Final Report

Independent

Mid Term Impact Assessment study

Scaling up Dissemination of Integrated Pest Management (IPM) Technology in Cotton in Perambalur District, Tamil Nadu

Implemented by

Reviving Green Revolution Cell

Regional Center

Coimbatore

under the

TATA Trusts "Reviving Green Revolution (RGR) Initiative – Tamil Nadu"

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EXECUTIVE SUMMARY

As a part of Reviving Green Revolution (RGR), present project is being implemented by Sir Ratan Tata Trust and Navajbai Ratan Tata Trust in Vepur block, Perambalur District Tamil Nadu focusing on improving the crop productivity, promoting Integrated Pest Management (IPM) technology in cotton crop and developing alternative sources of livelihoods of farmers. Two crop seasons of the project has already been completed. The midterm impact assessment study was conducted during April- May 2015 with the broad objectives to quantifying the impact of the project as well as identifying new potential initiatives/ strategies. The study was based on primary data collected from the household survey covering 105 sample farmers randomly selected from different strata representing the with and without project situation. Major findings of the study are presented below:

Impact Assessment

I. Technology transfer of Integrated Pest Management in cotton implemented by the Project has positive impact and benefited the farmers in various dimension like increased productivity and cost reduction through appropriate and reduced fertilizers and pesticides use etc.

II. The productivity of cotton in the IPM benefit farms was 8.23 quintal which was 17 percent more than the non IPM farms which quantify the positive impact of the project intervention. However still there was yield gap of about 9 percent among the benefit farms when compared to demo farms. The yield gap was showing increasing trend among indirect benefit farms and non IPM farms. Productivity of cotton in the non project village was 6.95 quintals, which was almost similar to non IPM farms. The yield gap analysis quantified the scope for increasing productivity through adoption of appropriate PoP and IPM technology in the project area. The productivity of cotton was relatively higher among small farmers and tends to reduce as the farm size increases. This might be due to high adoption level of IPM technology among small farms when compared to other farms.

III. Intervention of the project facilitated the farmers in using the recommended dose of fertilizers, thereby; direct beneficiaries were able to reduce the cost of fertilizers to the extent of 21 percent of the total cost. The estimated cost of fertilizers per acre was Rs.3647 which was around 35 percent more than the demo plots which might be due to excess dose applied due to unfamiliarity with the appropriate technology.

IV. There was significant reduction in use of pesticides in cotton cultivation due adoption of IPM technology. The IPM farms in the project area were able to reduce 42 to 54 percentages of the pesticide costs compared to non IPM farms. The impact was more pronounced among direct benefit farms than the indirect

benefit farms. Adoption of less number of sprays as recommended in the IPM technology with appropriate dosages was the major factor that influenced the pesticide cost reduction during the reference year. Among different farm size, the pesticide cost reduction was relatively higher among small and medium farms than the large farms which might be due to efficient adoption of the technology by the former than the later.

V. Adoption of 13:0:45 foliar sprays is one of the positive interventions for improving the productivity of cotton in the project area. The cost of this foliar application was estimated at Rs. 1530 per acre as a result there was an increase of 1.76 quintals per acre when compared to non foliar spray situation. The foliar application was fully adopted by the demo farms since the input was supplied free of cast under the project. Availability of Potassium Nitrate was ensured by the project team and hence about 52 and 24 percent of the benefit farms and non benefit farms respectively were applied this foliar spray.

VI. Despite better productivity and reduced cost of fertilizers and pesticides, profitability of cotton cultivation during the reference year was relatively less than the previous year which was mainly due to low price of cotton. The average price per quintal during 2014-15 was Rs 41.05 which was about 22 percent less than the previous year Assuming the farmers could realized previous year price of cotton, there will be 22 to 26 percent increase in profit among IPM farms compared to Non IPM farms during the reference year.

VII. The dissemination materials presented in the Village Information Centers were observed to have positive impact among farmers towards of the adoption of IPM technology. About 90 percent and 60 percent of the adoption level of direct and indirect benefit farms respectively was due to the extension techniques adopted in the project including VICs.

VIII. Availability of timely and adequate financial support at affordable costs by the farmers in the project area is still a challenge. Only 27 percent of the sample farmers were able to avail credit from support from formal sources and still 73 percent of them were depending on informal sources such as input dealers, money lender friend and relatives. Sample farmers are aware of the Self Help Groups approach however; their participation was limited to less than 30 percent. Joint Liability Group may be better option and there is greater scope for implementing this approach as an intervention of the project.

Future Strategies and Road Map

Considering the performance of the initiatives undertaken so for as well as requirements and expectations expressed by the respondents during the field study

with due validation though technical and economic feasibility, following new additional initiatives are suggested:

I. **Livelihood Focus:** Livelihood focus, instead of crop based technology alone, may be the broad concept in the next stage of the project. The components may include the development of farm activity and its complementary activities besides the social and environmental improvement within the family as well as society as a whole.

II. **Collectivizing Farmers:** Farmer's association may be encouraged to realize the benefits of collective bargaining for input purchase and output marketing. It may in the form of Farmer's Produce Organization (FPO) or Joint Liability Group (JLG) or Self Help Groups (SHGs) or any other informal collectives.

III. **Water Conservation and Management measures:** Adoption of watershed Management approach, construction of Farm Ponds with the integration of available government schemes may relive farmer's stress from uncertain and scanty rainfall situation.

IV. **Effective Dissemination of IPM Technology:** For improving the adoption level of IPM technology beyond the direct beneficiaries, the present practices like personal visit by scouts, displaying posters, locating more and more Information centers must be intensified further. Use of modern communication technology such as Mobile Agro Advisory System may be considered as a component of the project.

V. **Input Market Enhancement:** Keeping in view to improving the input marker arrangement, small scale agri-input shop may be organized on pilot basis. This initiative will address the easy and timely availability of inputs such as fertilizers, pesticides, fungicides and micro nutrients etc.

VI. **Marketing Issues in Cotton:** Farmers in the project area are still depending on the local traders and their use of regulated market channel is minimal which may mainly due to lack of awareness and inadequate/ misinformation. Providing timely market information, encouraging grading for better prices, collective sale etc., are some of the initiatives that may be considered.

VII. **Farm Mechanisation :** Farm mechanization component has become essential in the context of labour shortage and also add dignity of farming within the society besides adoption of recommended full package of practices. Tractor, power tiller, harvesting machines may be made available in the cluster of villages which may be used by the farmers on hiring basis. The machines may be owned and maintained by the group members. High powered sprayers may be owned and managed by the groups so that collective spraying covering the packets of area for effective control of insects and pesticides. Cotton plucking

machines may be made available under the project which will help the beneficiaries for managing the labour shortage during the harvesting season.

VIII. **Livestock Development:** Livestock development assumes greater significance for enhancing the profitability of farms especially in rainfed farming. Inadequate water supply, poor feeding of concentrates and marketing arrangements, is the common issues that restrict the progress of this activity on the project area. Azolla- A sustainable feed for Livestock may be encouraged in the project area. Better marketing arrangements may be considered through effective functioning of the milk societies and efficient milk collecting centers.

IX. **Livelihoods Promotion:** While the project scope is expanded to livelihoods promotion beyond agricultural development, components focusing on improvements in social and health aspects Kitchen vegetable gardens, ensure higher Milk Consumption, Sanitation improvement etc may be prioritized in the future project implementation.

Administrative Arrangements

i. The project team at Vepur needs to be further strengthened with a whole time project manager, field officer, scouts coordinator etc., and engage consultants for different components of the proposed interventions. While selecting the Scouts greater emphasis may be assigned for their attitude towards extension work and urge to learn new technology.

ii. Scouts, the field level machineries, must be trained and motivated to undertake the challenges. Unlike associated with the project during the cotton crop season alone, the scouts may be engaged with the project during the entire year. Their activities may be focused on cotton crop during the season and undertake other initiatives during offseason period. Scouts may be encouraged to be in the farmer's field with in the assigned villages as well as nearby villages.

Chapter I

INTRODUCTION

1.1 Background

Cotton is an important cash crop to many developing countries supporting the livelihoods of millions of poor peoples. Among the cotton growing countries, India has the largest area followed by China, United States and Pakistan. The area under cotton across the world has been stagnant for the last five decades however production has been increasing due do rise in productivity. World cotton production is estimated at 119.17 million bales (of 170 kgs) in 2014-15[1]. Cotton area in 2014-15 decreased to the tune of 1.47 million ha compared to 2013-14 (34 million ha). The early estimate of USDA indicates that India has replaced China and become the leading producer of cotton and also maintaining the largest area under cotton. The country is expected to consume 24 million bales in 2014-15. In India cotton is grown in about 12 million ha, under diversified agro-climatic conditions. The cotton production in India during 2014-15 was expected to reach 400 lakh bales with the productivity of 537 kg /ha[2]. As compared to china, which has the higher productivity of 1449 Kg/ha, there exist a greater potential for increasing the productivity of cotton in India.

In India Cotton is grown in the nine major states in three different zones. Punjab, Haryana and Rajasthan in North zone; Maharashtra, Gujarat and Madhya Pradesh in Central zone and Andhra Pradesh, Karnataka and Tamil Nadu in the south zone are the major cotton growing states. Central zone accounts for about 60 percent of all cotton production, and where only16 percent is irrigated. Cotton is also grown in other parts of the country and about four million farmers grow the crop in13 states. India is unique among the major cotton growing countries because of the broad range of agro-climatic and soil conditions which permit cultivation of all varieties and staple lengths of cotton.

Tamil Nadu is a net importer of cotton. With a share of just about one percent of countries area and 1.5 percent of cotton production, the mills of the state uses more than 13.3 percent of cotton produced in the country. The area under cotton in Tamil Nadu is 1.28 lakh hectares (1.1 % of national coverage) and records an annual production of 6.00 lakh bales against the mill consumption 50.00 lakh bales (2012-13)[3]. Though cotton crop in Tamil Nadu is not assuming greater significance in

[1]United States. Department of Agricullture: Economic, Statistices and Marketing Information System. http://www.fas.usda.gov/data

[2] All India Cordinated Cotton Improvement Project – Annual Report (2014-15)

[3] Cotton Corporation of India statistics. 2014

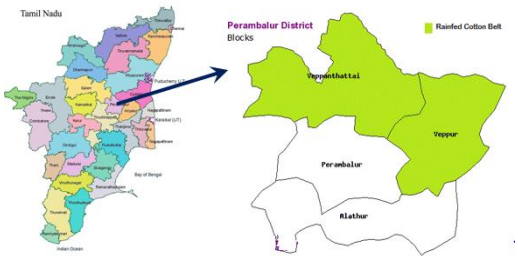
terms of area and production when compared to all India, consumption of cotton is the highest by the Tamil Nadu cotton mills amongst all states. Cotton in this state is cultivated in winter irrigated season (August-September), rainfed season (September-October), summer irrigated (February-March) and on rice fallows (January-February). Nearly 65 percent of the cultivated area is under rainfed conditions; where the entire production is dependent on erratic monsoon pattern.

1.2 Reviving the Green Revolution (RGR)

The "Reviving the Green Revolution" (RGR) Initiative is one of the flagship initiatives of the Sir Ratan Tata Trust and Navajbai Ratan Tata Trust and was operationalised in Punjab in 2002, to seek solutions to the stagnation in agricultural productivity[4]. During the last one decade various interventions were piloted and successful interventions such as Integrated Pest Management (IPM) in Cotton have been scaled up in partnership with institutions such as the State Government and State Agricultural Universities. In 2007-08, with a view of replicating the success achieved in Punjab to other regions of the country, the RGR initiative was expanded to Tamil Nadu, which in addition to post Green Revolution issues, faces frequent drought and a topographically varied agricultural situation. Partnering with the Tamil Nadu Agricultural University (TNAU) Coimbatore, an initial set of projects focusing on improving crop productivity, promoting Integrated Pest Management in food and cash crops; and developing alternate sources of livelihood for small, marginal, tribal and women farmers were undertaken. At present, the overall outreach of the RGR initiative, i.e. Punjab and Tamil Nadu combined covers 30 districts with approximately, 53,500 direct beneficiaries.

1.3 Project Area

The project is being implemented in Perambalur District where the area under cotton in Tamil Nadu is the maximum. Cotton is grown under rainfed conditions in this district and the total area under cotton is about 24,000 hectares[5]. The only competitive crop for cotton is maize, which farmers choose to cultivate depending on both the monsoon and the previous year profit received from cotton. With the introduction of Bt., cotton in 2002, cotton has become a natural choice for farmers and hence the area under cotton has increased many folds. Unfavorable monsoon/ erratic/ unseasonal rainfall increased input costs in terms of seeds (re-sowing) as well as arranging critical water supply for spraying and increased labour costs etc., are the multiple issues faced by the cotton growing farmers in the project area.



[4] Sir Ratan Tata Trust & Navajbai Ratan Tata Trust, Mumbai
[5] Cotton Resarch Station, Tamil Nadu Agricultural University, Veppanthatai, Perambalur Distrct.

