# Impact of Integrated Sericultural Technologies on Cocoon Productivity at Farmer Level

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## Abstract

*A study was conducted during 2005-06 to 2006-07 in Anekal division of Bangalore district, Karnataka to know the impact of group demonstration of integrated sericultural technologies (IST) on knowledge and adoption of sericultural technologies by farmers. Two villages were identified and 20 farmers each in selected villages were randomly selected whose benchmark mulberry yield was less than 40.00 MT/ha/year and cocoon yield was less than 40 kg/100 disease free laying (dfls) before initiating the group demonstration. At the beginning of the demonstration of IST, a baseline survey of selected farmers with respect to knowledge and adoption level of different sericultural technologies and their sericulture productivity level was carried out. The demonstration of IST covering 20 sericultural technologies was conducted in the field among the selected farmers who were guided in their sericulture activities for a period of two years. After two years, the impact of demonstration on knowledge and adoption level of sericultural technologies and improvement in mulberry and cocoon productivity levels were assessed among the selected farmers. The results reveal an improvement in knowledge level, adoption level among the selected farmers besides an improvement in the leaf yield and cocoon yield over the bench mark.*


## Introduction

Karnataka is the largest raw silk producing state, which accounts for more than 60 per cent of total national production. Anekal division of Bangalore urban district in Karnataka is a premier bivoltine area. In the area, mulberry is cultivated in about 776.32 ha covering 1055 farmers in 137 villages. Of the total area under mulberry, the high yielding V1 variety occupies 584.95 ha accounting for 75.34 per cent of the total mulberry area. In recent days, there has been a significant decline in mulberry area around Bangalore due to urbanization and hence, there


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is little scope for horizontal expansion of sericulture production. Thus, increasing productivity level in mulberry leaf and cocoon production is the only answer to keep sericulture sustainable in the area.

The introduction of new silkworm hybrids initiated the transformation of Indian sericulture and created large potential for increasing quality cocoon production. However, the economic viability and sustainability of sericulture can be achieved provided the farmers adopt new sericultural innovations besides new silkworm breeds/hybrids (Lakshmanan *et al.*, 1998). Though a number of new innovations were developed, the potentiality from new silkworm breeds/hybrids still remains to be realized in the field. As a result, the yield gap between the lab and land and among different categories of farmers is widening (Deepa and Sujathamma, 2005; Mallikarjuna *et al.*, 2006). This is mainly because of low or non–adoption of new innovations (Anonymous, 1974; Prakash Kumar, 1986; Aswathnarayana, 1989; Gopal, 1991).

Adoption of new innovations is not simple and a number of factors influence it. (Srivastava *et al.*, 1989). Therefore, there is a need for studies relating to influence of various factors on the adoption of new innovations, which would help the planners, policy makers, scientists and extension workers in understanding and devising appropriate measures to tackle the problems more effectively at the field level. The Central Sericultural Research and Training Institute, Mysore has come out with a new approach called integrated approach of technologies, which aims at increasing the productivity and reducing the cost of production. The new approach consists of a series of demonstrations of effective technologies on mulberry cultivation and silkworm rearing with a group of farmers. In this context, there is a need to examine the impact of group demonstration of integrated sericulture technologies (IST) on sericulture productivity. Hence, this study was undertaken in Anekal division of Bangalore district in Karnataka with the following objectives:

1. To study the knowledge and adoption pattern of mulberry cultivation and silkworm rearing technologies demonstrated to the farmers;
2. To study the impact of group demonstration of IST on mulberry and cocoon productivity among the respondents; and
3. To identify the constraints affecting the adoption of sericulture technologies.

## Methodology

The group demonstrations were conducted during the period between 2005-06 and 2006-07 in Anekal division of Bangalore urban district in Karnataka.

