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RESEARCH ARTICLE

Cultivation of safed musli (*Chlorophytum tuberosum* L.) by *Azolla* as green manure

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SUMMARY

The whole world including India, demand of natural ecofriendly or organic cultivation of medicinal plants and cereal crops is rapidly increased in last 2-3 decades. At present a number of methods of organic farming are popular for cultivation of crops as well as medicinal plants. *Azolla* a genus of water fern has specific place among various types of biofertilizers. It occurs in fresh stagnant water bodies of tropical, semitropical and warm temperate regions of entire world. Present study is based on effect of *Azolla* as organic compost on growth and composition of 100 days old safed musli (*Chlorophytum tuberosum* L.) plants. Safed musli plants were cultivated in soil-pot culture conditions and treated by different doses of *Azolla* as green manure. After 100 days of cultivation plants were studied for dry matter yield, chlorophyll, ascorbic acid, nitrogen and crude protein contents showed remarkable and significant growth. Thus *Azolla* can be better organic compost for cultivation of safed musli.

Key Words **:** Organic cultivation, *Azolla, Chlorophyutum tuberosum*, L., Safed musli

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Throughout the history agriculture has been a major activity of human beings since ancient times. Man cultivated useful plants from the very beginning of human civilization. All traditional Agricultural methods were based on organic farming. In ancient India agricultural practices were closely related with cow farming. Bulls were used for different agricultural processes and their excretory products were used as valuable organic compost. After industrial revolution, use of chemical fertilizers rapidly increased in whole world. In India excessive use of chemical fertilizers kept on increasing day by day since the beginning of green revolution. The uncontrolled use of agrochemicals creates various environmental problems as well as health hazards of human beings. Changes of soil characteristics, destruction of useful microbes and worms, chemical defects on vegetables, fruits cereals and agro products, decreasing the water holding potential of agriculture soil, increasing the water supply demand for irrigation, decreasing the ground and surface water quality, increasing the production cost of agriculture, infertility of soil, harmful effects on animals birds and human beings are the major looses of using chemical fertilizers. On accounts of these reasons entire globe is returning towards organic fertilizers in agriculture practices.

The beginning of 21st century Indian agricultural system is facing a number of problems like high investment, low return of agro products, decreasing the fertility of agriculture soil, decreasing the cultivation area of agriculture etc. Now sometimes loan, sometimes natural problems, sometimes very low return of crop is making our farmers to stay away from agricultural activities. A great number of subsides of formers in recent two decades create a great question mark on our agriculture pattern policies, as well as achievements of green

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revolution.Increasing of agriculture production by excessive use of chemical fertilizers and pesticides was the demand of 6th decade of 20th century but excessive use of ecofriendly techniques and the decreasing the use of agrochemicals is the demand of present time. Hence, proper nutrition of ever increasing population of our country by using ecofriendly or sustainable methods of agriculture will be a great challenge in present century. Therefore it is extremely essential to implement biofertilizers in the place of chemical fertilizers, as soon as possible. Various types of biofertilizers are popular in agriculture practices such as compost (dung manure), green manure, liquid compost, wormy compost, biodyanmic compost, bacterial composts, blue-green algae and *Azolla* (Agnihotri, 2008).

Azolla a genus of water fern has very specific place among different types of biofertilizers for its fast nitrogen fixing ability. *Azolla* contains nitrogen fixing blue-green alga *Anabaena azollae* in their cavities. It is easily available, ecofriendly, cost effective, fast growing source of biological nitrogen especially in low land rice fields. It is also a good source of phosphorus, potassium, organic carbon and other minerals. It is only symbiosis of two organisms which is directly used in agriculture activities. It has a great potential to improve soil fertility.