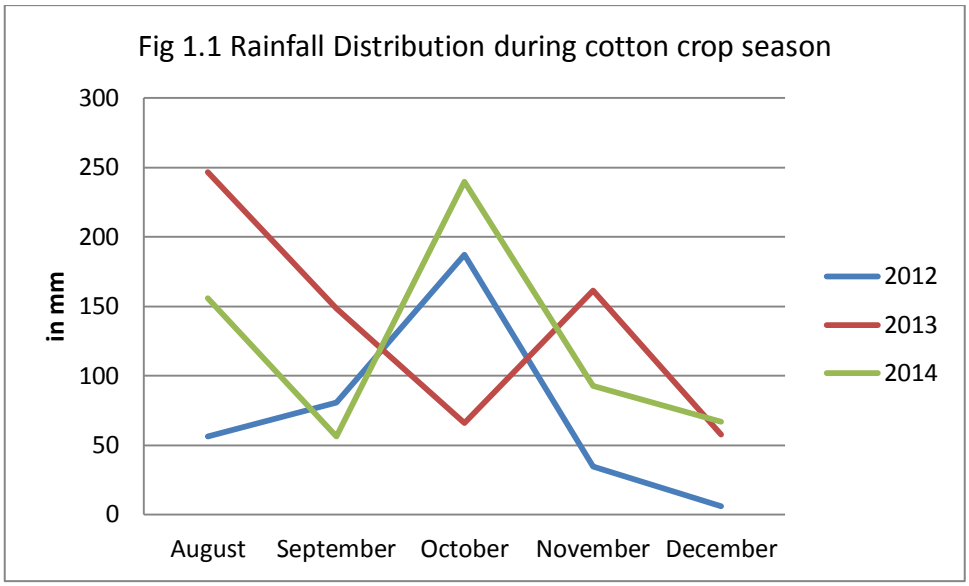
Rainfall distribution is one of the critical factors that influence the cotton cultivation in the project area. The annual rainfall received during 2014 was 872 mm which was more than the normal rainfall of 861 mm and also higher than the previous two years (Table 1.1) (Figure 1.1). Even the distribution of rainfall in terms of number of rainy days during the reference year was more (65 days) than the previous two years (32and 41 days during 2012 and 2013 respectively). Thus relatively favorable rainfall during the year 2014 must have positive impact on the cotton cultivation and production in the project area.

Table 1.1 Rainfall distributions in Perambalur District[6]

Month	Normal Rainfall	2012		2013		2014	
		Rainfall (mm)	Rainy days (Nos)	Rainfall (mm)	Rainy days (Nos)	Rainfall (mm)	Rainy days (Nos)
January	16.00	0.50	-	0.50	-	-	-
February	10.00	-	-	9.00	2	-	-
March	12.00	-	-	-	-	-	-
April	30.00	94.00	4	3.50	1	-	-
May	57.00	170.50	5	3.50	1	192.60	9
June	32.00	26.00	1	33.00	2	24.00	2
July	38.00	120.50	6	18.50	2	44.60	3
August	75.00	56.50	4	246.5	10	155.80	12
September	125.00	80.50	7	148.6	6	56.30	6
October	173.00	187.00	11	65.00	6	239.94	17
November	223.00	34.50	2	161.50	7	92.56	8
December	70.00	6.00	1	57.5	4	66.76	8
Total	861.00	775.00 (-9.99)	32	747.1 (-13,23)	41	872.56 (+ 1.34)	65

(Figures within the bracket indicate % deviation from normal rainfall)

[6] Source: Deputy Director office, Department of Agriculture, Perabalur



The project is being implemented in Veppur block where in cotton is cultivated in about 7,000 hectares (33 Panchayat villages). In Phase II, a “cluster approach” has been adopted and 20 out of 33 (60%) Panchayat villages, located in a contiguous cotton growing area have been selected for project implementation. In addition, an educated farmer youth (Scout) from each village has been recruited and trained in the IPM-Cotton PoP. This Scout functions as a village level technical advisory service provider and maintains the Village Information Center (VIC) set up in each village from where farmers can walk in and get technical advises at their convenience. Linkages have been developed with the local TNAU Cotton Research Station, Veppanthatai for updated technical information and District Department of Agriculture for implementation support.

The project is being directly implemented by Reviving Green Revolution (RGR) Cell, Regional Center Coimbatore, with a field team consisting of a Project Lead (Extension Activities); Consultant (IPM-Cotton); Field Officer; and Scouts. The project is overseen by Senior Development Officer, Tata Trusts. During Kharif 2014, the project was implemented by covering approximately 2000 farmers in 20 villages of Veppur block, Perambalur district with 220 direct contact farmers. The villages are Periyammapalayam, Othiyam, Perali (North), Moongilpadi, Vailapadi, Puduvettaikudi, Kunnam, Paravai (East), Thenur, Keelaperambalur, Perali (South), Sithali (West), Nannai, Olaipadi, Kolapadi, Periyavenmani, Anthur, Thungapuram, Karambiyam, and Chinnavenmani.

Innovative mechanisms of communication such as Village Boards, Wall Paintings, Days After Sowing (DAS) flyers in VIC's and tea shops, pest/disease identification and control cards etc. were taken up to further outreach of the project. Sending mobile SMS and alert to the participating farmers at appropriate time is one of the effective methods followed in the project. Regular trainings are conducted by the Scientists from Cotton Research Station (CRS), Veppanthattai and project Consultant to ensure correct technical information dissemination. During the season, pest and disease monitoring sheets were regularly maintained by the Scouts and the Field Officer. In addition, mechanical harvesting of Cotton through mobile solar harvesters has been demonstrated during the Field Day.

1.4 The Cotton IPM module

The IPM technology in cotton was developed by TNAU to provide an effective control of insect pests through proper and judicious use of pesticides. This technology is based on sound ecological principles to raise and sustain the crop productivity with the least destructive influence on crop environment. It is achieved through integration of all available techniques of crop management in harmony with environment. It consisted of timely sowing of early maturing, rapid fruiting *hirsutum* cotton hybrids, judicious use of fertilizers and irrigations, destruction of alternate weed hosts, weekly monitoring of pest population, spraying of recommended insecticide based on ETL and need based application of pesticides ensured adopting proper technology etc. The main thrust of IPM technology is to provide an effective control of pests and diseases with minimum use of pesticides. IPM module also includes all recommended crop management practices to ensure highest productivity of cotton with minimum cost of production. IPM is focusing from pre sowing to post harvesting with the objectives of increasing production, reducing the cost of production thereby increasing profitability of cotton in the project area with least disturbance of eco system.

1.5 Implementation of cotton IPM programme

The main objective of the project is to scale the benefits of IPM module through cluster approach and implement the 'Scout Model' for effective Transfer of Technology (ToT) to 2000 farmers (direct beneficiaries) in 20 villages of Veppur block. The specific objectives are to:

1. Disseminate IPM technology in cotton to farmers in 20 villages for management of insect pests, diseases, weeds and nutrient deficiencies
2. Develop an eco-friendly cotton cultivation system for an increase in income, improved yield and an overall improvement in the quality of life of small and marginal farmers.
3. Demonstration of the relevance and potential of the proposed scout model to persuade the State Government for additional funds to expand the gains from the project to a wider geographical area.

1.6 Project Plan

The project plan broadly includes the following activities**:**

1. Select 20 villages for spreading the IPM-Cotton technology to farmers through 20 "Scouts" who are trained on IPM-Cotton and are from the same village itself. A Field Officer, positioned at Perambalur would be responsible for field

level project execution and monitoring and ensuring that both farmers and scouts have correct technical knowledge of IPM-Cotton.

2. Set up Village Information Centres (VIC) which will be manned by the scout at common places in each village, from where farmers can get timely information on IPM as well as seeking advisory on symptoms of pest disease and nutritional deficiencies noticed in their fields.
3. Village level field visit, trainings to scouts, field officer and farmers will be done by a consultant whose specialization is in cotton.

At the end of the project period it is estimated that 6000 farmers in these 20 villages and an area of approximately 7000 ha will be covered under IPM-Cotton.

The IPM module included all required technologies to keep the pest under supervision with judicious use of pesticides and maximization of yields. One demo plot was set up in each of the selected 20 villages and scout model was adopted for providing effective and timely technical information and on field monitoring. In addition, farmers were educated on remedial measures for pests and diseases. The farmers were taught about the efficient spray technology. The benefits of IPM module were demonstrated through adoption of entire cotton area of the adopted villages. The scientists regularly visited the farmer's fields at weekly intervals throughout the season to survey and monitor the crop and pest situation. The cotton IPM technologies were demonstrated to the farmers at their own fields. They were educated about the identification of insect pests, their nature of damage and natural enemies. In addition, the farmers were educated on disease management and remedial measures for nutrient deficiencies. The farmers were also advised to use insecticidal sprays based on the Economic Threshold Level (ETL). The farmers were educated through Field Days where Consultants and Field Officers delivered lectures and held demonstrations and training on identification of pests/ diseases / ETL and choice of right type of pesticides.

1.7 Sequential activities of the IPM technologies[7]

The contents of IPM project include the following activities:

- Development of yearly action plan for cotton IPM project prior to the start of the season
- Selection of villages to be adopted for demonstration at village level
- Selection of village scouts & their training at CRS, Veppanthattai about cultivation of cotton with special emphasis on IPM

[7] Natarajan K, Baseline and Impact Study Integrated Pest Management – Cotton Perambalur District, Tamil Nadu, RGR Regional Center, Coimbatore

- Soil-testing of cotton farmers in adopted villages for judicious use of fertilizers
- Establishment of one Village Information Centre in each village to educate farmers about management of pests and diseases and other cultural practices.
- Entire village adoption with a target to include all cotton farming family's especially marginal and small farmers.
- Regular survey of area under cotton in adopted villages to record the incidence of pests and determination of Economic Threshold Level (ETL) for deciding the initiation of spray especially use of fertilizers and pesticides.
- Emphasis on adoption of recommended agronomic practices
- Adoption of plant protection measures based on pest surveillance and need based Economic Threshold Level (ETL) chemical control by adopting only recommended pesticides through right type of spray equipment.

Chapter II

STUDY DESIGN AND METHODOLOGY

The project was initiated during late 2012, with adequate preparatory work before the commencement of the season. Currently, the project has completed two full crop seasons (kharif 2013 and 2014). Series of interventions and initiatives undertaken through the project implementation are expected to bring improvement in management and productivity of crop husbandry in general, and cotton cultivation in particular, with direct impact on agriculture development for the region. Also this is the time to explore the potential for expanding the activities focusing on diversification and overall improvement of the livelihoods of the farmers.

2.1 Objectives

With a view to quantify the impact of the project both at overall and household level, midterm impact assessment of the IPM-Cotton Phase II project has been conducted. Following are the specific objectives as specified in the ToR (Appendix I):

a) Collect and review the relevant documents of the project in order to assess the progress and identify the information gaps to be filled by the present survey.
b) Analysis of the impact of the project on socio-economic and environmental parameters confronting farmers in the study area pre and post the interventions scenarios.
c) Identify key performance indicators to measure the performance and impact of the project and assess impact of project interventions on livelihood improvement of participating farmers and lateral impact of interventions on the whole village.
d) Assess the Comparative advantages of impact of adoption of 13:0:45, Cobalt Chloride and TNAU recommended Package of Practices such as azospirilium, phosphobacteria, trichoderma viride, micronutrient mixture on productivity of Cotton vis-à-vis farmers practice. Also, comparative control achieved in participatory farmers plot for prodenia attack vis-à-vis farmers practice.
e) Assess increase in awareness of proper sowing time, cultural control practices and economic threshold level, growing of non Bt as refuge crop, type of pesticides used and decision making channel, identification of natural enemies, awareness about host plants, level of benefits accrued from Scouts/dissemination material, visits to local village information centers, etc., and .

f) Identify avenues for expanding the impact of the IPM-Cotton programme to surrounding areas with additional interventions focusing on the overall improvement of the livelihoods of the farmers.

2.2 Sample Design and Methodology

The midterm assessment of the project is analyzed using both secondary data collected from the published sources and primary data collected from the sample farmers in the project area. Stratified random sampling technique was adopted for selecting the sample respondents.

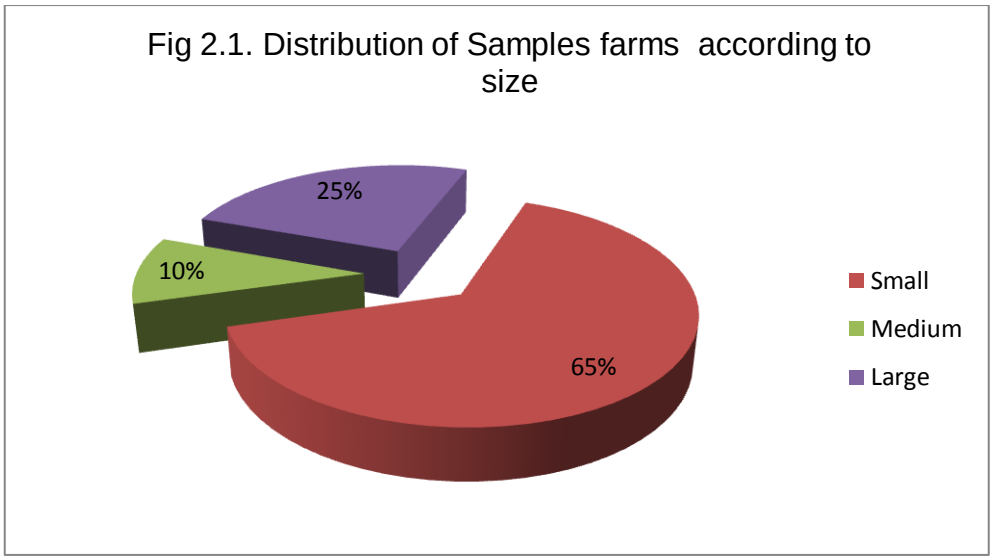
As per the project design, 20 Demonstration plots (one in each village) were envisaged which represents the full adoption of IPM technology and hence all the farms were considered for the study (Demo farms). The scouts were providing timely technical advices through different methods to 10 farmers in each village where no inputs were provided and only scouts periodically visited these farms for timely technical advice. These farmers were treated as direct benefit farms (separate strata) and one farmer in each village from this category was selected at random for the study. In addition 100 farmers were covered by the scouts using different techniques adopted under the project for disseminating IPM technology. This group of farmers was treated as indirect beneficiaries and 30 farmers were selected at random from all the project villages. For quantify the impact of the project among non beneficiaries in the project area, 30 sample farmers (Non IPM farms) were selected at random among all the villages. Thus in total 100 sample farmers constituted the sample frame (Table 2.1). With a view to assess the impact of the project among the non adopted villages 5, randomly selected sample farmers were covered from the adjacent project area village. Primary data were collected using the pre tested questionnaire covering the objectives of the study (Appendix II). Village wise distribution of sample farmers is presented in the Annexure 1. The details of field visits and interactions are presented in Appendix III.

