Journal of Pharmaceutical and Scientific Innovation
www.jpsionline.com
Research Article

BIOCHEMICAL ANALYSIS OF MULBERRY ASSOCIATED WITH INTERCROPPING OF MEDICINAL PLANTS UNDER TEMPERATE CLIMATIC CONDITIONS

M.S. Rathore*, Y. Srinivasulu, R. Kour, Anil Dhar and K.A. Sahaf
Central Sericultural Research and Training Institute, Central Silk Board, NH-44A, Galandhar, Pampore, Kashmir, India
*E-mail: mahendersr@gmail.com

Received on: 15/04/12 Revised on: 28/05/12 Accepted on: 05/06/12

ABSTRACT
The Kashmir valley represents temperate climatic conditions and is known for its bivoltine sericulture. The sericulture in the region however, sustains on tree type of plants. Majority of sericulturists in this traditional area have taken up mulberry cultivation on small land holdings as a life sustaining occupation. Other farmers with more land have taken up it as subsidiary occupation. Mulberry is facing stiff competition from other economic crops. In order to make the mulberry cultivation more profitable and sustainable, intercrops can be practiced with them. Medicinal plants like *Lavendula officinalis*, *Atropa belladonna* and *Echinacea purpurea* are important source of alkaloids and essential oils, which have huge demand in pharmaceutical industry. The wider spacing available in the tree type of plantation of mulberry facilitates the cultivation of these medicinal plants as an intercrop. The present paper focuses on utilization of medicinal plants as an intercrop with mulberry to generate an additional income to the progressive farmers as the biochemical studies shows that there is no significant impact on mulberry leaf quality and soil health.
Key words: Biochemical, Kashmir, Mulberry, Pharmaceutical, Temperate

INTRODUCTION

Jammu and Kashmir is the only traditional sericultural state of India where mulberry exists from time and its leaves used as obligate source of feed to silkworms for the fabrication of silk[1]. Majority of Sericulturists in the traditional areas of Kashmir depends on mulberry trees available on road sides. The successful adoption of mulberry Sericultural activities depends upon net returns. The farmers in this region (J&K) are usually reluctant to spare their land for mulberry plantation as they prefer other agricultural cash crops which provide them more income. Therefore, intercropping of mulberry with remunerative medicinal plants having high export potential can be promoted to optimize the production per unit area[2]. Additional income can be generated simultaneously from the same land area by adopting intercropping of medicinal plants like *Lavendula officinalis, Crocus sativus* (Saffron), *Atropa belladonna, Asparagus racemosus, Rosemarinus officinalis* etc. with mulberry, without effecting mulberry yield potential and leaf quality[3]. Besides, as per the market trend the cocoon price in the market remains is stable and rearing input cost within a period of time has gone up. Therefore, to strengthen sericulture, appropriate strategies needs to be adapted to raise economic status of farmer and sustainance of sericulture. As such, to improve the socio-economic status of farmers, it is envisaged to study the effect of intercropping of medicinal plants with mulberry in Kashmir valley. Selection of intercrops is an important factor[4]. The adoption of appropriate medicinal plants considered for intercrop is based upon their low cost of production, higher sale value and their adaptability to temperate environmental conditions. Also, their planting and harvesting schedules are well synchronizing with mulberry cultivation practices[5]. At CSR&TI, Pampore we have developed technology for intercropping of important medicinal plants with mulberry[6]. In the present study *Lavendula officinalis*, *Atropa belladonna* and *Echinacea purpurea* were grown as intercrop with tree type of mulberry (var. *Goshoerami*) (Fig. 1). In this paper results of biochemical analysis of mulberry grown along with intercrop and soil health status as influenced by intercropping are been presented.

MATERIALS AND METHODS

The experiment was laid out in RBD by procuring medicinal plants from IIIM, Boner Pulwama, Kashmir as per the following details:

Mulberry Genotype	: *Goshoerami*
Type of the plantation used	: Tree
Number of trees per treatment per replication	: 09
Area per treatment per replication	: 648 sq. ft.
Treatments	: 04
Replications per treatment	: 06

Details of the treatments

T-1: Mulberry with *Atropa belladonna*
T-2: Mulberry with *Lavendula officinalis*
T-3: Mulberry with *Echinacea purpurea*
T-4: Mulberry only as control

Collection of soil samples and Analysis

Soil Samples were collected from intercropping plot at CSR&TI, Pampore using soil Auger in a zigzag manner. The depth of sampling will be 0-30 cm. Composite sample will be prepared using Quartering method. Samples were analyzed for pH and EC using digital pH and EC meter. The standard methods adopted for nutrient analysis were following:

1. Av. Nitrogen: (Subbiah and Asija, 1956)
2. Av. Potassium: (Hanway and Heidel, 1952)
3. Av. Phosphorus: (Olsen's *et al.,* 1954)
4. Micronutrients cations (Zn,Cu, Fe & Mn): (Lindsay and Norvell, 1978)