Safed musli (*Chlorophytum tuberosum* L.) is a well known medicinal plant, which is used in a number of Ayurvedic, Unani, Siddha, as well as Homoeopathy and Allopathy. It is also popular in many ethnic, regional and local formulations. It is an effective tonic for health and vigour. A decoction of safed musli with turmeric is prescribed for all types of rheumatism. According to Ayurveda the root of safed musli is used for treating spruce, piles, blood disorders, and as rejuvenator and aphrodisiac. The dried root powder is also used for healing of mouth and throat ulcers. Present investigation is based on effect of *Azolla* as green manure on growth and composition of safed musli.

MATERIALS AND METHODS

Safed musli (*Chlorophytum tuberosum* L.) plants were cultivated in soil-pot culture conditions. Plants obtained from Forest Research Institute (FRI), Kanpur. All selected plants were equal in shape and size. *Azolla* was collected from ponds and ditches of nearby localities of Kanpur and adjunct areas. Soil amendments with *Azolla* as green manure were nil (0), 50,100,150,200and 250 g *Azolla*/kg soil. For each treatment there were three replicates. Calculated amount of distilled water were applied daily to pots to provide as far as possible equal moisture conditions. Tops and roots of 100 days old safed musli plants were taken from estimation of dry matter yield, chlorophyll, ascorbic acid, nitrogen and crude protein contents. Dry matter yield was determined by drying both tops and roots samples of safed muslin a forced drought oven at 70 C for 24 hours to constant weight. Chlorophyll content was determined by method of Petering *et al.* (1940). Determination of ascorbic acid, nitrogen and crude protein contents deals of procedure were same as described by Agnihotri (2008).

RESULTS AND DISCUSSION

Effect of *Azolla* on growth and composition of 100 days old safed musli (*Chlorophyutum tuberosum* L.) plants is arranged in Table 1, which deals the influence of *Azolla* as organic compost on dry matter yield, chlorophyll, ascorbic acid, nitrogen and crude protein contents of safed musli. 250 g *Azolla*/kg soil level showed maximum increase in dry matter yield and chlorophyll contents of safed musli. 200 g *Azolla* / kg soil level showed maximum increase in ascorbic acid contents of both tops and roots of safed musli. While maximum nitrogen and protein content were observed at 200 g *Azolla*/ kg soil level in roots and 250 g *Azolla*/kg soil in tops of 100 days old safed musli plants. Most of the levels of *Azolla* supply showed significant (P=0.05) or highly significant (P=0.01) growth in all parameters.

Application of *Azolla* as green manure showed a remarkable growth in dry matter yield and mineral composition of number of crops. A number of researchers marked that utilization of *Azolla* showed very beneficial for dry matter yield of crops. Numerous researchers *i e.* Moore (1969), Trans and Dao (1973), Peters (1978), Patel *et al.* (1980), Pillai (1982), Kannaiyan (1987), Van Hove (1989), Kolhe and Mitra (1990), Kalita and Sharma (1994), Datta (2000), Liu *et al.* (2000) Carrapico *et al.* (2002), Mishra *et al.* (2005) and Agnihotri *et al.* (2007) were reported beneficial results while using *Azolla* as manure for rice crops.Van Hove (1989) and Sharma *et al.* (1999) observed encouraging results using *Azolla* on wheat crop. Xiang and Li (1981) and Ferrera-Cerrato and Marenda (1982) reported that *Azolla* showed very effective results on maize crops. Pereria and Shetty (1987) observed beneficial effects of *Azolla* on coffee crop. Application of *Azolla* increased chlorophyll content of numerous crops reported by Kalita and Sharma (1994), Ismail *et al.* (1995) and Agnihotri *et al.* (2007). Potential of *Azolla* application on ascorbic acid contents was estimated by Saxena (2001), Saxena *et al.* (2007) and Agnihotri *et al.* (2007). Beneficial effects of *Azolla* on nitrogen and crude protein contents is well observed by Yatazawa *et al.* (1980), Kalita and Sharma (1994), Sharma *et al.* (1999), Singh and Singh (1995) and Agnihotri *et al.* (2008).