With a view to capturing the impact of the project on the size of farms, the sample farms were post stratified according to land holding size. The farm size area up to 5 acres is defined as small farms. Medium farm size is represented by 5 to 9 acres, where as the large farms represented by more than 9 acres. The distribution of sample farm households among different farm size is presented in table 2.1 (Fig 2.1).

Table: 2.1 Distribution of sample farms according to size

(Nos)

Farm size	Demo farms	Direct benefit farms	Indirect B benefit farms	Non IPM farms	All farms
Small	16	13	18	18	65
Medium	2	3	2	3	10
Large	2	4	10	9	25
All Farmers	20	20	30	30	100



2.3 Data Source

Assessment of the progress and performance of the project has been attempted though reviewing the project documents and secondary data collected from the published sources. Primary data covering the objectives of the study was collected from the sample farm households through administering pretested questionnaire. Implementation aspects of the project was analyzed through series of discussions with project officials including Scouts, group meetings with the farmers, input and produce traders, extension and research experts in the project area.

Under the project, 20 demonstration plots, one in each village, were arranged and the recommended Package of Practices including IPM technology was adopted with the technical and limited financial support. Hence, the performance of the cotton crop in the demo farms was treated as potential yield in the project area. The impact assessment was attempted using the comparison of ***'with and without'*** situation. Tabular and percentage analysis were used to draw conclusions. The field study was conducted during March- April 2015 and reference year of the study was 2014-15.

2.4 Project Implementation

The project is being implemented with a well conceived work plan during the preseason itself considering the field situation. Systematic and rigorous monitoring system is put in place which provided ample scope for midterm correction. The activity wise work plan implemented during the reference year is presented in the Table 2.2[8].

Table 2.2 Activity wise Progress during the year 2014-15

Month	Work	Activity
June	• Pre –Season Training Scientist –Cotton Research Station -TNAU, Dr.Sohi –Advisor, RGR Cell, Ms. Khorshed Talati, Senior Development Officer Mr.K. Natarajan- Consultant	One day Pre-Season training to scouts at Cotton Research Station- TNAU, on Integrated Cotton Production Technology. PoP on Cotton fertilization; weed management, Pest and disease management.
July	• Training at Kunnam Ms. Pachammal –Agricultural Officer- Soil Testing Lab, Joint Director Agriculture – Perambalur	Training to Scouts and Field Officer on importance of Soil Health – Card and method of soil sampling
August	• Issuing Soil Health Cards Field Officer	Soil Health Card were issued. Recommendation of manures and fertilizers as per soil test. For other farmers as per TNAU recommendation
	• Technical bulletin – Integrated cotton production Technologies (Tamil) Consultant	Technical bulletin on cotton production technology in multi colour was printed and distributed to scouts, Agro input dealers and Lead farmers
	• Village level Training Senior Development Officer Consultant Field Officer	Village level Training to Scouts and Lead farmers on method of application of biofertilzer, Trochoderma viride and cotton micronutrient, mixture were held
	• Printing publication – Leaflet Consultant Senior Development Officer Field Officer	Printing of cotton production technologies to be adopted from 0-30 days &distribution
September	• Village Information Centre Charts & Field visits Consultant Senior Development Officer	Charts on ETL of insect pests and their management and Thrips management were prepared and fixed in all Village Information Centres.

[8] Natarajan K, Baseline and Impact Study Integrated Pest Management – Cotton Perambalur District, Tamil Nadu, RGR Regional Center, Coimbatore

	• Preparation of Colour Charts & Field visits Consultant	Mini multi colour charts were prepared as ready recogner to keep in Field books of scouts.
October	• Field Level Training & Field visit Consultant	Field level training on identification of insect pests their natural enemies and diseases to scouts at two IPM villages were given
	• Printing –Leaflet and Field visit Consultant	Production Technology to be adopted 30-50days were printed and distributed.
November	• Field visit and Appraisal of IPM activities Dr. Sohi – Advisor Ms. Khorshed Talati Senior Development Officer	Visited demo fields and Parawilt identified. Recommended to give suitable remedies.
	• Parawilt awarenees campaign & Field visit Consultant Field Officer	Diagnosis of Parawilt and its management were explained to scouts in cotton parawilt infested Field – Remedial measure – Cobal Chloride spraying @ 1g/100lt of water recommended.
	• Training & Field Visit Consultant , Scientists - Cotton Research Station –TNAU	One day training was offered to scouts and identification of foliar diseases and micronutrient deficiencies and their management. Identification of pest and their management
	• Publication – Leaflet & Field visit Consultant, Field Officer	Leaflet containing technologies to be adopted during 60-90 days in cotton was printed and distributed
	• Publication Leaflet and Training and Field visits Consultant	Leaflets on Prodenia damage and its management were printed and distributed to scouts and farmers
December	• Grey mildew awareness campaign and Field Visits Consultant	Incidence of Grey mildew in certain fields noticed. Management strategies were explained to scouts and lead farmers
January	• Field day Scientist - Cotton Research Station Ms. Khorshed Talati – Senior Development Officer Project Lead – Extension Activities Consultant	Field day was conducted at Periammapalayam village. Demonstration on Kapas picking by Cotton picker was demonstrated to scouts and farmers.
February	Field Visits Project Lead Extension	Field Visits were made and cotton picker was

	Consultant	demonstrated.
March	• Field day Senior Development Officer Project Lead – Extension Activities Consultant Sub Collector – Perambalur Joint Director of Agriculture Deputy Director of Agriculture Assistant Director of Agriculture Department of Agriculture	Field day was conducted at Vyalapadi village Cotton picker & Cotton stalk remover were demonstrated

The review of project documents including the periodical action taken reports brings out the following observations:

i. The proposed action plan for implementation before the crop season was well prepared and included all the possible events that cover the spirit and objectives of the project.

ii. Better performance of the project team at all levels in terms of monitoring, undertaking timely and appropriate initiatives etc.

iii. The project team at the field level represented by the field officer and scouts is strong enough in undertaking the process of dissemination of IPM technology.

iv. Timely diagnosis of the occurrence of pest and disease and recommending appropriate technology including pesticides by the Consultant along with effective follow up by Field Officer was the major factor for successful project implementation.

Chapter III
Results and Discussions

3.1 Socio Economic Features

An attempt has been made in this section to bring out the socio economic features of the sample households such as size and educational level of the family as well as size of operation, cropping system, and enterprise mix that are directly influencing the adoption level of IPM technology.

3.1.1 Social Background

The average size of the sample households was 4 members with 2 children. The literacy level of the sample farmers was reasonably good with 82 percents were literate of which 24 percent were having the education at college level. About 57 percent of the sample households were having agriculture as primary occupation and 86 percent of them were having the mixed enterprises which include animal husbandry and other non farm activities. Remaining 14 percent of the sample households were combining wage labouring in the other farms along with their own cultivation.

3.1.2 Farm size

The average farm size of sample farms was 4.94 acres with a range from 4.36 acre in the direct benefit farms to 5.75 acre in the indirect benefit farms. The distribution of the extent of farm size among different sample categories is presented in Table 3.1(Village wise distribution of Sample in Annexure 2).

Table: 3.1 Average Farm Size among different categories of farms

(in acre)

Farmer Category	Demo farms	Direct Benefit farms	Indirect Benefit farms	Non- IPM farms	All farms
Small	2.67	2.71	2.80	2.72	2.71
Medium	6.50	6.33	6.00	6.33	6.41
Large	8.00	8.25	11.00	10.56	10.15
All farms	3.59	4.36	5.75	5.43	4.94

3.1.3 Cropping Pattern and Enterprise mix

Cotton and maize were the predominant crops grown under rainfed condition constituted 82 percent of the area. The share of area under cotton was about 70 percent of the total cropped area with the range from 68 to 72 percent among different category of farms. The remaining area was cultivated under maize. The area under cultivation remained same during the last two crop seasons. However, there was shift in the cropping pattern and about 15 to17 percent additional area was brought under cotton replacing maize crop during 2014 compared to previous year (Table 3.2). The increase in cotton area during the reference year was relatively more in IPM farms compared to non IPM farms. Better cotton price realized during the 2013 season, favourable rainfall that too during sowing season of 2014, and efforts of project team etc., were the attributes for the increased area under cotton during the reference year.

Table 3.2 Distribution crops in the rainfed area

Farmer Category	Cotton area (%)		Maize area (%)		Total area (acre)	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
Direct Benefit farms	54.76	71.38 (+16.62)	45.24	28.62 (-16.62)	4.36	4.36
Indirect Benefit farms	52.49	70.17 (+17.68)	47.51	29.83 (-17.68)	5.75	5.75
Non- IPM farms	53.18	68.14 (+14.96)	46.82	31.86 (-14.96)	5.43	5.43

(Figures with in bracket indicates the % change over the previous year)

RCH 2 and RCH 20 were the predominant varies of cotton in the area which were cultivated by about 80 percent of the sample farmers. The choice of particular variety was based on the rainfall pattern and soil type besides farmers own past experience. RCH 20 was preferred by the farmers in the favourable rainfall condition with black cotton soil where as the choice of RCH 2 was in the red/ gravel soil with low rainfall precipitation.

While mono cropping was observed in the rainfed area (82%), remaining 18 percent of the area having irrigation sources was cultivated under paddy, sugarcane, vegetables etc. The estimated average cropping Intensity was 113 percent which is marginally higher than the district average of 104 percent on account of more area cultivated in the irrigated land. Animal Husbandry activity was the major complementary activity in the project area. About 84 percent of the sample

households were having animal husbandry units which includes milk animals, sheep and poultry rearing. Since many of the sample farmers were having wage earning as a source of income and hence the dairy units maintained, were relatively small with the size of 2-3 animals.

3.2 Impact Assessment

3.2.1 Productivity Impact

The impact of the IPM technology has been assessed through the comparison of the yield of cotton among IPM and non IPM farms (Table 3.3) (Village wise productivity in Annexure 3). The estimated productivity of cotton in the project area was 9.01 quintals in the demo farms which is considered as the potential yield during the reference year. The productivity of benefit farms was 8.23 quintal which was 17 percent more than the non IPM farms which quantify the positive impact of the project intervention. However still there was yield gap of about 9 percent among the benefit farms when compared to demo farms. The yield gap was showing increasing trend among indirect and non IPM farms. Productivity of cotton in the non project village was 6.95 quintals, which was almost similar to non IPM farms. The yield gap analysis revealed the greater scope for increasing productivity through adoption of appropriate package of practices (PoP) and IPM technology in the project area. The productivity of cotton was relatively higher among small farmers and tends to reduce as the farm size increases which might be due to high adoption level of IPM technology among small farms when compared to other farms.

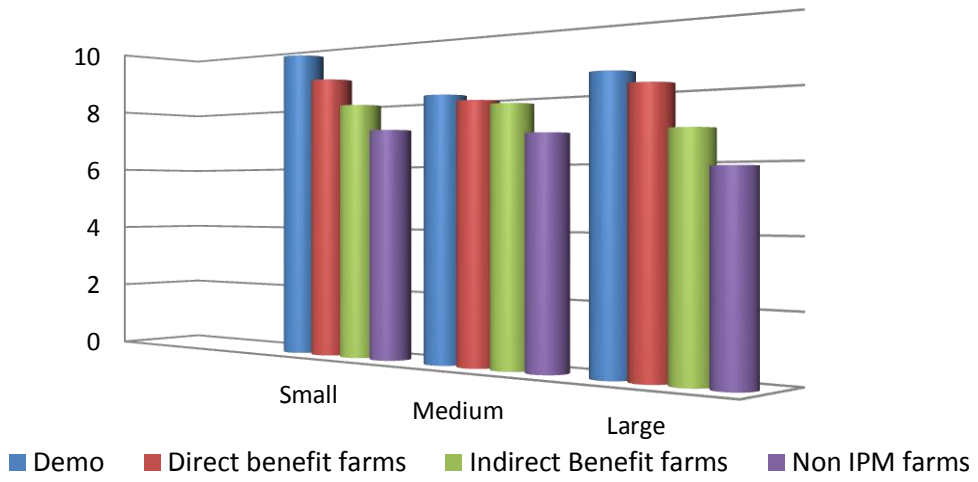
Table 3.3 Productivity of cotton among different farm size

(Quintals/acre)

Farm Size	Demo farms	Direct Benefit farms	Indirect Benefit farms	Non IPM farms
Small	9.63	8.79	7.93	7.11
Medium	8.01	7.83	7.75	6.87
Large	8.50	8.13	6.88	5.86
All Farmers	9.01 (+3.14)	8.23 (+3.15)	7.44 (+2.72)	7.02 (+2.16)

(Figures with in brackets indicates the productivity increase compared to previous year (2013-14)

Fig 3.1 Productivity of Cotton Among Different Farm Size



Maximum Cotton Yielder through IPM Technology

Mr A. Natarajan, the progressive scout from Kollapadi Village is the maximum cotton yielder during this season. He produced 15.75 quintals yield in one acre of Demonstration plot (RCH 20). This has been the highest productivity recorded and received appreciation and reorganization by the project team, officials from the Department of Agriculture and farmers during the field day. According to him, the attributes for achieving the highest yield were effective ploughing, timely sowing, methodical and systematic adoption of IPM technology etc. In addition, he has also adopted certain innovations in fertilizer application. He has extensively used sheep penning and mixed the fertilizers with manure and kept it for few days before application. He could reduce the cost through appropriate pest management with reduced number of sprays. His total income from the one acre demo plot was Rs. 63000 and the total cost of cultivation was Rs. 25325. Hence he could achieve a net profit of Rs. 37665 from one acre of cotton under rainfed condition.

