I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3.03

Promising Som *Persea bombycina* Kost. based Intercropping System for Increasing Productivity and Sustainability

U. Hazarika[1], S. K. Barthakur[2], R. Chakravarty[3] and K. Pathak[4]

ABSTRACT: *To identify the promising Som Persea bombycina Kost. based intercropping system which can sustain and be well suited under Assam agro climatic conditions, an experiment was conducted during 2007-08 to 2009-10 at Lahdoigarh, Jorhat. The intercropping systems included were Som Persea bombycina Kost. + Ginger Zingiber officinale Rosc., Som Persea bombycina Kost. + Turmeric Curcuma longa L., Som Persea bombycina Kost. + Garlic Allium sativum L., Som Persea bombycina Kost. + Stevia Stevia rebaudiana (Bertoni) Hemsl., Som Persea bombycina Kost. + Patchouli Pogostemon cablin Benth., Som Persea bombycina Kost. + Brahmi Bacopa monnieri (L.) Wetts., Som Persea bombycina Kost. + Colocasia Colocasia esculenta Schott, Som Persea bombycina Kost. + Potato Solanum tuberosum L. and Som Persea bombycina Kost. + Onion Allium cepa L. The total productivity of a system in terms of muga cocoon equivalent yield (117.1'000 numbers /ha/year) was recorded maximum in Som + Stevia than other intercropping systems. Som + Stevia was also found more economically viable in terms of net returns (Rs. 41,110 /ha/yr), profitability (Rs. 112.6/ha/day), REE (87.80 %), employment generation efficiency (89.59%) and sustainability with respect to net return (165.11) which was followed by Som + Patchouli. On the other hand, Som + Patchouli recorded the highest benefit cost ratio (1.67) than all other systems which was identified to be superior and more economically viable. Som + Patchouli also registered higher net returns (Rs. 38,710 /ha/yr), profitability (Rs. 106.1 /ha/day), REE (76.84 %).), employment generation efficiency (76.16%) and sustainability with respect to net return (165.17) over the years owing to less fluctuation in net returns. The higher cost involved in Stevia cuttings and other intercultural operations increased the cost of cultivation of Som + Stevia system. Thus, Som + Stevia was in second rank in order of economic merit followed by Som + Patchouli.*

Key words: *Economic viability, Employment generation efficiency (EGE), Productivity and Sustainability.*

Muga silk is obtained from semi domesticated silk worm called *Antheraea assamensis* Helfer of which Som *Persea bombycina* Kost. and Soalu *Litsaea polyantha* Juss. are the primary food plants. Assam has the unique distinction for producing muga silk with an annual production of around 119 t (2011-12) of muga raw silk. The area under muga food plants, Som *Persea bombycina* Kost. and Soalu *Litsaea polyantha* Juss. in Assam is around 7305 hectares (*Economic Survey of Assam 2009-10)* which is about 26-per cent of total cropped areas of Assam. For full utilization of plantation, Assam alone presently needs one crore disease free layings (dfls) of Muga. But consequent upon the short supply of quality seed in time, the muga rearers cannot utilize their plantation for rearing to their fullest potential even during the favorable commercial crops. As muga silkworm rearing is conducted outdoor for which silkworms are exposed to fluctuating environmental conditions with profound impact on production and productivity during different seasons, the possibility of crop failure in muga culture cannot be ignored. Moreover, crop loss due to pebrine is a perpetual problem in muga sector. Further, most of the world's production in muga comes from smallholdings. Because of the limited size of the holdings and limited rearing capacity, farmers get limited returns from muga culture which is not sufficient for most of the families to survive only on the income of muga culture. This has made muga farmers to look for supporting

[1&3] Central Muga Eri Research & Training Institute, Lahdoigarh, Jorhat, Assam and
[2] Department of Botany, Gauhati University, Guwahati, Assam
[4] Directorate of Research, Assam Agricultural University, Jorhat
**for correspondence (e-mail: dr.urmicsb@yahoo.co.in)*

cropping systems like crop intensification in space or intercropping introducing some new profitable crops as intercrops in between Som plantation which can sustain and be well suited under Assam agro climatic conditions. This will not only enhance the socio-economic conditions of the farmers by providing employment for longer duration and also enable them to exploit the upcoming marketing and processing infrastructure in this area. Keeping in view above facts, present investigation was carried out to evaluate production potential and economic viability of different Som based intercropping systems.