Biochemical analysis of Mulberry

The trees of Goshoerami were maintained according to recommended package and practices. The plant samples were harvested and dried in shade (except for chlorophyll analysis). These plant samples were then analyzed in laboratory. The standard methods adopted for biochemical analysis of plant material were:

1. Total Protein: (Bradford, 1976)
2. Total Carbohydrate: (Anthrone method by Hedge and Hofreiter, 1962)
3. Total Chlorophyll: (Arnon, 1949)

RESULTS AND DISCUSSION

The data recorded by analysis of soil samples doesn't showed significant differences among the treatments. The soil health

status in terms of Nitrogen, Phosphorus and Potassium revealed that the amount of macronutrients in the soil was lower in the intercropping plot as compared to control. But, the status was within the recommended limits (Graph 1). The pH status of the soil also remained constant in all the treatments (Table 1). The soil micronutrients (cations) status of control plot and intercropping plot showed that there is significant difference in Zn and Fe concentrations. However, these differences were in permissible limits (Graph 2). The mulberry plant leaf samples were analyzed for quality parameters. The data analyzed revealed that there was some impact of intercropping of *Atropa belladonna* and *Echinacea purpurea* on the mulberry leaf quality parameters. However, intercropping of the *Lavendula officinalis* does not pose any significant effect on mulberry leaf quality (Graphs 3, 4 & 5).

The analysis of data has shown that the intercropping of medicinal plants with mulberry does not have significant effect on quantitative and qualitative parameters of mulberry[14,15,16]. Also soil health status remains stable. If this technology is adapted by farmer, he can generate a handsome additional income from intercrop[17, 18]. *Lavendula officinalis*, when grown as intercrop with mulberry, has more potential in Kashmir valley as the net returns in comparison to the other crops are high.

CONCLUSION

Medicinal and aromatic plants are upstream elements of food, flavour and cosmetic industries. These plants can be cultivated in order to obtain essential oils and fragrant chemicals for commercial use. The demand for medicinal and aromatic plants is increasing day by day at national as well as international market. The plants experimented for intercropping with mulberry under temperate conditions of Kashmir has shown alluring prospects. Therefore, intercropping of medicinal plants with mulberry shall be advocated and adopted for obtaining additional remuneration for the farmers in this region.

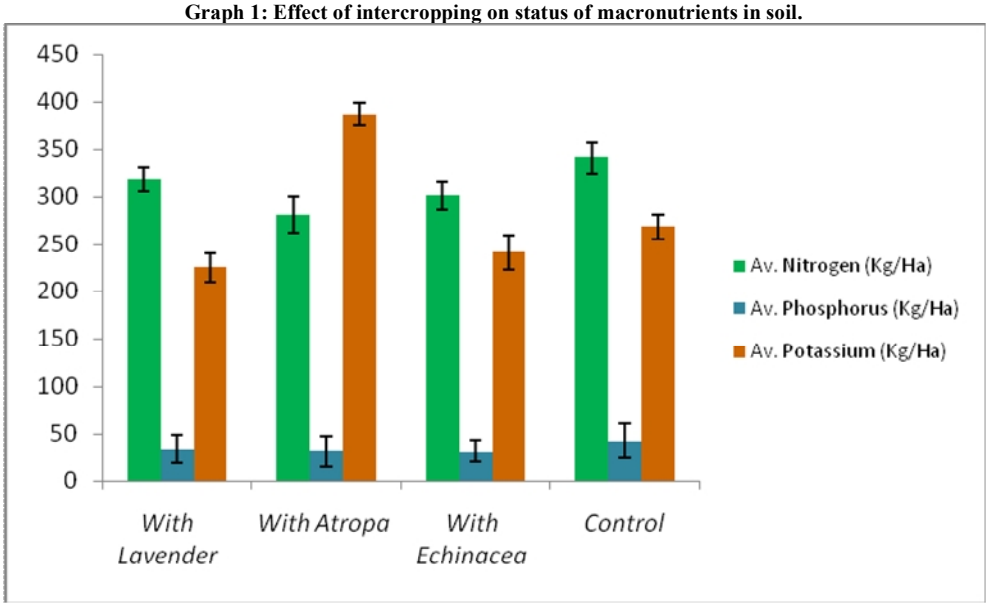
ACKNOWLEDGEMENTS

Authors are grateful to Mr. Mohd. Ashraf Hajam and Mr. Mohd. Shafi Ganayee for their support and assistance in the study. We are also indebted to Central Silk Board, Government of India, Ministry of Textiles, for providing financial assistance.