The productivity of cotton during the reference year was higher than the previous year. This was mainly due to favorable distribution of rainfall as well efforts of the

project interventions in disseminating timely recommendation of IPM technology. As a result the sample farms were able to realise 3.08 percent higher yield than the previous year. The increase in yield was observed in all the categories of farms with the range of 3.14 percent in the demo farms to 2.16 percent in non IPM farms.

Normal precipitation of the rainfall and its optimal distribution assumes greater significance in the productivity of cotton in the study area. As discussed elsewhere in the report, the rainfall distribution pattern was relatively better during the reference year when compared to previous year. However, only 12 out of 20 villages received normal rainfall during the year and 6 villages received low rainfall. Very low rainfall was received in the remaining two villages viz. Chinnavenmani and Periyavenmani. With a view to quantify the impact of the rainfall distribution on productivity of cotton, the sample farms were disaggregated according to rainfall and the results are presented in the Table 3.4.

While the productivity of cotton with normal rainfall was 8.19 quintal, it was 32 percent less in low rainfall area. Farmers in Chinnavenmani and periyavenmani villages were received lowest rainfall and hence realized lowest productivity level of 52 percent less than the normal rainfall situation during the reference year.

Table 3. 4 Productivity of cotton among different rainfall distribution farms.

(Quintal/acre)

Rainfall distribution	Demo	Direct Benefit farms	Indirect Benefit farms	Non IPM farms	All farms
Normal	9.82	9.68	7.57	7.19	8.19
Low	6.04	5.72	5.18	4.20	5.54
Very low	5.36	4.87	4.65	4.01	4.19
All Farms	9.01	8.23	7.44	7.02	7.78

Predominantly, the study area was characterized by black cotton soil which is well suited for rainfed cotton cultivation. However, the farmers are also cultivating cotton crop in the other soil type areas which are characterized by red soil with gravels. These type of soils though not well suited for the cotton, the sample farmers were cultivated in some pockets of area. Categorization of sample farms according to soil type revealed that black soil farms were able to realize better yield of 8.46 quintals per acre which was 50 percent more than the other soil type farms.

3.2.2 Cost Impact

Fertilizer Cost

Application of timely and required fertilizer doses assume greater significance in cotton cultivation. The farmers generally use Di-ammonium Phosphate (DAP), Urea and Muriate of potash as basal application. The farmers were not in the habit of using micronutrient basally. As a part of IPM technology, foliar spray of DAP 1.5% + Potash two to three times during flowering stage was recommended. Still farmers were habituated in applying excess dose of fertilizers without adopting the recommended doses suited to the given soil condition. While implementing the IPM technology, the project envisaged the recommendation of timely and required fertilizer/pesticide/ fungicide dosesbased on soil test results. Hence there must be significant benefits in terms of cost reduction that leads to increased profitability of the farm as a whole. This apriori assumption of the project implementation has been validated using the primary data collected from the sample farmers and results are presented in Table 3.5 (Village wise distribution in Annexure 4).

Table 3.5 Average fertilizer cost among different farm size

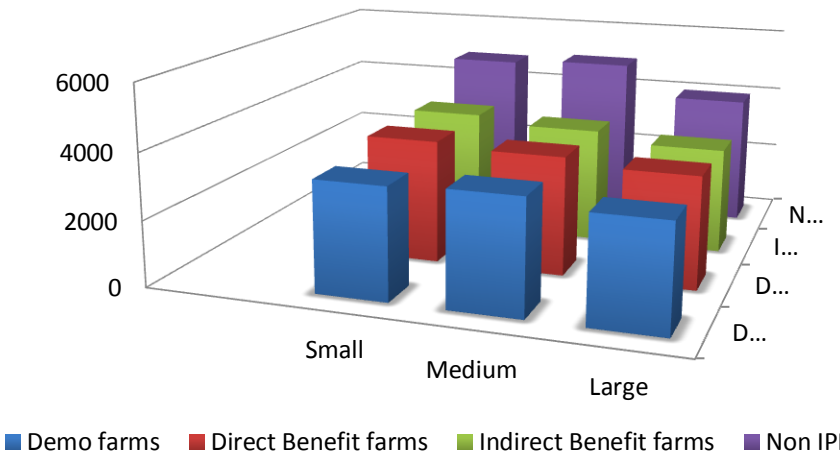
(Rupees/acre)

Farm size	Demo farms	Direct Benefited farms	Indirect Benefited farms	Non IPM farms
Small	3472	3738	3854	4834
Medium	3465	3601	3523	4955
Large	3200	3390	3218	3968
All Farms	3264 (- 34.95)	3647 (-20.78)	3795 (- 16.07)	4405 (100.00)

(Figures within bracket indicates the % of reduction of fertilizer cost per acre compared to non IPM farms)

The estimated cost of fertilizers per acre was Rs.3264 which was around 35 percent less than the non IPM farms. This reduction might be as a result of excess dose applied by the non IPM farms due to unfamiliarity with the appropriate technology and fertilizers applied not based on the soil test results. The basal dose of fertilizers applied by the IPM farms was about 50 percent of the non IPM farms thereby there was substantial reduction in fertilizer costs of IPM farms (Fig 3.2). As an impact of the project intervention the fertilizer cost reduction was 21 and 16 percent in direct and indirect benefit farms, respectively. Similar to non IPM farms, cotton farmers in the non project area also applied higher doses of fertilizers as a result the cost of fertilizers was 32 percentages more than IPM farms.

Fig. 3.2 Average Fertilizer Cost Among Different Farm Size



The analyses based on the soil type revealed that use of fertilizers among different soil type as well as varieties of cotton remain almost same with the excess level of 27 to 35 percent than the recommended dose. As the result of about 10 to 12 percent increase in cost, the expenditure on fertilizers during the reference year has registered an increase of 15 percent more than the previous year. Otherwise there was no difference in the dosage of fertilizers application during the two years.

Pesticide Cost

The whole concept of IPM depends upon the proper identification of pest and diseases and correct use of insecticides / pesticides at appropriate time depending upon the ETL values. The scouts were trained in the identification of pest and proper use of insecticide. Adoption of IPM technology is expected to demonstrate the use of appropriate and timely pesticide spray based on the recommendation thereby there will be significant reduction in the costs on pesticide use. Project intervention recommended to the farmers about the selection of appropriate insecticide and pesticides and timely sprays at appropriate for the control of sucking pests. Jassid, thrips, whitefly adults were the serious pest in this area.The incidences were noticed throughout the cropping season from 30 days onwards. In general mealy bug incidence was not observed in the area. On the basis of the insect pest incidence and taking into consideration of Economic Threshold Level (ETL), farmers were recommended to spray suitable chemical at recommended dose. Need based timely recommendation of insecticides based on ETL includes Jassid 2 nymphs / leaf, Thrips 10 number /l leaf, Whitefly 6 Adult/ leaf, Mealy bug I grade. Farmers were advised to spray the chemical either in the morning or evening. Invariably they were advised to use soap solution while spraying to increase the persistence of the spray chemical. The number sprays among the IPM farms was 4.56 times with the range from 5.12 and 3.26 times among the sample

farms. In comparison with the non IPM farms within and outside project area, number of sprays was reduced by 17 percent.

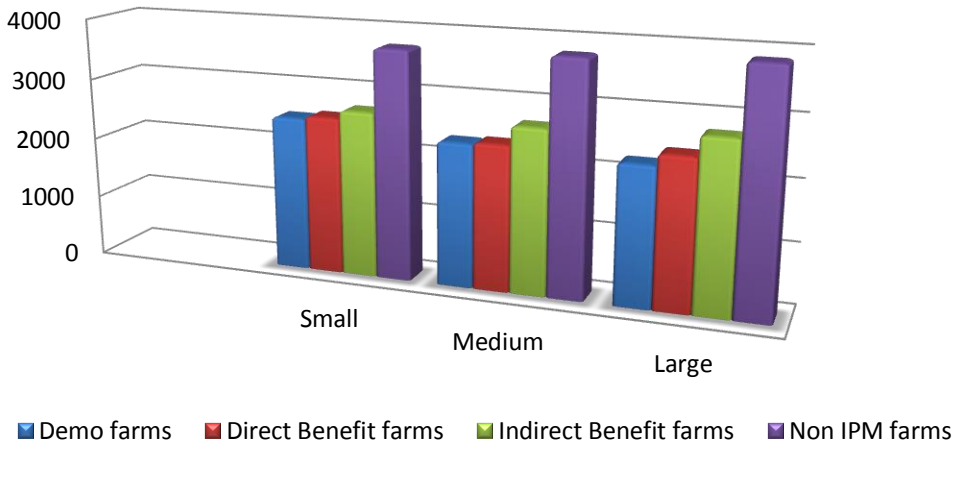
In terms of cost comparison, in general, the cost of pesticide incurred by the farmers in the project area was considerably reduced due to the project interventions. As could be observed from the table 3.12, the IPM farms in the project area were able to reduce 42 to 54 percent of the pesticide cost compared to non IPM farms (Table 3.6) (Village wise distribution in Annexure 5). The impact was more pronounced among direct benefit farms (49.46 %) than the indirect benefit farms (42.48%) (Fig 3.3). Adoption of less number of sprays as recommended in the IPM technology with appropriate dosages was the major factor that influenced the pesticide cost reduction during the reference year. Relative performance of non project farmers in comparison with IPM farms revealed that they incurred 45 percent higher costs than the IPM farms. Among different farm size, the pesticide cost reduction was relatively higher among small and medium farms than the large farms which might be due to efficient adoption of the technology by the former than the later.

Table: 3.6 Average Pesticide Cost among different categories of farms

(Rupees/ac)

Farmer Category	Demo farms	Direct Benefit farms	Indirect Benefit farms	Non IPM farms
Small	2520	2571	2706	3739
Medium	2345	2373	2680	3790
Large	2258	2441	2765	3876
All Farms	2426 (- 54.69)	2514 (-49.46)	2634 (-42.48)	3753 (100.00)

Fig. 3 Average pesticide cost among different farms



Micro Nutrients application

Adoption of 13:0:45 foliar sprays is one of the positive interventions for improving the productivity of cotton in the project area. The recommended dose of foliar nutrition of Potassium Nitrate (13:0:45) was thrice from flowering stage at the rate of 2Kg/ac/time. The survey data revealed that the cost of this foliar application was estimated at Rs. 1530 per acre as a result there was an increase of 1.76 quintals per acre when compared to non foliar spray situation (Table 3.7). The foliar application was fully adopted by the demo farms since the input was supplied free of cast under the project. Further, availability of Potassium Nitrate was ensured by the project team and hence about 52 percent and 24 percent of the benefit farms and non benefited farms respectively were applied this foliar spray.

Table 3.7 Benefit of Potassium Nitrate (13:0:45) application

Particulars	Cost and benefit In Rs
Cost of Foliar Spray including labour charges	1530
Additional Income realized	8319
Net benefit	6789

Similarly the application of phosphobacteria, trichoderma viride, azospirilum, has made positive impact at the field level with the increase yield of 9 to 10 percent. Prudinea attack was prevalent in a cluster of 6 villages. With the timely invention of project team recommendation, the farmers were able to prevent the crop damage

thereby realised the benefit of 12 percent increase in yield when compare to non project area farmers.

Total Cost

The estimated average total cost of cultivation per acre of cotton crop during the reference year, in the demo farms was Rs 18,490 which was about 12 to 16 percent less than the non IPM farms. (Table 3.8) (Village wise distribution in Annexure 6 and 7).Similar cost reduction was observed with direct benefit farms. The cost reduction due to IPM technology among indirect benefit farms was 2.77 percent which quantify the scope for further efforts in the project area. The total cost was relatively higher among small farms when compared to other farm sizes which might be due to intensive cultivation by small farms with higher labour intensity.

Table 3.8 Average total cost among different farm size

(Rupees/ac)

Farm size	Demo farms	Direct Benefited farms	Indirect Benefited farms	Non IPM farms
Small	18794	18783	19208	18486
Medium	18365	18775	18672	19895
Large	18958	19648	18552	21352
All Farms	18432 (- 6.29)	18992 (-3.16)	19064 (- 2.77)	19592

(Figures with in brackets indicates % less than the non IPM farms)

The variety wise analysis revealed that average total cost of RCH 2 was 3.29 percent less in the demo farms when compared to non IPM farms. However the impact of IPM technology among RCH 20 was relatively better with increased cost reduction of 6 percent in demo farms in comparison with non IPM farms. Similarly, black cotton soil farms had efficient cost reduction (5.17 %) when compared to red gravel soil farms (2.34%).

The average total cost has registered an increase of 2 to 3.5 percent during the reference year when compared to previous year (Table 3.9). The cost increase was relatively more among non IPM farms than the direct and indirect benefit farms. The attributes for such cost increase include increase in input cost of both fertilizers and pesticides and wage rate of hired labourers etc.

Table 3.9 Average total cost – Two season comparison

(in Rupees)

Particulars	Demo farms		Direct benefit farms		Indirect benefit farms		Non IPM farms	
	2013-14	2014-15	2013- 14	2014-15	2013-14	2014-15	2013-14	2014-15
Preparatory cultivation	2178	2438	2689	2639	2318	2538	2425	2517
Seeds and Sowing	1790	1865	1789	1794	1750	1830	1790	1892
Manures and fertilizers	3270	3264	3518	3647	3461	3795	3975	4405
Insecticide / pesticide	2356	2426	2387	2514	2470	2634	3378	3753
Labour cost -weeding and picking	8308	8439	8396	8398	8652	8267	7399	7025
Total Cost	17902	18432 (+2.96)	18579	18992 (+2.22)	18651	19064 (+ 2.21)	18967	19592 (+3.08)

(Figures within the brackets indicate % increase than the previous year)

3.2.3 Profitability Impact

Profitability of cotton cultivation which is the ultimate benefit to farmer is the sole factor that is deciding the sustainability of project initiatives. Extent of favorable prices and market conditions that are influencing the profitability of cotton in the project area are discussed in this section. Despite of better productivity and reduced cost of fertilizers and pesticides among the direct and indirect beneficiaries, cotton cultivation in the project area during the reference year was not as profitable when compared to previous year. As could be observed from Table 3.10, per acre net profit was around 20 percent less than that of previous year. (Village wise Distribution in Annexure 8). Assuming the farmers realized previous year price of cotton, there will be 22 to 26 percent increase in profit among IPM farms compared to Non IPM farms during the reference year.