In India, utility of *Azolla* as green manure is limited to only research activities while China cultivated about 60 thousand and Vietnam cultivated 40 thousand hectare of rice crop by using *Azolla* as green manure. Cultivation of *Azolla* as green manure has great potential in the context of India because it is a cheaper, ecofriendly and low cost source of biological nitrogen. Labour cost is low and 60 per cent of the formers are small and marginal in India create more possibilities in relation to *Azolla* application. The demand of organic food

Table 1 : Effect of *Azolla* as green manure on growth and composition of 100 days old safed musli (*Chlorophyutum tuberosum* L.)

Plant part	g *Azolla* kg soil						L.S.D.	
	0	50	100	150	200	250	P=0.05	P=0.01
				g dry matter yield/plant				
Tops	19.87	25.30	28.65	29.30	31.65	34.18	1.65	2.35
Roots	19.70	21.15	22.48	26.05	29.05	30.75	1.10	1.56
				mg chlorophyll/ acid 100g fresh matter				
Leaves	28	38	44	49	42	52	5.03	7.16
				mg ascorbic acid/ 100 g fresh matter				
Tops	62	72	77	88	90	87	8	11
Roots	52	58	64	73	75	67	6	9
				percentage of nitrogen (in dry matter)				
Tops	0.85	1.03	1.20	1.42	1.75	1.88	0.08	0.11
Roots	1.15	1.32	1.73	2.07	2.32	1.94	0.16	0.23
				percentage crude protein (in dry matter)				
Tops	5.34	6.46	7.50	8.89	10.94	11.77	0.50	0.71
Roots	7.20	8.23	10.83	12.92	14.48	12.13	1.00	1.42

products and organic cultivation of medicinal plants is rapidly increased throughout entire globe. *Azolla* as organic compost has a lot of possibility in the cultivation of medicinal plants. It is concluded that *Azolla* can very effective for boosting second green revolution in 21st century.

REFERENCES

Agnihotri, Nikhil (2008). Soil-plant relationship as influenced by *Azolla* as organic compost. Ph.D. Thesis, C.S.J.M. University, KANPUR, U.P. (India).

Agnihotri, Nikhil, Mahadev, Mohan, J. and Mohan, N. (2007). Soil-plant relationship as influenced by *Azolla* as organic compost II. Chlorophyll and ascorbic acid content of medicinal plant safed musli. National Seminar on "Combating pollution to create a healthier planet", Kanpur. Dec. 10 – 12, pp. 37-38.

Agnihotri, Nikhil, Mohan, J. and Mohan, N. (2008). Growth and composition of medicinal plant sarpagandha as influenced by *Azolla* as organic compost. In proceedings of "95th session of Indian Science congress", Visakhapatnam. Part III Sect. XIV. Abst. 97, pp. 57-58.

Carrapico, F., Teixeira, G. and Adeliadiniz, M. (2002). *Azolla* as a biofertilizer: A challenge for the future.In: *Biotechnology of bioinformatics*. Ed. S. Kannaiyan. Narosa Publishing House. New Delhi. pp. 277-292.

Datta, B. K. (2000). *Azolla* and its utilization for rice production in West Bengal. In fertilizer: *Blue green algae and Azolla*. Ed. P.K. Singh, D.W. Dhar, S. Pabbi, R. Prasanna and A. Arora, NCCUBGA, New Delhi. pp.122 – 123.

Ferrera-Cerrato, R. and Miranda, R. A. (1982). Propagation of an *Azolla* sp. and its potential as a green manure for corn in Mexico. *Biological nitrogen fixation technologies for tropical agriculture*, Ed., P.H. Graham and S.C. Harris. Centro International de Agricultra Tropical, Cali, Colombia, pp. 561-564.