The IST includes ten practices each of mulberry cultivation and silkworm rearing. At the beginning of the programme, a baseline survey of farmers in two villages was carried out and 20 farmers were selected in each village, whose mulberry leaf yield was below 40.00 MT/ha/year and cocoon yield was below 40.00 kg/ 100 dfls. The knowledge and adoption levels of various technologies were worked out using a three-point scoring pattern (Prakash Kumar, 1986; Gopala, 1991). Complete knowledge/adoption was given a score of 3, partial knowledge/adoption was scored as 2 and no knowledge/non adoption was given a score of 0. Thus the maximum possible score was 120. The knowledge and adoption indices were worked out by using the following formula:

$$\text{Knowledge/Adoption index (\%)} = \frac{\text{Total score obtained}}{\text{Maximum possible score}} \times 100$$

Based on the knowledge/adoption index, the farmers were placed in six groups as followed by Singhavi *et al.*, (1994) viz., complete knowledge/adoption (100.00 per cent), very high knowledge/adoption (80.00 to 99. per cent), high knowledge/ adoption (60.00 to 79.99 per cent), moderate knowledge/adoption (40.00 to 59.99 per cent), low knowledge/adoption (20.00 to 39.99 per cent), very low knowledge/ adoption (0.01 – 19.99 per cent), and no knowledge/adoption (0.00 per cent).

The demonstration of IST covering said 20 technologies were conducted in the field in two villages among the selected farmers under close technical supervision on a single platform. After the demonstration, all the selected farmers were guided and supervised in their sericultural activities and regularly recorded the data with respect of mulberry leaf and cocoon production for a period of two years. After two years of IST demonstration, the knowledge and adoption levels of different technologies were assessed. The leaf and the cocoon production recorded for the period of two years were compiled using simple tabular form. Further, the constraints for low and medium adoption of technologies among the respondents were documented by using pre-structured interview. A simple 't' test is carried out to test the significance of difference in knowledge, adoption indices and productivity level before and after the demonstration of IST.

## Results and Discussion

**Knowledge level of IST:** The results obtained with respect of knowledge and adoption of different technologies before and after the demonstration among the respondents is presented in Table 1. The benchmark survey conducted before the

demonstration revealed that, the knowledge level of all the mulberry cultivation practices was low to medium (37.50 to 58.33 per cent) except drip irrigation, in which the knowledge level was high (65 per cent). The average knowledge level with respect to mulberry cultivation practices was at medium level (46.17 per cent).

**Table 1. Impact of demonstration on knowledge of different sericulture technologies among respondents (N = 40)**

| Sl. No. | Practice | Before demonstration | | | After demonstration | | | 't' test |
|---|---|---|---|---|---|---|---|---|
| | | Total score | Index (%) | Cate-gory | Total score | Index (%) | Cate-gory | |
| | **Mulberry cultivation** | | | | | | | |
| 1 | Variety and spacing | 70 | 58.33 | M | 115 | 95.83 | VH | ** |
| 2 | Split application of fertilizers | 61 | 50.83 | M | 97 | 80.83 | VH | ** |
| 3 | Application of FYM | 68 | 56.67 | M | 98 | 81.67 | VH | ** |
| 4 | Composting technique | 47 | 39.17 | L | 101 | 84.17 | VH | ** |
| 5 | Vermi-composting technique | 46 | 38.33 | L | 95 | 79.17 | H | ** |
| 6 | Use of Bio-fertilizers | 45 | 37.50 | L | 91 | 75.83 | H | ** |
| 7 | Green manuring technique | 49 | 40.83 | M | 101 | 84.17 | VH | ** |
| 8 | Use of growth regulators | 45 | 37.50 | L | 90 | 75.00 | H | * |
| 9 | Drip irrigation | 78 | 65.00 | H | 115 | 95.83 | VH | * |
| 10 | Plant protection measures | 45 | 37.50 | L | 92 | 76.67 | H | ** |
| | **Average** | **55.40** | **46.17** | **M** | **99.50** | **82.92** | **VH** | ** |
| | **Silkworm rearing** | | | | | | | |
| 1 | Improved silkworm breeds/hybrids | 71 | 59.17 | M | 98 | 81.67 | VH | ** |
| 2 | Separate rearing house | 86 | 71.67 | H | 115 | 95.83 | VH | ** |
| 3 | Disinfection with B.P/ClO2 | 69 | 57.50 | M | 113 | 94.17 | VH | ** |
| 4 | Shoot rearing | 58 | 48.33 | M | 115 | 95.83 | VH | ** |
| 5 | Incubation and black boxing | 64 | 53.33 | M | 97 | 80.83 | VH | ** |
| 6 | Leaf feeding/bed spacing | 65 | 54.17 | M | 95 | 79.17 | H | ** |
| 7 | Hygiene maintenance | 52 | 43.33 | M | 92 | 76.67 | H | ** |
| 8 | Crop protection measures | 64 | 53.33 | M | 84 | 70.00 | H | * |
| 9 | Use of rotary mountages | 52 | 43.33 | M | 92 | 76.67 | H | * |
| 10 | Cocoon harvesting/ marketing | 62 | 51.67 | M | 91 | 75.83 | H | * |
| | **Average** | **64.30** | **53.58** | **M** | **99.20** | **82.67** | **VH** | ** |
| | **Overall average** | **59.85** | **49.88** | **M** | **99.35** | **82.79** | **VH** | ** |