Table 3.10 Profitability (Net Profit/ acre) of cotton among different categories of farms

Rupees/ac)

Sample Type	Small		Medium		Large		All Farms	
	A*	B*	A*	B*	A*	B*	A*	B*
Demo farms	25634	18706	22548	18635	21586	18043	23302	18509
Direct Benefit farms	22164	16860	19086	16559	19205	16052	21250	16751
Indirect Benefit farms	16325	11012	13633	11329	14318	11968	16263	12640
Non IPM farms	15225	12689	15149	12572	13658	11093	14383	11190

**A – Profit 2012-13; B – Profit 2013-14*

Disaggregated analysis of the profitability revealed the same trend among all categories of farms which was mainly due to low price realised by the farmers during the reference year. This trend of low profitability is a real concern and may directly affect the sustainability of the project.

In-depth analysis of the price of cotton received by the sample farmers indicates that the average price per quintal during 2014-15 was Rs 41.05 which was about 22 percent less than the previous year (Table 3.11). Inverse trend between the size and price was observed among the size of farms which might be due to the higher volume of sale by the large farmers with their better market information. Further, the range of price was much wider during the reference year when compared to previous year which might be attributed due to varied quality of cotton as well as less demand from the markets.

Table 3.11 Range of cotton price during the years 2013-14 and 14-15

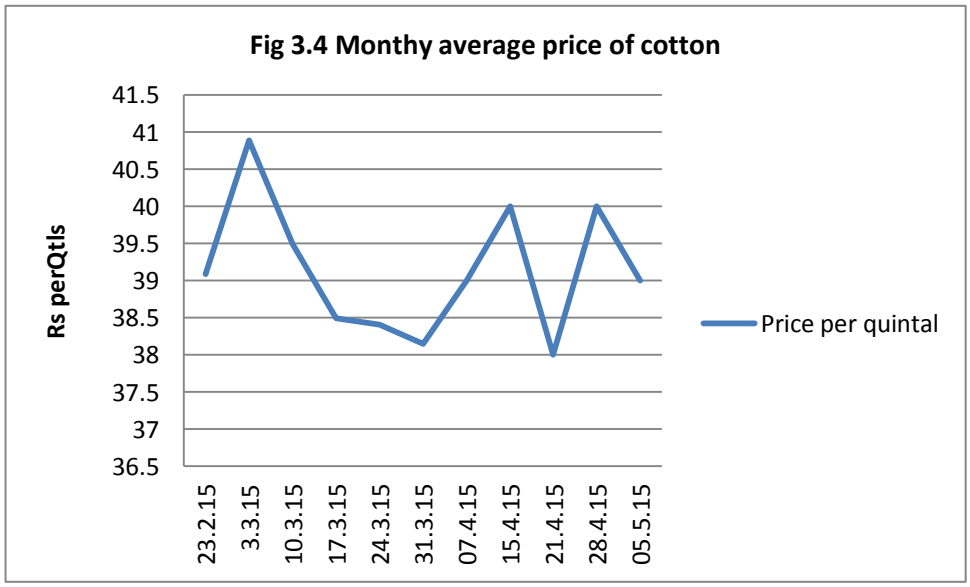
Rs per Quintal

Farm size	Year 2013-14			Year 2014-15		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Small	43.49	50.20	44.45	32.96	42.15	39.02
Medium	45.16	52.49	50.19	37.29	47.14	42.19
Large	53.17	59.17	52.27	39.12	48.92	44.57
All Farmers	48.27	55.14	50.18	35.41	46.17	41.05

With a view to understand the seasonality of cotton prices, the details of arrivals and rates recorded by the regulated market in Perambalur is analysed and presented in the Table3.12 . The market arrivals concentrate during the months from February to May and the higher price was observed during April-May months Figure 3.4).

Table 3.12 Price trend of cotton during 2015

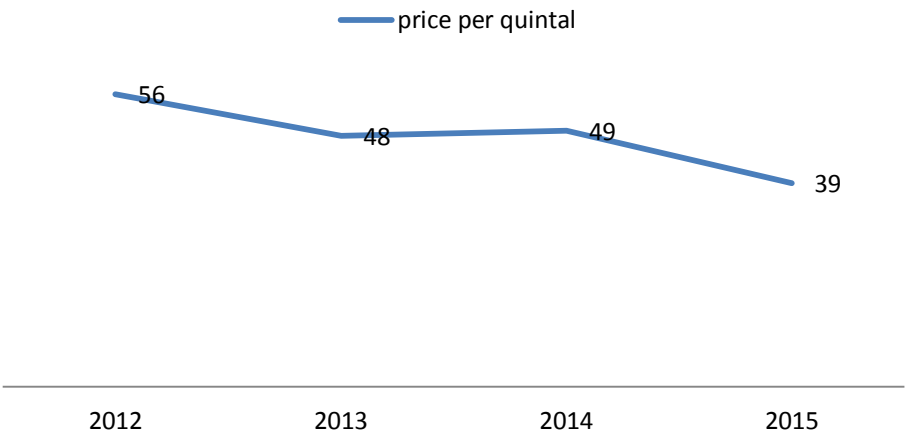
Date	Farmers	Traders	Arrival (Qtls)	Rate.Rs/Qtl		
				Min	Max	Average
5.1.15	5	4	7.51	24.01	36.05	27.00
8.1.15	--	--	--	--	--	--
12.1.15	8	2	19.56	30.00	33.60	32.01
9.2.15	1	3	9.74	29.85	34.15	31.85
23.2.15	71	8	200.35	37.61	43.09	39.09
3.3.15	61	8	266.58	35.00	42.29	40.89
10.3.15	109	9	595.30	34.05	40.39	39.49
17.3.15	83	9	427.55	35.09	40.39	38.09
24.3.15	64	9	286.73	33.29	39.89	38.41
31.3.15	48	9	198.63	33.52	40.69	38.15
7.4.15	45	5	257.63	33.00	41.29	39.00
15.4.15	55	5	227.70	32.59	42.09	40.00
21.4.15	139	6	469.82	34.51	41.31	38.00
20.4.15	105	6	579.82	30.05	42.69	40.00
5.5.15	146	6	649.30	30.29	41.29	39.00



Primary details collected from the traders in the project area were used to understand the price trend of cotton during the last four years. As could be observed from the Fig 3.5, there was declining trend of cotton price during the last four years. The International cotton Advisory Committee predicted that India's cotton exports could come down by up to 20 percent in 2014-15, due to less global trade and more local consumption. The volume of cotton traded internationally was expected to decline by 8 percent to 8.1 million tonnes in 2014-15, driven by reduced shipments

to China from a record of 5.3 mt in 2011-12 to an anticipated 2.1 mt in this year. The Chinese government has a huge stock of cotton and wants local users to use more of the home product. As a result, there could be a fall in India's exports in 2014-15 by 15 percent and exports might settle at around 8.5 million bales (a bale is 170 kg) compared to the previous two years' export of around 10 million bales (annually). This trend has reflected in the domestic market thereby set in the downward trend in cotton price during this season.

Fig 3.5 Cotton price in Regulated market at Perambalur



The unfavorable price is a serious concern that needs to be addressed on priority basis. Majority of the sample farmers were still having the village traders as a major channel and only 5 percent of them were using the regulated market support. Discussion with the sample farmers during the field study revealed that majority of them were not recognizing the need for accurate weighing machine facilities, proper grading and sorting the cotton based on quality etc. There is greater scope for improving the marketing arrangements. In view of sluggish export trend, domestic consumption of cotton must be encouraged and appropriate strategies must be evolved so as to reverse the downward trend of cotton price.

3.2.4 Enterprise Mix

As discussed elsewhere in the report, recognizing the uncertainly nature of rainfed farming, farmers in the project area, manage the financial risk and liquidity issues through opting for different crops or allied enterprises such as dairy, poultry, sheep rearing etc. Among the alternatives, dairy was the most preferred enterprise and about 84 percent of the sample was having milch cattle. Average milk yield per day of the cattle was 14 litters with range of 10 to 17 litters depending on the breed, feeding schedule and management. The milk was sold to the local collection agents with the average per litter price of Rs. 27. The economics of dairy enterprises estimated based on the sample farms responses is presented in table 3.13.

Table 3.13 Economics of Dairy enterprise among the IPM Farms

(Rupees/cattle)

Particulars	Cost and Benefit
Green fodder	12264
Dry Fodder	9709
Concentrate	6364
Medical	310
Labour	27272
Total Cost	55919
Total Benefit	79145
Profit	23227

The estimated profit per cattle was Rs 23227 with the imputed value for family labours. However, when compared to the potential income of dairy enterprise, it was relatively low. The discussions with the sample respondents revealed that low level of feeding, inadequate market arrangements were the contributing factor for such low profit which need to be addressed on priority basis for the overall development of farming in the project area.

3.2.5 Dissemination of Technology

As envisaged in the project design, ensuring adoption of recommended PoP as well as IPM technology in cotton cultivation is the most important parameter for assessing the impact of the initiatives. Appropriate decision of the sowing date of cotton crop based on the rainfall and other critical parameters, assumes greater significance of the success of the crop. The sowing dates of cotton in the study area are decided mainly based on the arrival of rainfall and hence there is no significant difference among different categories of farmers.

The level of adoption of PoP is quantified based on the deviation of the farmer's practices (both excess and deficit) in comparison with the recommended PoP using the primary data collected from the sample farms as well as information received through group discussions and interaction with scouts and scientists from research station and extension officials of the department of Agriculture.

The estimated adoption level of PoP was 90 percent among the direct beneficiaries which indicated the positive performance of the project. However, the adoption level among indirect beneficiaries was relatively less (67%) (Table3.14). Small farmers were observed to be better adopters and farm size has inverse relationship with the level of adoption.

Table 3.14 Adoption of recommended Package of Practices (PoP).

(In %)

Particulars	Direct Beneficiaries	Indirect Beneficiaries
Marginal	97.29	72.19
Small	94.16	67.20
Medium	89.28	68.17
Large	72.17	62.16
All Farms	90.00	66.86

Cotton farmers in the study area, in general, preferred to use excess fertilizers and preventive use of insecticides and pesticides which have directly affecting the profitability of crop production. However, implementation of this project has positive impact as better adoption of recommended use of inputs (Table 3.15) especially among direct and indirect beneficiaries. Adoption level of pesticide use was higher (95%) than the fertilizer use (77%).

Table 3.15 Adoption level of Input uses

(in %s)

Particulars	Direct Benefit farms	Indirect Benefit farms	Non IPM farms
Fertilizer Use			
Small	79.17	61.49	19.14
Medium	72.18	56.17	17.29
Large	69.21	52.10	16.32
All Farms	77.10	58.21	19.00
Pesticide Use			
Small	95.26	82.17	19.40 16.92
Medium	92.17	79.48	16.26
Large	92.28	77.50	15.18
All Farms	95.00	80.44	17.51

Knowledge on identification of natural enemies and Economic Threshold Level are the thrust area in IPM technology. Discussion with the sample farmers revealed that due to the project interventions, about 67 percent of them could understand the significance of these aspects. Small farmer's perception in this regard was better among small farms than other farmers which might be due to their interest in increasing the production level with the limited land area.

The dissemination materials presented in the Village Information Centers had positive impact among farmers towards adoption of IPM technology. About 90 percent and 60 percent of the adoption level of direct and indirect beneficiaries respectively was due to the extension techniques adopted in the project including VICs. These facilities were not effectively used by the non-beneficiaries and hence the adoption level was only 12 percent among non IPM farmers. Hence there is greater scope for expanding the extension efforts.

The Scout model implemented in the project seems to be successful to a greater extent at the field level. All the scouts engaged in the project implementation are enthusiastic and are having the aptitude towards undertaking the challenges. All the direct benefit farmers expressed that scouts was the major information source. They were able to reach only 64 percent of the indirect beneficiary farmers. There is greater scope for increasing the outreach of information through scouts. Discussions with the scouts revealed that their involvement with the project activities was limited to cotton crop that too only during the crop season and hence could not make better impact among the non beneficiaries.

One of a Meritorious Scout

Mr A Thirunavukarasu (age 43 years) is a progressive cotton farmer from Puduvetttaikudi village who is inducted in this project as scout from the beginning of the project. He is a post graduate worked in cooperative sugar mill for over 5 years and has excellent communication skill and committed to extension activities. He is familiar with the IPM technology and strongly believes that IPM technology will certainly increase the prosperity of the cotton cultivators in the project area. The Village Information Centre (VIC) organized by him was effectively utilized by the cotton farmers within and outside his village. His efforts in identifying pests and diseases attack especially during September were timely as a result the adoption level of IPM technology was significantly higher than other villages. He also provided timely market information as well as traders offering competitive price has helped the farmers in improving the profitability of cotton cultivation. Price list of cotton has been displayed by him in the VIC. As reported by the farmers during the group discussion in the village, he is one of the scouts who visited the farmer's field maximum number of times.

3.3. Farm Credit support

Availability of timely and adequate financial support at affordable costs by the farmers in the project area is still a challenge. The study findings quantified that only 27 percent of the sample farmers were able to avail credit from support from formal sources and still 73 percent of them was depending on informal sources. Input dealers were the major informal sources accounting for 54 percent followed by money lender (32%) and friend and relatives (14%). Primary Agricultural Credit society was the major formal source of credit delivery (83%) and remaining by commercial banks. Sample farmers are aware of the Self Help Groups approach however; their participation was limited to less than 30 percent. Interaction with the bank officials revealed that poor recovery performance of earlier loan was the major issue in credit delivery in the project area. In this context, Joint Liability Group may be better option and there is greater scope for implementing this toll as an intervention of the project.