Ismail, B. S., Sew, T. C. and Mushrifah, I. (1995). Effect of molinate and carbofuran on nitrogen fixation by *Azolla pinnata*. *Microbios.*, **82**: 127-134.

Kalita, M.C. and Sharma, C.M. (1994). Response of rice variety Mahsuri to green biofertilizer *Azolla pinnata*. *J. Assam Sci. Soc.,* **36** (4): 260-265.

Kannaiyan, S. (1987). Studies on the use of symbiotic blue-green algae *Anabaena azollae- Azolla* Association for rice crop. In "All India Applied Phycological Congress" New Delhi. Oct. 16-17, 9pp.

Kohle, S.S. and Mitra, B.N. (1990). *Azolla* as an organic source of nitrogen in a rice wheat cropping system. *Trop. Agric.* (Trinidad), **64**: 267-269.

Liu, R.Q., Ou, X.M., Xie, L.W., Xiao, S.Y. Xia, H.A., Huang, Y.B., Wen, H.B., Chen,Y.G. and Huang, D.F. (2000). Technique and application of the *Azolla*–fish ecosystem in row planted rice fields; *Soils Fertility,* **1**: 38 – 41.

Moore, A.W.(1969). *Azolla*: biology and agronomic significance *Bot. Rev. (Lancaster),* **34**: 17-34.

Mishra, U., Chaudhary, K. K., Pabbi, S., Wattaldhar, D. and Singh, P.K. (2005). Influence of blue-green algae and *Azolla* inoculation on specific soil enzyme under paddy cultivation. *Asian J. Microbiol., Biotech & Environmental Sci.,* **7** (1): 9-12.

Patel, C.S., Singh, J., Mittra, B.N., Patro, G.K. and Suhrawardy, M.Z. (1980). Use of *Azolla* fern as a good source of organic nitrogen in rice. *Fertil. News,* **25**: 15-16.

Peters,G.A.(1978). The *Azolla Anabaena* symbiosis: morphology and physiology: In increasing Productivity under light supplies, Proc. II Review meeting INPJTS project Honolulu, Hawaii, U.S.A. 153-165. From *Soil & Fort*., **45** (7): 6113.

Pillai, K.G. (1982).Current status of agro-technology for rainfed rice culture. *Oryza*, **19**: 125-140.

Saxena, Vishal (2001). Role of *Azolla* as organic manure on growth and yield of paddy and tomato. Ph.D. Thesis, C.S.J.M. University, KANPUR, U.P. (India).

Saxena, V., Gupta, L.K. and Kumar, T. (2007). Effect of *Azolla* as biofertilizer chlorophyll of paddy (*Oryza sativa*, L. Ver. Saket) plants. In the Proceedings of National Seminar on "Plants and Human Welfare: Past to Present" Kanpur. Dec. 24, 67pp.

Singh, D.P. and Singh, P.K. (1995). Response of *Azolla caroliniana* and rice to phosphorus enrichment of the *Azolla* inoculum and phosphorus fertilization during intercropping. *Exp. Agric*., **31**: 21-26.

Sharma, M.P., Singh, R. and Singh, R. (1999). Effect of *Azolla* on wheat (*Triticum aestivum*) yield and soil properties. *Indian J. Agric. Sci*., **69**: 55-57.

Trans, Quang and Dao, Tuan (1973). *Azolla* a green manure. *Agric. Prob.* Vol. 4 *Victnamase studies,* **38**: 119-127.

Van Hove, C. (1989). *Azolla* and its multiple uses with emphasis on Africa. Food and Agriculture Organization, Rome.

Xiang, Z.A. and Li, Z.F. (1981). *Zhejiang nongye Kexue,* **6**:281. (In Chinese).

Yatazawa, M., Tamomatsu, N., Hosoda, N. and Nunome, K. (1980). Nitrogen fixation in *Azolla-Anabaena* symbiosis as affected by mineral nutrient status. *Soil Sci. Plant Nutr.,* **26**: 415-426.

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