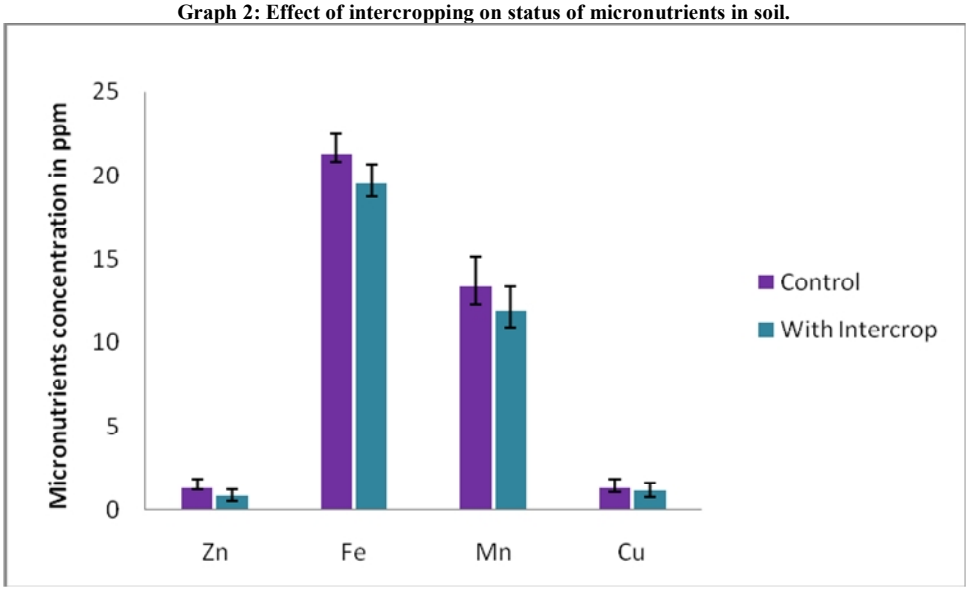
REFERENCES

1. Ahsan MM, Dhar Anil, Dhar KL, Fotadar RK. Package of practices for mulberry cultivation under temperate conditions. Indian Silk 1990, 29(2): 7-12.
2. Rathore MS, Srinivasulu Y, Shabnam AA, Kour R, Dhar Anil, Khan MA. Cryopreservation of elite mulberry germplasm. Current Science 2010; 99(5): 557.
3. Dhar A, Khan MA. Package of Practices for mulberry tree cultivation. Asian Textile Journal 2004; 13(5): 62-66.
4. Dandin SB, Jataswal J, Giridhar K. Handbook of Sericulture Technologies. 2003. Central Silk Board, Bangalore, India; pp. 1-259.
5. Ahsan MM, Dhar KL, Fotadar RK, Dhar Anil. Studies on intercropping of short duration crops will mulberry. Indian Journal of Sericulture 1989; 28(2); 194-199.
6. Kour R, Mir MR, Khan MA, Nazir S. Intercropping of mulberry with Saffron in the valley- convenient and profitable. Indian Silk 2002; 41(2):5-6.
7. Subbiah BV, Asija GL. A rapid procedure for the determination of available nitrogen in soils. Current Science 1956; 25:259–260.
8. Hanway JJ, Heidel H. Soil analysis methods as used in Iowa State College Soil Testing Laboratory. Iowa Agriculture 1952; 57:1-31.
9. Olsen SR, Cole, CV, Watanable FS, Dean L.A. Estimation of available phosphorus in soil by extraction with sodium carbonate. Cir. U.S. Dep. Agric.1954; 939.
10. Lindsay WL, Norvell WA. Development of DTPA soil test for zinc, iron, manganese and copper. Soil Sci. Am. J. 1978; 42: 421-48.
11. Bradford MM. A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. Anal. Biochem.1976; 72:248-254.
12. Arnon DI. Copper enzymes in isolated chloroplasts, Polyphenol oxidase in *Beta vulgaris*. Plant Physiol. 1949; 24:1-15.
13. Hedge JE, Hofreiter BT1962. In: Carbohydrate Chemistry, 17 (Eds. Whistler R.L and Be Miller, J.N), Academic Press, New York,.
14. Tikader A. Intercropping with legumes to increase mulberry production. Indian Silk 1992a; 30 (11): 41-42.
15. Tikader A. Turmeric as an intercrop with mulberry. Indian Silk 1992b; 30(5): 20-25.
16. Dayakar Yadav B R, Nagendra Kumar TD. Effect of row-arrangement on yield and monetary benefits in mulberry (*Morus indica*) + soybean (*Glycine max*) and mulberry + greengram (*Phaseolus radiatus*) intercropping. Indian Journal of Agriculture Sciences 1998; 68 (3): 149-151.
17. Hadimini DK, Patil G M, Alagundagi SC. Impact of legume intercropping in paired row of mulberry on silkworm. Karnataka Journal of Agriculture Sciences 2004; 17(3): 498-501.
18. Shankar MA, Jayaramaiah M, Anita P, Rangaswamy B.T, Bharti VP. Feasibility of intercropping flower crops in irrigated mulberry. 4th China International Silk Conference 2000; pp. 51-55.