Chapter IV

Future Strategies and Road Map

Results presented in the earlier section of the report have quantified the positive impact of the Implementation of IPM in Cotton cultivation in the project area. However, sustainability as well as scalability of the initiatives is depended more on expanding the scope of the initiatives with a broader focus on profitability of farming with improvement in livelihood promotion in a holistic manner. During the first two years of the project has facilitated the acceptance of the IPM technology and hence may be treated as Initiation stage. Hence the second stage of the project may be conceptualized as consolidation stage where there is greater scope for integrating several new initiatives for the progress of the farming community in the project area. Livelihood focus instead of crop based technology alone may be the broad concept in the second stage of the project. The components may include the development of farm activity and its complementary activities besides the social and environmental improvement within the family as well as society as a whole.

Considering the performance of the initiatives undertaken so for, as well as requirements and expectations expressed by the respondents during the field study with due validation though technical and economic feasibility, following new additional initiatives are suggested:

4.1 Collectivizing Farmers

Farmer's association may be encouraged to realize the benefits of collective bargaining for input purchase and output marketing. It may in the form of Farmer's Produce Organization (FPO) or Joint Liability Group (JLG) or Self Help Groups (SHGs) or any other informal collectives (more details in Annexure 9). The scope of the groups may be expanded to input purchase, produce sale, credit management, and adoption of technology etc., besides women empowerment. Future road map includes:

i. Considering the rainfed nature of farming and relatively less level of awareness, initially informal groups of farmers may be encouraged. Three groups of 30- 40 farmers in each village may be formed with broad guidelines suggested in the Joint liability group or Self Help Groups concept suggested by NABARD with flexibility suiting to the project area. The task of group formation, training and management during the initial periods may be undertaken by the project team or identified local Non Governmental Organization (NGOs). The groups may be informal and voluntary in nature without aspiring for free components. The members of the group must meet at periodical intervals, more frequently (monthly) at the initial stage till the cohesiveness is established. Broad guideline of SHGs adopted by NANARD may be taken as reference. Project staff may support the groups in formalizing the discussions, record keeping. The group is

expected to undertake all the activities of input purchase and output sale besides ensuring the high level of technology adoption. The group may be assigned the responsibility of collective marketing, maintenance of equipments and renting out to members and ensuring credit support from institutional agencies.

ii. As per the above proposal around 2000 farmers may be covered during the first year. Based on the experience, the groups may be converted in to Farmers Producer Company which can be registered under company act or cooperative society act.

4.2 Water Conservation and Management measures

Inadequate, scanty and uneven distribution of rainfall in the project area as a whole and some pockets of villages in particular is affecting the crop yield that lead to distress among farmers. Even the available rainwater is not properly conserved, though there is scope for efficient rainwater management. Following are some of the proposed initiatives that can be considered during the consolidation stage of the project:

i. **Adoption of watershed Management approach** : using the technically sound geological survey, check dams, water conservation structure may be constructed

ii. **Construction of Farm Ponds**: based on the appropriate survey, local farm ponds may be made and the farmers are encouraged to construct farm ponds for rainwater harvesting. Available government schemes may be integrated along with this initiative.

4.3 Effective Dissemination of IPM Technology

For improving the adoption level of IPM technology beyond the direct beneficiaries, the present practices like personal visit by scouts, displaying posters, locating more and more Information centers must be intensified further. Following initiatives are suggested for effective dissemination:

i. **Mobile Agro Advisory System:** Technology driven initiatives using mobile phone is a most appropriate method which may be considered. Mobile Agro Advisory System of the Tata Consultancy service is a successful model with farmers friendly features may be considered for adoption in the project area. More details of the mKrishi – Mobile Agro Advisory System are presented in Annexure 10.

ii. **Capacity Building :** More number of on spot farm level practical training on pest and disease control may be considered for enhanced success of the intervention.

iii. **Exposure Visits:** Exposure visits to research stations, Agricultural Universities within and outside the state will improve the better adoption of improved package of practices.

iv. **Sensitizing Input Dealers:** Efforts must be initiated for timely and adequate quantity availability of recommended fertilizers and pesticides. The input dealers may be sensitized and informed about the forecasted required inputs and a training programme to input dealers may be considered for keeping them as partner/ player of the project.

v. **Soil Testing:** Prescription of fertilizer dose based on the Soil testing results are well recognized by the farmers and hence this effort may be strengthened further using mobile soil testing lab in coordination with department of agriculture.

4.4. Input Market Enhancement

Keeping in view to improving the input marker arrangement, small scale agri-input shop may be organized on pilot basis. This initiative will address the easy and timely availability of inputs such as fertilizers, pesticides, fungicides and micro nutrients etc. Identification of strategic location of the proposed shop and long term sustainability of this initiative must be examined in depth.

4.5 Risk Mitigation initiatives

Weather risk and Price risk are the major factors that directly affect the profitability of cotton cultivation. Using the technology advancement, this uncertainty may be minimized with the following initiatives:

i. **Weather Based Crop Insurance**: Crop Insurance is a tool to protect the farmers, especially under rainfed condition, against a small probability of a large unexpected loss. Weather Based Crop Insurance aims to mitigate the hardship of the insured farmers against the likelihood of financial loss on account of anticipated crop loss resulting from incidence of adverse conditions of weather parameters like rainfall, temperature, frost, humidity etc (See Annexure 11 for more details). Thought this aspect is much beyond the reach under the

project in the short run, this is an effective tool for risk mitigation in the long run. Technological advancement and crop insurance is being considered as a priority area, better insight will emerge as we progress.

ii. **Price Forecasting**: The Central Sector Umbrella Scheme viz. 'Forecasting and Remote Sensing Applications in Crop Husbandry' during the Tenth Five Year Plan includes three components (i) National Crop Forecasting Centre (NCFC) (ii) Crop Acreage and Production Estimates (CAPE)and (iii) Special Data Dissemination Standards (SDDS).The available results needs to effectively integrated under the project and guide the farmers. In order to improve upon the quality of quarterly estimates by way of refining the estimation procedure and cross validation of results, available data from other sources such as Timely Reporting Scheme, market Intelligence Unit of DES, National Sample Survey Organization etc ., may also be used.

4.6 Marketing Issues in Cotton

Farmers in the project area are still depending on the local traders and their use of regulated market channel is minimal which may mainly due to lack of awareness and inadequate/ mis information. During the group discussions with the farmers during the field study it was observed that the present marketing arrangements followed by the farmers needs greater improvement for which following interventions are proposed:

i. **Market information:** Arrangements may be made to provide updated market information such as maximum, minimum and average prices through different channels and different options may be made available for the farmers to take prudent decisions.

ii. **Grading and Standardization:** Price advantage of adopting proper grading and standardization of cotton must be made aware among the farmers. In general they harvest and pool all the produces in one lot there by realizing low price than the potential one. It is suggested the farmers may be provided different colour gunny back representing the particular grade and standards. This small initiative will certainly motivate them in following system grading.

iii. **Collective sale**: Many of the small size holding farmers were in the disadvantages of less quantity of cotton that led to economies of scale in operation. Collecting the produces at the village level or cluster level through group approach will have the advantages of expecting better prices.

iv. **Avoid loss in weighing:** Many of the sample farmers expressed that local traders are using faulty weighing machines thereby they are paid for the less quantity of output. As a project component, weighing machines may be provided on cluster basis which may be a small initiative but will certainly improve the market arrangements in the project area.

4.7 Farm Mechanisation

Labour shortage in general and especially during peak seasons on land preparation during the rainy days and harvesting is a one of the major constrain experienced by the farmers. Farm mechanization component has become essential in the context of labour shortage and also add dignity of farming within the society besides adoption of recommended full package of practices. With a view to encourage farm mechanization following initiatives may be considered:

i. Tractor, power tiller, harvesting machines may be made available in the cluster of villages which may be used by the farmers on hiring basis. The machines may be owned and maintained by the group members.

ii. High powered sprayers may be owned and managed by the groups so that collective spraying covering the packets of area for effective control of insects and pesticides.

iii. Cotton Plucking machines may be made available under the project which will help the beneficiaries for managing the labour shortage during the harvesting season.

4.8 Integration with State Government Programmes

Most of the components suggest in the proposed road map are included directly or indirectly in the schemes implemented by the state governments. A list of such programmes is presented in the Annexure for ready reference. However, due to lack of coordination and inadequate monitoring and follow up, the full benefits are not reaching the farmers. Hence as the project component, frequent interactions with the concerned department officials, make use of the subsidy components for the benefit of the farmers, ensure effective coordination among different schemes, may be considered.

4.9 Livestock Development

Livestock development assumes greater significance for enhancing the profitability of farms especially in rainfed farming. Inadequate water supply, poor feeding of concentrates and marketing arrangements, is the common issues that restrict the progress of this activity on the project area. Some of the suggested initiatives addressing these issues are as follows:

i. **Azolla- A sustainable feed for Livestock**: Azolla is a floating fern and belongs to the family of Azollaceae. Azolla hosts a symbiotic blue green algae, Anabaena azollae, which is responsible for the fixation and assimilation of atmospheric nitrogen (more details in Annexure12). Azolla, in turn, provides the carbon source and favourable environment for the growth and development of the algae. It is this unique symbiotic relationship that makes azolla a wonderful plant with high protein content. Azolla is easy to cultivate and can be used as an ideal feed for cattle, fish, pigs and poultry, and also is of value as a bio-fertilizer for wetland paddy and hence may be considered popularizing in the project area.

ii. **Milk Societies:** Better marketing arrangements may be considered through effective functioning of the milk societies and efficient milk collecting centers.

4.10 Farm Credit arrangements

As discussed elsewhere in the report, still farmers are depending on informal sources and input dealers for credit support. Hence access to credit from institutional sources such as commercial banks, Primary Agricultural Credit Societies may be ensured through joint liability group approach. Interaction with NABARD District Development Manager, Lead District Manager will have better impact for accessing credit from Banks. Block Level bankers Meeting may be used as a platform for showcasing the project interventions for the benefit of the Bankers.

4.11 Social Development

While the project scope is expanded to livelihoods promotion beyond agricultural development, components focusing on improvements in social aspects have become necessary. Following are some of the suggested interventions for improving the effectiveness of the project:

Nutrition Status:

The study findings observed the relatively low level of nutrition consumption by the family members of sample farmers. The analysis of the pattern of food consumption revealed that the quantum of consumption of milk and vegetables are must lower

than the standard level. Though the sample households attribute low income level for this status, the real issue seems to be lack of awareness of the implications. Following initiatives are suggested to address this issue:

i. **Kitchen vegetable gardens:** Farmers may be encouraged to raise vegetables and greens in the space available around the dwelling house as well as in the farm house. Having this component in the project, will certainly contribute to the health improvement of the children in the family.

ii. **Milk Consumption:** With the proper motivation and encouraging dairy enterprise as complementary activity will increase the scope of additional milk consumption.

Sanitation improvement

Total sanitation with providing adequate toilet facilities is one of the priority based programme of the Government. It is disheartening to observe that about 82 percent of the sample households do not have the toilet facilities in the project area. It is time to coordinate with the government programmes and facilitate the construction of toilets with the subsidy from the government and a token contribution by the households. Following intervention is proposed:

i. Assuming the cost of construction of toilet is Rs. 14000, with the government support of Rs. 10000 and the balance of Rs 4000 may be equally shared by the project and farmer household. If the construction is done on collective basis on the cluster basis by a single contractor, the toilets can be made with high quality at affordable costs.

4.12 Administrative Arrangements

Since the scope of the project in the consolidation stage expanding and different initiatives are proposed to be included, the team at the project area must be strong enough to coordinate and implement the project in an effective manner. Following suggestions may help in this regard:

- The project team at Vepur needs to be further strengthened with a whole time project manager, field officer, scouts coordinators etc., and engage consultants for different components of the proposed interventions. While selecting the Scouts greater emphasis may be assigned for their attitude towards extension work and urge to learn new technology.

- Scouts, the field level machineries, must be trained and motivated to undertake the challenges. Unlike associated with the project during the cotton crop season alone, the scouts may be engaged with the project entire year. Their activities may be focused on cotton crop during the seasons and undertake other initiatives during offseason period.

- The Scouts must be trained for the updated technology with and outside the project areas. Periodical exposure visits to Universities will add value for their assignments. Scouts may be encouraged to be in the farmer's field with in the assigned villages as well as nearby villages.