MATERIALS AND METHODS

The study was initiated at the research farm of Central Muga Eri Research & Training Institute, Jorhat, Assam during 2007-08 to 2009-10. The soil of the experimental site was sandy loam in texture and acidic in reaction (pH 5.03). It was medium in organic carbon (0.58%), low in available nitrogen (138 kg/ha), low in available phosphorus (6.87 kg/ha) and low in available potassium (91.3 kg/ha). The experiment was laid out in RBD with 3 replications. The treatments consisted nine intercropping systems *viz*., Som + Ginger, Som + Turmeric, Som+ Colocasia, Som + Patchouli, Som + Stevia, Som + Brahmi, Som + Colocasia > Potato (Colocasia followed by Potato), Som + Colocasia > Onion (Colocasia followed by Onion), Som + Colocasia > Garlic (Colocasia followed by Garlic) which were compared with Som sole cropping (Control). An area of 5040 m^2 under existing 13 years old Som plantation of 3m x 3m spacing was selected for the study. Three months before raising of intercrops, selected plantation was pruned at a height of 3 m (10 ft) above the ground level. For each treatment, replication wise individual plot of 144 m^2 size was prepared by harrowing and leveling the selected area. In each individual plot, three beds of 16.2 sq. m. size (1.8 m breadth and 9.0 m length) leaving 60 cm from each side of the Som plants were prepared and raised up to a height of 30 cm for plantation of intercrops. Recommended package of practices were followed for maintenance of both Som and intercrops. Nitrogen, phosphorus and potassium were supplied through urea, single super phosphate and muriate of potash as per recommended doses of the crops. The total rainfall received was 1026.1 mm, 611.7 mm and 1340.9 mm (126, 125 & 130 rainy days) during 2007-08, 2008-09 and 2009-10 respectively.

Leaf yield of Som was recorded before starting of two commercial rearings of muga silkworm during April-May and October-November per year which was converted to muga cocoon equivalent yield based on silkworm rearing capacity of Som plantation in terms of disease free layings (dfls) and potential cocoon yield per dfl. The yield obtained from different intercrops were also converted to muga cocoon equivalent yield by multiplying yield with prevailing farm gate price of produce and divided by price of muga cocoons. The prevailing farm gate prices of produce were also used to work out the economics of different systems. The production efficiency (PE) was obtained dividing the total productivity of a system (in terms of muga cocoon equivalent yield) by total duration of that system (Tomar & Tiwari, 1990). Total duration of the system includes period required for field preparation also.

The profitability of the systems was calculated by dividing the net returns (Rs/ha) in a system by 365 days. The relative productivity efficiency (RPE) and relative economic efficiency (REE) were calculated by using following formula (Urkurkar *et al*, 2006 and Urkurkar *et al*, 2008).

RPE (%) = (Total productivity of a system– Productivity of Som sole cropping)/ Productivity of Som sole cropping x 100

REE (%) = (Total net return of a system–Net return from Som sole cropping)/ Net return of Som sole cropping x 100

The sustainable yield index (SYI) and sustainable return index (SRI) were calculated by using following formula given by Singh *et al.* (1990).

SYI = (Total productivity of a system –Standard deviation) / Observed maximum productivity in the experiment over the years

SRI = (Total net return of a system –Standard deviation) / Observed maximum net return in the experiment over the years

Employment generation efficiency (EGE) was determined dividing the total mandays employment for the system by 365 days and expressed in percentage.

RESULTS AND DISCUSSION

System Productivity

The pooled data over 3 years revealed that the total productivity in terms of muga cocoon equivalent yield was significantly higher in Som + Stevia intercropping system (117.1'000 numbers /ha) than other systems (Table 1). It was statistically at par with Som +

Colocasia > Garlic (114.7'000 numbers /ha). Again, Som + Colocasia > Garlic was at par with Som + Colocasia > Potato (111.7'000 numbers /ha) and Som + Colocasia > Potato was at par with Som + Colocasia > Onion (109.3'000 numbers /ha). The relative productivity efficiency (RPE) also followed the similar trend. The production efficiency of different intercropping systems showed maximum efficiency in Som + Colocasia > Potato (304 numbers /ha/day) followed by Som + Patchouli (255 numbers /ha/day) systems.