*: Significant at 5%; **: Significant at 1%

Abbreviations: L = Low, M = Medium, H = High, VH = Very high

All the practices of silkworm rearing fell under medium level of knowledge (48.33 to 59.17 per cent) except the importance of separate rearing house in which, the respondents had high level of knowledge (71.67 per cent). The average knowledge level with respect to rearing practices was also at medium (53.58 per cent) level. Overall, the knowledge level of IST before demonstration was at medium (49.88 per cent) level.

After the demonstration, a majority of the mulberry cultivation practices viz., variety and spacing, drip irrigation, composting technique, green manuring technique, application of FYM and application of fertilizers recorded very high level of knowledge (80.83 to 95.83 per cent), whereas other practices like vermi-composting technique, use of bio-fertilizers, plant protection measures and use of growth regulators fell in high knowledge (75.00 to 79.17 per cent) category.

Thus, average knowledge level of mulberry cultivation technologies was at a very high level with an index score of 82.92 per cent indicating an improvement from medium (46.17 per cent) to very high (82.92 per cent) level of knowledge.

The rearing practices like improved silkworm breeds/hybrids, separate rearing house, shoot rearing, disinfections with bleaching powder/chlorine dioxide and incubation and black boxing fell in very high knowledge level (80.83 to 95.83 per cent) whereas leaf feeding/bed spacing, hygiene maintenance, use of rotary mountages, cocoon harvesting/ marketing and crop protection measures fell under high level of knowledge (70.00 to 79.17 per cent). The average knowledge levels of rearing practices were also at very high level (82.67 per cent) indicating an improvement from medium (53.58 per cent) to very high (82.67 per cent).

Overall, results on knowledge level among the respondents indicated an improvement in knowledge level of IST which reached to very high level (82.79 per cent) after the demonstration compared to medium level (49.88 per cent) before the demonstration (Table 1). The variation between, before and after demonstration of IST on knowledge level is found statistically significant either at one per cent or 5 per cent level for all the technologies.

**Adoption level of IST:** The results obtained with respect to adoption of different technologies before and after the demonstrations among the respondents are presented in Table 2.

The adoption level of most of the mulberry cultivation practices viz., plant protection measures, use of bio-fertilizers, composting technique, green manuring technique, vermi-composting technique and use of growth regulators were under low adoption level (35 to 37.50 per cent), where as the other technologies fell under medium level of adoption (46.67 to 52.50 per cent). The average adoption level with respect to mulberry cultivation practices was at medium level (41.67 per cent). All the practices of silkworm rearing fell under medium level of

adoption (43.33 to 53.33 per cent) except the use of rotary mountage, which fell under the category of no adoption. Then average adoption level with respect of silkworm rearing practices was medium (44.17 per cent). Thus, the overall adoption level of IST before demonstration was at medium level with an index of 42.92 per cent.