Annexure: 1 Village wise distribution of Sample Farms

(Nos)

Particulars	Small Farms	Medium Farms	Large Farms	All Farms
Anthur	3	1	2	6
Chinnavenmani	6	..	1	7
Karambiyam	6	..	..	6
Keelaperambalur	4	1	1	6
Kolapadi	3	1	1	5
Kunnam	1	1	3	5
Moongilpadi	4	..	2	6
Nannai	4	..	..	4
Olaipadi	2	..	2	4
Othiyam	1	..	3	4
Paravai East	2	..	1	3
Perali North	3	..	1	4
Perali South	2	1	1	4
Periyammapalayam	4	..	1	5
Periyavenmani	1	3	1	5
Puduvettaikudi	3	..	..	3
Sithali West	4	1	1	6
Thenur	5		1	6
Thungapuram	3		2	5
Vayalapadi	4	1	1	6
All Village	**65**	**10**	**25**	**100**
Non Project area – Melamathur	4	1	..	5

Annexure: 2 Village wise average farm size of Sample Farms

(ac)

Particulars	Small Farms	Medium Farms	Large Farms	All Farms
Anthur	3.67	7.00	10.50	6.50
Chinnavenmani	3.88	..	10.00	4.21
Karambiyam	3.25	..	..	2.83
Keelaperambalur	4.17	6.00	8.00	4.75
Kolapadi	3.50	6.00	9.00	4.50
Kunnam	..	6.00	8.67	6.80
Moongilpadi	3.13	..	14.00	7.42
Nannai	4.17	..	..	3.63
Olaipadi	..	..	9.33	7.50
Othiyam	..	..	9.00	7.25
Paravai East	4.00	..	10.00	5.17
Perali North	3.50	..	9.00	4.88
Perali South	3.10	6.00	10.00	5.50
Periyammapalayam	3.20	..	10.00	3.70
Periyavenmani	4.03	6.33	11.00	6.80
Puduvettaikudi	3.00	..	..	2.00
Sithali West	3.75	6.00	9.00	4.42
Thenur	3.67	..	10.00	4.17
Thungapuram	5.00	..	9.00	4.67
Vayalapadi	2.50	7.00	18.00	6.33
All Village	**2.71**	**6.41**	**10.15**	**4.94**
Mealamathur – Non Project area	3.00	7.50	..	5.25

Annexure: 3 Village wise average yield of cotton among Sample Farms

(Quintals/ac)

Particulars	Small Farms	Medium Farms	Large Farms	All Farms
Anthur	9.33	5.3	7.2	7.95
Chinnavenmani	7.38	..	10.00	8.86
Karambiyam	6.75	..		8.08
Keelaperambalur	7.57	6.50	10.50	7.95
Kolapadi	10.00	3.80	7.70	8.50
Kunnam	..	10.00	7.47	8.48
Moongilpadi	7.60	..	6.50	7.23
Nannai	9.60	..		9.83
Olaipadi	..	..	7.93	8.83
Othiyam	..	..	7.43	8.33
Paravai East	5.80	..	5.00	5.60
Perali North	8.53	..	6.00	7.90
Perali South	6.10	10.50	3.80	6.63
Periyammapalayam	10.00	..	6.90	9.56
Periyavenmani	10.00	8.83	9.00	9.10
Puduvettaikudi	11.00	..	..	7.98
Sithali West	7.95	8.50	9.00	8.98
Thenur	7.40	..	7.00	6.48
Thungapuram	10.00	..	3.63	7.43
Vayalapadi	10.00	9.50	6.00	8.92
All Village	**7.11**	**6.87**	**5.86**	**7.02**
Mealamathur – Non Project Area	5.90	4.40	…	5.15

Annexure: 4 Village wise fertilizer cost of cotton of cultivation of among Sample Farms

(Rupees/ac)

Particulars	Small	Medium	Large	All Farmers
Anthur	2643	3698	3238	3017
Chinnavenmani	3997	..	4700	3826
Karambiyam	3170	..	..	3290
Keelaperambalur	2903	2800	2450	3025
Kolapadi	2100	3204	2200	2949
Kunnam	..	2435	2675	2717
Moongilpadi	3304	..	4187	3598
Nannai	2438	..	..	3035
Olaipadi	..	..	3714	3561
Othiyam	..	..	3552	3214
Paravai East	4775	..	4041	4384
Perali North	3084	..	2823	3019
Perali South	3485	2459	5118	3637
Periyammapalayam	2150	..	2823	3121
Periyavenmani	2790	2643	4038	2951
Puduvettaikudi	2821	..	..	3560
Sithali West	3634	4063	2803	3197
Thenur	3493	..	4875	3683
Thungapuram	2632	..	4495	3338
Vayalapadi	3771	2995	2763	3357
All Village	**3197**	**2973**	**3550**	**3311**
Mealamathur – Non Project Area	3260	3118	..	3189

Annexure: 5 Village wise average pesticide cost of Cotton among Sample Farms

(Rupees/ac)

Particulars	Small	Medium	Large	All Farmers
Anthur	2037	2212	1450	1870
Chinnavenmani	1729	..	2089	1732
Karambiyam	1838	..	..	1735
Keelaperambalur	1740	1250	1320	1707
Kolapadi	1350	2023	1845	1811
Kunnam	..	1310	1608	1639
Moongilpadi	1873	..	1916	1888
Nannai	1587	..	..	1842
Olaipadi	..	..	2196	1972
Othiyam	..	..	1619	1571
Paravai East	2187	..	2029	2097
Perali North	1700	..	1530	1658
Perali South	1695	1320	2497	1802
Periyammapalayam	2245	..	1560	1826
Periyavenmani	1560	1560	2177	113
Puduvettaikudi	1575	..	..	1835
Sithali West	1795	2155	2090	1896
Thenur	2076	..	1535	2029
Thungapuram	1490	..	2316	1844
Vayalapadi	1763	1610	2135	1845
All Village	**1794**	**1683**	**1863**	**1812**
Mealamathur – Non Project Area	1675	1952	..	1814

Annexure: 6 Village wise average total cost of cultivation of cotton among Sample Farms

(Rupees/ac)

Particulars	Small	Medium	Large	All Farmers
Anthur	18328	15360	20678	18617
Chinnavenmani	17963	..	18259	19861
Karambiyam	19397	..	..	17983
Keelaperambalur	14463	15653	17770	15996
Kolapadi	15355	13777	23133	20308
Kunnam	..	14319	19927	18827
Moongilpadi	17201	..	15711	16704
Nannai	20328	..	..	21113
Olaipadi	..	..	18255	17629
Othiyam	..	..	21374	20287
Paravai East	15096	..	19770	16842
Perali North	15905	..	12560	15069
Perali South	20274	15275	16565	18097
Periyammapalayam	25050	..	21593	19640
Periyavenmani	21905	15848	18233	17537
Puduvettaikudi	17065	..	..	16855
Sithali West	15961	18548	17610	18105
Thenur	18067	..	22548	17606
Thungapuram	17850	..	17511	17470
Vayalapadi	17791	16605	12450	17633
All Village	**17870**	**15523**	**18729**	**18033**
Mealamathur- Non Project Area	14912	13675	..	14294

Annexure 7. Village wise break up of cost of cultivation

Villages	Preparatory cultivation	Seeds and Sowing	Manures and fertilizers	Insecticide / pesticide	Labour cost - weeding and picking	Total Cost
Anthur	2546	1627	4768	2876	6734	18551
Chinnavenmani	2365	1529	4981	4286	8270	21431
Karambiyam	2167	1975	4670	4529	7395	20736
Keelaperambalur	2217	1650	5519	3769	6395	19550
Kolapadi	2794	1408	4578	4017	7219	20016
Kunnam	2687	1587	4510	3287	6073	18144
Moongilpadi	2198	2167	5981	3298	8276	21920
Nannai	2870	1895	5495	5860	6359	22479
Olaipadi	2562	1591	5860	3548	8763	22324
Othiyam	2469	1987	4516	3124	7465	19561
Paravai East	2365	1465	4976	3769	7590	20165
Perali North	2287	1680	5215	3870	7295	20347
Perali South	2878	1769	5687	3827	8129	22290
Periyammapalayam	2156	1613	5139	3823	7930	20661
Periyavenmani	2876	1589	5838	3752	8173	22228
Puduvettaikudi	2518	1548	5486	4318	7290	21160
Sithali West	2987	2189	4589	3428	6973	20166
Thenur	2581	1870	5489	3687	7492	21119
Thungapuram	2934	2470	4678	3482	7368	20932
Vayalapadi	2156	1498	4651	3876	8027	20208
All Village	**2506**	**1790**	**4216**	**3576**	**7168**	**19256**
Mealamathur – Non Project area	2480	1527	4529	3287	7620	19443

Annexure: 8 Village wise impact of price on cotton among the sample Farm's profit

(Rupees/ac)

Villages	Small		Medium		Large		All Farms	
	A*	B*	A*	B*	A*	B*	A*	B*
Anthur	28339	19005	11140	5840	15322	8122	21133	13183
Chinna Venmani	18912	11537	..	..	31741	21741	24424	15567
Karambiyam	14353	7603	..	..	..	..	22433	14350
Keela Perambalur	23371	15804	16847	10347	34730	24230	23755	15805
Kolapadi	34645	24645	5223	1423	15367	7667	22192	13692
Kunnam			35681	25681	17406	9939	23573	15093
Mealamathur	14588	8688	8325	3925	..	..	11457	6307
Nannai	27672	18072	..	..	..	..	28012	18187
Olaipadi	..	..	..	..	21411	13478	26496	17671
Othiyam	..	..	..	..	15793	8360	21339	13014
Paravai East	13904	8104	..	..	5230	230	11158	5558
Perali North	26762	18229	..	..	17440	11440	24432	16532
Perali South	10226	4126	37225	26725	2435	-1365	15028	8403
Periya Venmani	28095	18095	28318	19485	26767	17767	27963	18863
Periyamma Palayam	24950	14950	..	..	12907	6007	28160	18600
Puduvettaikudi	37935	26935	..	...	..	..	23045	15065
Sithali West	23790	15840	23952	15452	27390	18390	26812	17829
Thenur	18933	11533	..	..	12452	5452	14811	8328
Thungapuram	32150	22150	..	..	614	-3011	19655	12230
Vayalapadi	32209	22209	30895	21395	17550	11550	26951	18034
Grand Total	**22755**	**14630**	**23113**	**15386**	**16665**	**9586**	**22508**	**14400**
Moongilpadi – Non Project Area	20800	13200	..	..	16789	10289	19463	12229

**A – Profit 2012-13; B – Profit 2013-14*

Annexure 9 Farmers Producer Company (FPCs)

Collectivizing farmers in to Producer Company has been considered as one of the way to overcome the challenges faced by the small and marginal farmers. This approach is demonstrating the potential to be more successful in breaking farmer's dependency on intermediaries, and enabling them to access better markets (inputs and output). In the last decade, efforts have been made towards creating and strengthening FPCs and thus strengthening their position in the mainstream value chain/s. Over the years, there has been a growing interest in promoting an enabling environment for the FPCs. Several initiatives have been taken by the Government, Apex financial institutions such as NABARD, private donor organizations, financial institutions and many other institutions to support the growth of the FPCs and facilitate their emergence as successful business enterprises.

As per the concept, farmers, who are the producers of agricultural products, can form groups and register themselves under the Indian Companies Act. These can be created both at State, cluster, and village levels. It is aimed at engaging the farmer companies to procure agricultural products and sell them. Supply of inputs such as seed, fertilizer and machinery, market linkages, training & networking and financial and technical advice are also among the major activities of FPC. The Small Farmers' Agribusiness Consortium (SFAC) has been nominated as a central procurement agency to undertake price support operations under Minimum Support Price (MSP) for pulses and oilseeds through the FPC's.

Under the 12th Five Year Plan of the Government of India, promotion and strengthening of FPCs has been one of the key strategies to achieve inclusive agricultural growth. In the last three years, the growth of the FPCs has witnessed a big spurt in the formation of FPCs. Given this rapid growth of the FPCs, the issue of access to credit - linking the FPOs to reliable and affordable sources of financing to meet their working capital, infrastructure development and other needs - has assumed center stage. As the FPCs strive to achieve sustainability, there is an urgent need to reorient the funding ecosystem to support the newly formed FPCs.

Stages of the FPCs are broadly categorized into three phases: (i) Incubation and Early Stage,(ii) Emerging and Growing Stage (iii) Matured Stage (Business Expansion). In each of the stage of the FPC, the financial needs were found to be different. In early stages, financial need of the FPCs revolves around the cost of mobilizing farmers, registration cost, cost of operations and management, training, exposure visits etc. Mostly the need is met thorough the grant support. Later in the emerging and growing stage, FPCs need working capital to run their businesses. As the FPCs move towards expanding their 12th Five Year Plan of the Government of India, promotion and strengthening of FPCs has been one of the key strategies to achieve inclusive agricultural growth. In the last three years, the growth of the FPCs has witnessed a big spurt in the formation of FPCs. Given this rapid growth of the FPCs, the issue of access to credit - linking the FPCs to reliable and affordable

sources of financing to meet their working capital, infrastructure development and other needs - has assumed center stage. As the FPCs strive to achieve sustainability, there is an urgent need to reorient the funding ecosystem to support the newly formed FPCs. Businesses, PCs need term loans to set up processing units, processing/grading/sorting yards, storage godowns, cold storage, transport facilities, etc.

Farmers Producer Company is a legal form of the company. In 2002 an Act was passed in Parliament and this legal form was created. It takes care of the flaws in the cooperative societies but keeps its strengths. It has also borrowed the strengths of the corporate companies. According to this new law, only farmer – producers can be members of the FPC and the farmer members themselves will manage this company. Paid staff can be employed to help the farmer- producers run the FPC. These FPCs will be promoted by the farmers, will be run by the farmers and for the benefits of the farmers. Over the years, the surplus would be shared among the farmers only.
This FPC is being established so that it can improve returns to farmers through collective inputs purchase, collective marketing, and processing, increasing productivity through better inputs, increasing knowledge of farmers and ensuring quality

The FPC can undertake any economic activity for the benefit of its members. Infrastructure and value addition support will also be provided. To measure the expected growth potential of soil, soil testing will be conducted in the farmers land at a very reasonable cost as per the external agency. By getting the soil testing done, a farmer can know which crop can be grown in which type of soil, can know the moisture content and fertility of the soil and which fertilizers and micro-nutrients to apply in what quantity. Farmers will be given tips on alternative crops and on multi cropping by the experts and they will be provided on agricultural practices and technologies to enhance production. For example, organic farming is one of the farming technique on which the farmers will be educated. The farmers will also be given tips on compost making, use of pesticides etc. Quality seeds will be procured at the right time and right price. Farmers will be educated on which fertilizer should be used for which pest and the amount of fertilizer to be used. They will be linked up with the external agencies for the procurement of the fertilizers at a reasonable cost. Marketing support and linkages will be provided. During this project period, [the name of the Promoting NGO] shall provide the farmers handholding support in building their capacity and upgrading their skills. The farmers will be provided guidance in managing the FPCs smoothly. Apart from this they shall also be given technical training on agriculture practices, finance, and institutional aspects etc. Processing: To avoid the wastage or to minimize post harvest waste, the member farmers will be trained on post harvest processing techniques. Some of them are supply cut vegetables as per the customer requirement. They will also be trained on the capital required for setting up a processing unit.