Monetary Returns

Different intercropping systems had different growth characters due to which the individual crop productivity does not give any comparable indication. Therefore, considering the prevailing market prices of inputs and farm gate prices of different produce, the net return, profitability and relative economic efficiency (REE) were worked out separately to have a proper interpretation of results. The maximum net returns (Rs.41,110 /ha/yr), profitability **(**Rs. 112.6 / ha/day**)** and REE (87.8%) were obtained under Som + Stevia intercropping system which was followed by Som + Patchouli registering higher net returns (Rs. 38,710 /ha/yr), profitability **(**Rs.106.1 /ha/day**)** and REE (76.8%) than rest of the systems. (Table 2).

Sustainability

Sustainability with respect to total productivity reflects the fluctuation in yield over the years. Based on over the years analysis, sustainability of the system with respect to total productivity was found highest with Som + Stevia system (0.54) which was closely followed by Som + Colocasia > Garlic, Som + Colocasia > Potato and Som + Colocasia > Onion systems showing sustainability of 0.52, 0.49 and 0.47 respectively revealing the consistency of producing higher yields over the years and found to be more compatible than other systems. However, sustainability was the lowest (0.27) in Som + Brahmi showing less stability in order of merit and limited adoptability of the system in Assam.

Sustainability with respect to total net return was negative in all the systems. However, Som + Stevia (165.11), Som + Patchouli (165.17) and Som + Colocasia > Potato (165.19) showed more sustainability than other systems (Table 2).

Employment Generation

Crop diversification through crop intensification will not only enhance the productivity and profitability of the farmers but also generates employment to the farming community for longer periods which will help in minimizing the problem of migration during lean periods after harvesting of muga cocoons and even during the time of muga crop failure. Employment generation efficiency of any diversified system is a direct measure of it's preferability in any area. Som + Stevia and Som + Patchouli systems were found to be most preferable in terms of providing employment coupled with better economic returns. These systems employed maximum number of man-days in a year and showed highest employment generation efficiency (89.59% and 76.16% respectively) as compared with other systems (Table 2).

Economic Viability

The maximum net returns, profitability**,** REE , sustainability with respect to total net return and employment generation efficiency were obtained under Som + Stevia intercropping system and it was followed by Som + Patchouli system. But amongst all the systems, Som + Patchouli was identified to be superior and more economically viable in terms of BCR (1.67) and ranked first in order of economic merit. The higher cost involved in Stevia cuttings and other intercultural operations increased the cost of cultivation of Som + Stevia system. Thus, Som + Stevia was in second rank in order of economic merit followed by Som + Patchouli (Table 2). Som + Colocasia > Garlic, Som + Colocasia > Onion and Som + Brahmi systems registered lower BCR than Som sole cropping indicating non-viability of the systems over Som sole cropping.

CONCLUSION

All the tested Som based intercropping systems were more efficient than Som sole crop with respect to total productivity in terms of cocoon equivalent yield, production efficiency, net returns, profitability, sustainability and employment generation efficiency. However, from BCR point of view, Som + Patchouli were found to be superior over all the systems which was followed by Som + Stevia. On the other hand, Som + Colocasia > Garlic, Som + Colocasia > Onion and Som + Brahmi systems were found economically non-viable over Som sole cropping.

Hence, it can be concluded that existing Som sole cropping system can effectively be diversified with the inclusion of various crops like Ginger, Turmeric, Colocasia, Stevia, Patchouli, Colocasia, followed by

Potato to fetch higher economic returns from a Som plantation. However, among all the systems, Som + Patchouli has been identified as the most promising Som based intercropping system for agro climatic condition of Assam.

REFERENCES

Singh, R. P., Das, S. K., Bhaskar Rao, U.M. and Narayana Reddy, M. (1990), Towards Sustainable Dryland Agriculture Practice. Bulletin published by CRIDA, Hyderabad.

Tomar, S. S. and Tiwari, A. S. (1990), Production potential and economics of different cropping sequences. *Indian Journal of Agronomy* **35** (1, 2): 30-35.

Urkurkar, J. S., Mishra, R. K., Tiwari, A., Tomar, H. S. and Savu, R. M. (2006), Annual Progress Report AICRP on Cropping Systems. Raipur Centre, Department of Agronomy, IGKV, Raipur, pp. 1-71.

Urkurkar, J. S., Shrikant Chitale, Alok Tiwari, Savu, R. M. and Tomar, H. S. (2008), Identification of promising rice based cropping system for increasing productivity and sustainability for Chhattisgarh plains *J. Farming Systems Research & Development* **14** (1): 50-55.