**Table 2. Impact of demonstration on adoption of different sericulture technologies by the respondents (N = 40)**

| Sl. No. | Practice | Before demonstration | | | After demonstration | | | 't' test |
|---|---|---|---|---|---|---|---|---|
| | | Total score | Index (%) | Cate-gory | Total score | Index (%) | Cate-gory | |
| **Mulberry cultivation** | | | | | | | | |
| 1 | Variety and spacing | 63 | 52.50 | M | 115 | 95.83 | V.H | ** |
| 2 | Split application of fertilizers | 59 | 49.17 | M | 84 | 70.00 | H | * |
| 3 | Application of FYM | 62 | 51.67 | M | 88 | 73.33 | H | ** |
| 4 | Composting technique | 44 | 36.67 | L | 85 | 70.83 | H | ** |
| 5 | Vermi-composting technique | 45 | 37.50 | L | 51 | 42.50 | M | * |
| 6 | Use of Bio-fertilizers | 42 | 35.00 | L | 53 | 44.17 | M | * |
| 7 | Green manuring technique | 45 | 37.50 | L | 88 | 73.33 | H | ** |
| 8 | Use of growth regulators | 42 | 35.00 | L | 56 | 46.67 | M | * |
| 9 | Drip irrigation | 56 | 46.67 | M | 114 | 95.00 | V.H | ** |
| 10 | Plant protection measures | 42 | 35.00 | L | 45 | 37.50 | L | NS |
| | **Average** | **50** | **41.67** | **M** | **77.90** | **64.92** | **H** | ** |
| **Silkworm rearing** | | | | | | | | |
| 1 | Improved silkworm breeds/hybrids | 62 | 51.67 | M | 95 | 79.17 | H | * |
| 2 | Separate rearing house | 64 | 53.33 | M | 114 | 95.00 | VH | ** |
| 3 | Disinfection with B.P/ClO2 | 63 | 52.50 | M | 92 | 76.67 | H | * |
| 4 | Shoot rearing | 60 | 50.00 | M | 120 | 100.00 | CA | ** |
| 5 | Incubation and black boxing | 61 | 50.83 | M | 90 | 75.00 | H | ** |
| 6 | Leaf feeding/bed spacing | 58 | 48.33 | M | 91 | 75.83 | H | ** |
| 7 | Hygiene maintenance | 52 | 43.33 | M | 80 | 66.67 | H | ** |
| 8 | Crop protection measures | 58 | 48.33 | M | 76 | 63.33 | H | ** |
| 9 | Use of rotary mountages | 00 | 0.00 | N | 0 | 0.00 | N | NS |
| 10 | Cocoon harvesting/marketing | 52 | 43.33 | M | 85 | 70.83 | H | ** |
| | **Average** | **53** | **44.17** | **M** | **88** | **73.58** | **H** | ** |
| | **Overall average** | **51.50** | **42.92** | **M** | **83.10** | **69.25** | **H** | ** |

*: Significant at 5%; **: Significant at 1%; NS: Non significant
Abbreviations: N = No; VL = Very low; L = Low; M = Medium; H = High; VH = Very high; CA = Complete adoption

After the demonstration, the adoption level of a majority of the mulberry cultivation practices were under high to very high level (70 to 95.83 per cent). Few technologies like vermi-composting technique, use of bio-fertilizers and use of growth regulators witnessed medium level of adoption (42.50 to 46.67 per cent), where as low level of adoption was observed for plant protection measures (37.50 per cent). The average adoption level of mulberry cultivation practices was at high level (64.92 per cent) indicating an improvement from medium (41.67 per cent) to high (64.92 per cent) level of adoption. Pertaining to silkworm rearing practices, complete adoption (100.00 per cent) was recorded in case of shoot rearing and very high level of adoption for separate rearing house (95.00 per cent), where as the other technologies had high level of adoption (63.33 to 79.17 per cent) except use of rotary mountage which was not adopted by any respondent (no adoption). The average adoption level of rearing practices was also at high level with an improvement from medium (44.17 %) to high (73.58 %).

Overall results on adoption level of IST among the respondents indicated an improvement in adoption level of sericultural technologies to high level (69.25 per cent) after the demonstration compared to medium level (42.92 per cent) before the demonstration (Table 2). The variation between before and after demonstration of IST on adoption level is also significant at 1 % or 5 % level for all the technologies except plant protection measures in mulberry cultivation and use of rotary mountages in silkworm rearing.

## Constraints in adoption of sericulture technologies

Of the 20 sericulture technologies covered under IST, low and medium adoption was recorded for five technologies viz., vermin-composting technique, use of bio-fertilizers, use of growth regulators, plant protection measures and use of rotary mountages. The constraints for low and medium adoption of the said technologies among the respondents were documented and presented in Table 3.

