997) in kalamegh.

Influence of bio ferlilizers on total alkaloid content

The variation in total alkaloid content was not spectacular among the treatments. However the maximum (0.51% w/w), total alkaloid content was recorded in 75% NP plus full dose of K along with *Azospirillum, Aspergillus* and FYM. While, the minimum (0.17%w/w) was found in treatment involving the application of 100:50:50:NPK kg/ha + FYM. Sena and Das (1998) obtained similar results in turmeric.

TABLE 2: Influence of Bio fertilizers on days to 50% flowering, herbage yield and alkaloid content in Makoi

Treatments	No of days to 50 % flowering	Herbage yield				Total alkaloid content (% w/w)
		Fresh (g/plt)	Dry (g/plt)	Fresh (t ha^{-1})	Dry (t ha^{-1})	
T_1 – 100:50:50 NPK kg/ha + FYM (10 tha^{-1})	27.66	804.66	145.84	29.75	5.37	0.17
T_2 – 200 % FYM	22.33	409.66	75.17	15.02	2.75	0.27
T_3 – 75 % N+PK+Azoto.+ FYM	26.33	782.33	138.59	28.95	5.10	0.39
T_4 – 75 % N+PK+Azosp.+FYM	25.00	754.66	129.21	28.16	4.75	0.36
T_5 – 75 % P+NK+PSF+FYM	26.33	695.66	125.50	25.99	4.84	0.34
T_6 – 75 % NP+K+Azoto.+PSF+FYM	33.00	992.33	208.10	36.74	7.68	0.51
T_7 – 75 % NP+K+Azosp.+PSF+FYM	30.00	883.33	167.38	32.69	6.23	0.47
T_8 – 50 % N+PK+Azoto.+FYM	25.00	599.66	124.33	22.16	3.55	0.28
T_9 – 50 % N+PK+Azosp.+FYM	22.66	571.00	93.33	21.11	3.54	0.42
T_{10} – 50 % P+NK+PSF+FYM	22.66	529.66	884.66	19.61	3.23	0.22
T_{11} – 50 % NP+K+Azoto.+PSF+FYM	26.00	696.00	118.84	25.77	4.36	0.33
T_{12} – 50 % NP+K+Azosp.+PSF+FYM	26.66	631.00	105.44	23.31	3.87	0.31
F test	*	*	*	*	*	*
Sem $\pm$	0.67	24.20	8.16	0.93	0.24	0.02
C.D. (P=0.05)	1.97	70.99	23.94	2.73	0.69	0.05

* Significant at P = 0.05%

CONCLUSION

The present study suggests that application of bio fertilizers had pronounced effect on growth, yield and quality. Thus, a combination of 75% NP plus 100 % of K along with Azotobacter. PSF and FYM may be applied to obtain the maximum growth and yield in makoi. The application of organic manures and bio inoculants improves the soil texture, reduces the pollution of soil due to reduced fertilizer application which is beneficial for the present day problems of high fertilizer cost and environmental pollution.

REFERENCES

Amrith Lingam, S. & Balakrishnan, K. (1998) Studies on the effect of Azospirillum, nitrogen and NAA on growth and yield of chilli. (*Capsicum annum*, Cv. K_1). *South Indian Hort.*, 36 (4): 218-19.

Duraiswamy, A., Dhakshnarnorthy, M. and Sampath. Y., (1981) Effects of NPK on growth and yield of foxglove (*Digitalis lanata* Ehrh.) *Madras Agri. J.*, 68 (3): 174 -177.

Guseua , A.R., V.A., Borikhina. M.G. and Moiseev , R.K. (1965) Determination of Steroid glyco-alkaloids in *Solanum laciniatum, Bioknimia* 30: 260-264.

Harborne, J.B. (1973) In *Phyto Chemical Methods*, pp. 191. Chapman and Hall, London.

Manonamanin, R. (1992) Effect of soil inoculation of Azospirillum and phospho bacteria and graded levels of nitrogen and phosphorous bio fertilizers on growth and yield of *Jasminum sambac* Ait. Cv. Gundumalli. MSc. (Hort.) thesis, Tarnil Nadu, Agricultural University, Coimbatore.

Muniramappa, R.P., Farooqi, A.A., Gowda, H.G .R. and Maricapu, S. (1997) Influence of macro-nutrients on yield and active principle content in Kalmegh, *Journal of Medicinal and Aromatic plants* 19 (4): 1039-1042.

Shivalingappa. J. (1998) Influence of bio fertilizers on growth, yield and essential oil content in tuberose (*Polianthes tuberose*), M.Sc. (Hort.) thesis submitted to the University of Agricultural Sciences, Bangalore.

Sundharaiya, K., Nainar, R., Ponnuswami, V., Javajasmine, A. and Muthuswamy (2000) Effect of Inorganic nutrients and spacing on the yield of Maranthukathri (*Solanum khasianum* Clarke). *South Indian Hort*. 48 (1-6): 168-171.

Varshney I. P., and Shnrma, S.C. (1965) Saponins and Spogenins- XXIX, the sapogenin of *Solanum nigrum berries, Phytochemistry*: 967-968.