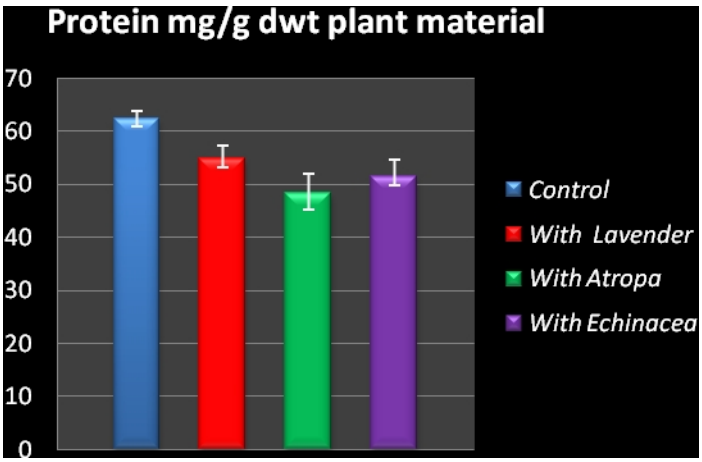
Graph 1: Effect of intercropping on status of macronutrients in soil.



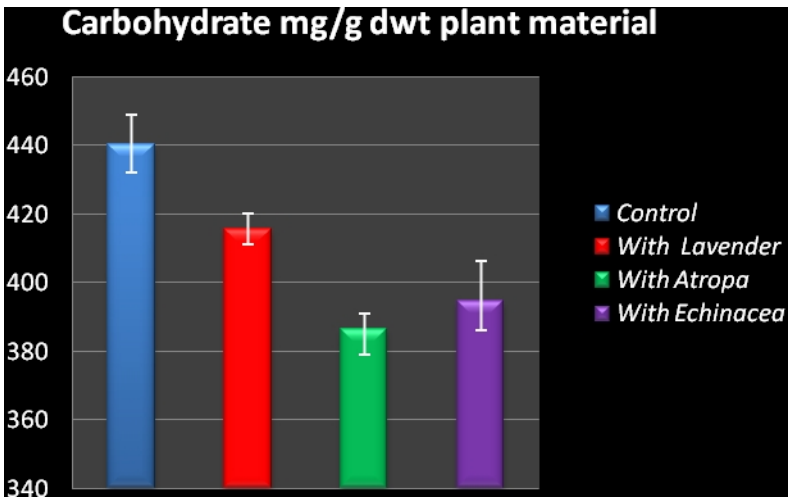
Graph 2: Effect of intercropping on status of micronutrients in soil.



Graph 3: Effect of intercropping on protein content in mulberry leaf.



Graph 4: Effect of intercropping on protein content in mulberry leaf.



Graph 5: Effect of intercropping on chlorophyll content in mulberry leaf.

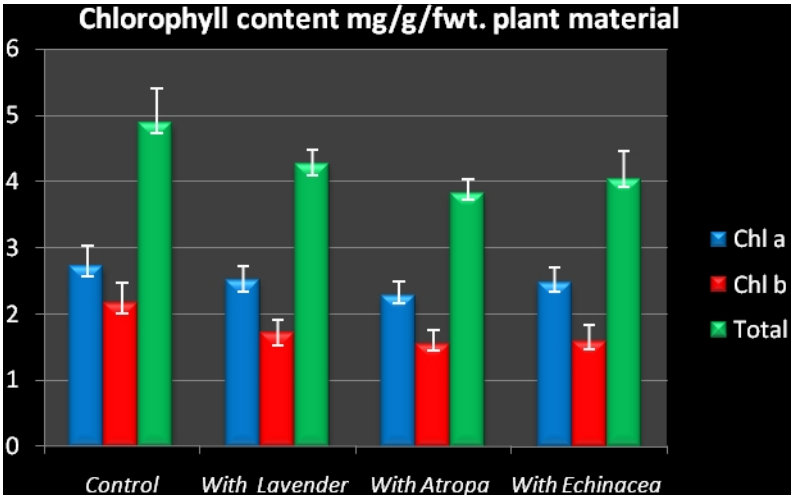


Table 1: Effect on soil pH and EC by intercropping.

Treatments	pH	EC (dS/m)
With *Lavender*	7.32	0.28
With *Atropa*	7.62	0.32
With *Echinacea*	7.38	0.25
Control Mulberry alone (*Goshoerami tree*)	7.41	0.28

Fig. 1: Intercropping of mulberry with A) *Lavendula officinalis* B) *Echinacea purpurea* and C) *Atropa belladonna.*