**Table 3. Constraints for low and medium adoption of sericulture technologies** **(N = 40)**

| Sl. No. | Practice | Constraints | No. | % |
|---|---|---|---|---|
| 1 | Vermicomposting technique | 1. Cumbersome process | 25 | 62.50 |
| | | 2. Requires skill | 10 | 25.00 |
| 2 | Use of Bio-fertilizers | 1. No visible benefit | 21 | 52.50 |
| | | 2. Non availability of inputs | 33 | 82.50 |
| 3 | Use of growth regulators | 1. Laborious | 32 | 80.00 |
| | | 2. No visible benefit | 16 | 40.00 |
| 4 | Plant protection measures | 1. Non-occurrence of disease | 28 | 70.00 |
| | | 2. Apprehension for using chemicals | 18 | 45.00 |
| 5 | Use of rotary mountages | 1. High investment cost | 30 | 75.00 |
| | | 2. Requires separate mounting hall | 38 | 95.00 |

The major constraints for low and medium adoption of vermicomposting technique were, cumbersome process (62.50 per cent) and requirement of skills (25.00 per cent). Non-availability of inputs (82.50 per cent) and non-visible benefit (52.50 per cent) were the constraints expressed by the respondents for the use of bio-fertilizers. Labourious job (80 per cent) and no visible benefit (40.00 per cent) were recorded as constraints for the use of growth regulators. Non-occurrence of mulberry diseases and pests (70 per cent) and apprehension to use chemicals for mulberry garden (45.00 per cent) as it may affect silkworm were the reasons for low adoption of plant protection measures. Requirement of a separate hall for mounting (75 per cent) and high investment for procuring rotary mountages (75.00 per cent) were the reasons for no adoption of rotary mountages in the area.

## Productivity improvement after demonstration of IST

By adopting the improved technologies of mulberry cultivation and silkworm rearing practices, the mulberry leaf yield and cocoon yield gradually increased from 35.89 to 44.71 MT/ha/year and 38.250 to 55.495 kg/100 dfls, respectively. There was an average increase of 8.82 MT/ha/year in mulberry leaf yield and 17.245 kg/100 dfls in cocoon yield indicating an improvement of 24.58 and 45.08 per cent, respectively (Table 4).

**Table 4. Improvement in sericulture productivity after demonstration of integrated sericulture technology package**

| Sl. No. | Particular | Mulberry leaf yield (MT/ha/yr) | | | Cocoon yield (kg/100dfls) | | |
|---|---|---|---|---|---|---|---|
| | | 2005-06 | 2006-07 | Average | 2005-06 | 2006-07 | Average |
| 1 | Before demo | 32.53 | 39.25 | 35.89 | 34.570 | 41.930 | 38.250 |
| 2 | After demo | 44.70 | 44.75 | 44.71 | 53.460 | 57.530 | 55.495 |
| 3 | Improvement | 12.17 | 5.50 | 8.82 | 18.890 | 15.600 | 17.245 |
| 4 | Improvement (%) | 37.41 | 14.01 | 24.58 | 54.64 | 37.20 | 45.08 |
| | 't' Value | | | 2.08* | | | 4.20** |

*: Significant at 5%; **: Significant at 1%

The variation between before and after demonstration of IST on mulberry and cocoon production is significant at 5 per cent and one per cent level, respectively. This improvement could be due to adoption of improved mulberry variety, application of recommended dose of fertilizers and organic manure,

adoption of green manuring technique and drip irrigation in mulberry cultivation and adoption of proper disinfection technique, incubation and black boxing of silkworm eggs, shoot rearing and separate rearing house (Sreenivasa Rao *et al.*, 2005).

## Conclusion

It can be concluded from the results that, there is a good scope to improve sericulture productivity by adopting integrated sericultural technologies in mulberry cultivation and silkworm rearing in the area. The adoption of IST through group demonstration is one of the solutions to keep sericulture sustainable in Anekal division for better production of quality bivoltine cocoons. The same model can be adopted for dissemination of sericulture technologies in other sericulture areas to improve sericulture productivity in general and quality bivoltine cocoon production in particular.

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