Annexure 10. m Krishi – Mobile Agro Advisory System

With technological advancements, the mobile phone has become a multi-functional device. Its applications have gone beyond voice and data communication. mKrishi, a mobile agro advisory system of the Tata Consultancy Services, is an innovation that allows farmers to send queries to agricultural experts in their local languages through a mobile and receive personalised advice or relevant information in the local language. It also helps literacy-challenged farmers by allowing them to send queries and receive advice and information as 'voice SMS.'

TCS Mobile Agro Advisory System has evolved from the efforts of TCS Innovation Labs-Mumbai, which researches into sensor as well as speech recognition. The company has also used an internally developed IVR (interactive voice response) type platform — packet interactive multimedia response (PIM2R) — which uses the inexpensive data channel for transferring rich content. Through mKrishi, farmers can send their queries to a remote expert by their mobile CDMA handsets. Along with their queries, they can also send a photograph of the crop through a camera phone. The information related to crop, soil and micro-environment, gathered by sensors, is sent to experts.The solution broadcasts best farming practices to each farmer, and provides organizations, NGOs , and the government a platform to exchange information with farmers. TCS Mobile Agro Advisory System is best suited for a rural audience, as it: Breaks literacy barriers. The solution has rich content and media formats, local language interfaces, voice messaging systems that are accessible to semi-literate and number-literate users. Uses familiar technology: The end user needs to use mobile phone which is more popular compared to computers in rural India. It provides a framework to connect farmers to the information relating to government policies, financial institutions, crop insurance, market prices, fungicides, pesticides, seeds and cold storage availability. Improves social Interaction among rural community: With the help of developed Rural-Net (R-Net), a mobile phone based social networking environment, rural masses can interact with each other by posting and browsing voice microblogs in any language of their choice. The application also provides news feeds in local language and information about cloud coverage, rainfall and temperature in easy to interpret graphical format. Currently R-Net is available in its two variants Gappa Goshti and Gappa Shappa, for Maharashtra-India and Punjab-India, respectively. Inspires scalable business models. The technical adaptations and the business model of the Agro Advisory System can be scaled to reach a large underserved population. It provides another channel for stakeholders in the agriculture sector to address the base of the pyramid market. Farmers receive responses to their queries through the same channel and advices are given after farmers submit the soil nutrient and farming pattern data. The application of fertilizer and pesticide is uploaded through a handset application. Thus, the expert has access to the information such as soil, crop, farming practice

and so on; mKrishi tries to address the concerns of farmers with the help of CDMA technology.[9]

This model broadcasts best farming practices to each farmer, and provides organizations, NGOs , and the government a platform to exchange information with farmers. This toll is best suited for a rural audience, as it: Breaks literacy barriers. It has rich content and media formats, local language interfaces, voice messaging systems that are accessible to semi-literate and number-literate users. The end user needs to use mobile phone which is more popular compared to computers in rural India. It provides a framework to connect farmers to the information relating to government policies, financial institutions, crop insurance, market prices, fungicides, pesticides, seeds and cold storage availability. Improves social Interaction among rural community: With the help of developed Rural-Net (R-Net), a mobile phone based social networking environment, rural masses can interact with each other by posting and browsing voice microblogs in any language of their choice. The application also provides news feeds in local language and information about cloud coverage, rainfall and temperature in easy to interpret graphical format. Currently R-Net is available in its two variants Gappa Goshti and Gappa Shappa, for Maharashtra-India and Punjab-India, respectively. The technical adaptations and the business model of the Agro Advisory System can be scaled to reach a large underserved population. It provides another channel for stakeholders in the agriculture sector to address the base of the pyramid market.

[9] The project is being implemented in close cooperation with various eco-partners such as Tata Teleservices, M.S. Swaminathan Foundation, Tata Chemicals & Rallies, National Centre of Grapes, Cotton Research Centre and (National Commodities and Derivatives Exchange Limited) NCDEX.

Annexure 11 Need for Weather Based Crop Insurance Scheme

Insurance is a tool to protect the farmers, especially under rainfed condition, against a small probability of a large unexpected loss. It is a technique of providing people a means to transfer and share risk where losses suffered by few are met from the funds accumulated through small contributions made by many who are exposed to similar risks. Insurance is not a tool to make money but a tool to help compensate an individual or business for unexpected losses that might otherwise cause a financial disaster. Crop insurance is a means of protecting the agriculturist against financial losses due to uncertainties that may arise from crop failures/losses arising from named or all unforeseen perils beyond their control. Weather Based Crop Insurance aims to mitigate the hardship of the insured farmers against the likelihood of financial loss on account of anticipated crop loss resulting from incidence of adverse conditions of weather parameters like rainfall, temperature, frost, humidity etc.

Historical correlation studies of crop yield with weather parameters help us in developing weather thresholds (triggers) beyond which crop starts getting affected adversely. Payout structures are developed to compensate cultivators to the extent of losses deemed to have been suffered by them using the weather triggers. Weather Insurance has been piloted in the country since Kharif 2003 season. Some of the States where it's piloted are Andhra Pradesh, Chattisgarh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan etc.

Weather Insurance is a new concept. High level of transparency was / is maintained throughout. After every period of insurance some improvements were made based on feedback received and also on internal research and experience. Limitations are many like - distance of the farm from the weather station, non-coverage of perils other than weather, wider sowing / planting window of the crop, differences in soil types & management practices, shift in climatic& weather patterns, etc. leading to weak correlation between the yield and the weather indices, etc.

Weather based Crop Insurance Scheme (WBCIS) is a unique Weather based Insurance Product designed to provide insurance protection against losses in crop yield resulting from adverse weather incidences. It provides payout against adverse rainfall incidence (both deficit & excess) during Kharif and adverse incidence in weather parameters like frost, heat, relative humidity, un-seasonal rainfall etc. during Rabi. It is not Yield guarantee insurance.

Practically all risks covered (drought, excess rainfall, flood, hail, pest infestation, etc.) Parametric weather related risks like rainfall, frost, heat (temperature), humidity etc.) are covered. However, these parametric weather parameters appear to account for majority of crop losses.

Weather Based Crop Insurance Scheme (WBCIS)

Weather based Crop Insurance Scheme (WBCIS) operates on the concept of “Area Approach” i.e., for the purposes of compensation, a ‘Reference Unit Area (RUA)’ shall be deemed to be a homogeneous unit of Insurance. This RUA shall be notified before the commencement of the season by the State Government and all the insured cultivators of a particular insured crop in that Area will be deemed to be on par in the assessment of claims. Each RUA is linked to a Reference Weather Station (RWS), on the basis of which current weather data and the claims would be processed. Adverse Weather Incidences, if any during the current season would entitle the insured a payout, subject to the weather triggers defined in the ‘Payout Structure’ and the terms & conditions of the Scheme. The “Area Approach” is as opposed to “Individual Approach”, where claim assessment is made for every individual insured farmer who has suffered a loss.

Weather based Crop Insurance Scheme (WBCIS) provides protection to the insured cultivators in the event of loss in crops yields resulting from the adverse weather incidences, like un-seasonal/excess rainfall, heat (temperature), frost, relative humidity etc. Triggers are broadly fixed so as to capture the adverse incidence of weather parameters on crop yield.

Annexure 12 Azolla: A sustainable feed for livestock

The demand for milk and meat in India is creating new potential in the profitability of animal husbandry as an occupation. Yet, at the same time, there is a substantial decline in fodder availability. The area under forest and grasslands is decreasing as is the amount of various crop residues available for feed, largely due to the introduction of high yielding dwarf varieties. The shortage of fodder is therefore compensated with commercial feed, resulting in increased costs in meat and milk production. Moreover, as commercial feed is mixed with urea and other artificial milk boosters, it has a negative effect on the quality of milk and the health of the livestock.

The search for alternatives to concentrates led us to a wonderful plant azolla, which holds the promise of providing a sustainable feed for livestock. Azolla is a floating fern and belongs to the family of Azollaceae. Azolla hosts a symbiotic blue green algae, Anabaena azollae, which is responsible for the fixation and assimilation of atmospheric nitrogen. Azolla, in turn, provides the carbon source and favourable environment for the growth and development of the algae. It is this unique symbiotic relationship that makes azolla, a wonderful plant with high protein content.

Nutrient content and its impact on growth

Azolla is very rich in proteins, essential amino acids, vitamins (vitamin A, vitamin B12 and Beta- Carotene), growth promoter intermediaries and minerals like calcium, phosphorous, potassium, ferrous, copper, magnesium etc. On a dry weight basis, it contains 25 - 35 percent protein, 10 - 15 percent minerals and 7 - 10 percent of amino acids, bio-active substances and bio-polymers. The carbohydrate and fat content of azolla is very low. Its nutrient composition makes it a highly efficient and effective feed for livestock. Livestock easily digest it, owing to its high protein and low lignin content, and they quickly grow accustomed to it. Moreover it is easy and economic to grow.

The Natural Resources Development Project (NARDEP), Vivekananda Kendra, carried out trials in Tamil Nadu and Kerala using azolla as a feed substitute. The trials on dairy animals showed an overall increase of milk yield of about 15 percent when 1.5 - 2 kg of azolla per day was combined with regular feed. The increase in the quantity of the milk produced was higher than could be expected based on the nutrient content of azolla alone. Hence, it is assumed that it is not only the nutrients, but also other components, like carotinoids, bio-polymers, probiotics etc., that contribute to the overall increase in the production of milk. Feeding azolla to poultry improves the weight of broiler chickens and increases the egg production of layers. Azolla can also be fed to sheep, goats, pigs and rabbits. In China, cultivation of azolla along with paddy and fish is said to have increased the rice production by 20 percent and fish production by 30 percent.

Azolla production

NARDEP has been working on azolla for the last three to four years, studying its potential as a feed and exploring cost effective methods for the mass multiplication of azolla in farmers' homesteads. In our method, a water body is made, preferably under the shade of a tree, with the help of a silpauline sheet. Silpauline is a polythene tarpaulin which is resistant to the ultra violet radiation in sunlight. A pit of 2 x 2 x 0.2 m is dug as a first step. All corners of the pit should be at the same level so that a uniform water level can be maintained. The pit is covered with plastic gunnies to prevent the roots of the nearby trees piercing the silpauline sheet, which is spread over the plastic gunnies. About 10 - 15 kg of sieved fertile soil is uniformly spread over the silpauline sheet. Slurry made of 2 kg cow dung and 30 g of Super Phosphate mixed in 10 litres of water, is poured onto the sheet. More water is poured on to raise the water level to about 10 cm. About 0.5 - 1 kg of fresh and pure culture of azolla is placed in the water. This will grow rapidly and fill the pit within 10 - 15 days. From then on, 500 - 600 g of azolla can be harvested daily. A mixture of 20 g of Super Phosphate and about 1 kg of cow dung should be added once every 5 days in order to maintain rapid multiplication of the azolla and to maintain the daily yield of 500 g. A micronutrient mix containing magnesium, iron, copper, sulphur etc., can also be added at weekly intervals to enhance the mineral content of azolla.

Azolla can be used as an ideal feed for cattle, fish, pigs and poultry, and also is of value as a bio-fertilizer for wetland paddy. It is popular and cultivated widely in other countries like China, Vietnam, and the Philippines, but has yet to be taken up in India, in a big way.

Appendix 1
Terms of Reference

"To undertake an impact assessment for the project titled, "Scaling up Dissemination of Integrated Pest Management (IPM) Technologies in Cotton in Perambalur district, Tamil Nadu" as part of the "Reviving the Green Revolution (RGR) Initiative"

Background

The "Reviving the Green Revolution" (RGR) Initiative is one of the flagship initiatives of the Trusts[10] and was operationalised in Punjab in 2002, to seek solutions to the stagnation in agricultural productivity which had set in post the Green Revolution period. The Johl Committee Report[11] gave strategic direction to the RGR Initiative, influencing the development of its focal areas, i.e. improving agricultural production through adoption of crop specific Package of Practices (PoP); promoting agricultural diversification; and furthering the development of agriculture based livelihoods. Based on this, various interventions were piloted and successful interventions such as Integrated Pest Management (IPM) in Cotton have been scaled up in partnership with institutions such as the State Government and State Agricultural Universities. In 2007-08, with a view of replicating the success achieved in Punjab to other regions of the country, the RGR initiative was expanded to Tamil Nadu, which in addition to post Green Revolution issues, faces frequent drought and a topographically varied agricultural situation. Partnering with the Tamil Nadu Agricultural University (TNAU), Coimbatore an initial set of projects focusing on improving crop productivity, promoting Integrated Pest Management in food and cash crops; and developing alternate sources of livelihood for small, marginal, tribal and women farmers was undertaken. Today, the overall outreach of the RGR initiative, i.e. Punjab and Tamil Nadu combined covers 30districts with approximately, 53,500 direct beneficiaries.

Reviving Green Revolution (RGR) Cell, Ludhiana, Punjab: The overall success within the initiative, coupled with a major expansion and coverage under the projects, encouraged the Trusts to upscale the level of funding individual projects to a centralized organization with a dedicated team through operationalizing the "Reviving Green Revolution (RGR) Cell" with key objectives to support: (i) large scale activities for adoption of technologies by the farmers in prime areas of concern in agriculture; (ii) development departments of state governments and the private sector in frontline extension activities for increasing agricultural productivity and augmenting economy of farmers; (iii) activities that build market linkages of farmers, growth of subsidiaries and encourage agro-based entrepreneurship; and (iv) researchable issues in agricultural universities to fill in the gaps of agricultural technologies developed. Registered in 2008 under the Society Registration Act, 1860, RGR Cell has been in existence for the past 4 years and is housed in PAU, Ludhiana. It is also responsible for prioritization of thrust areas of funding for Trusts, besides monitoring progress of ongoing projects. The RGR Cell, also functions as an idea incubator for developing potential sustainable agriculture technologies, e.g., technology of 'Direct seed sowing in rice' which ensures water saving has been approved by PAU and recommended to farmers. Similarly, technology demonstration on 'Use of Artificial Insemination technique for cattle breed improvement' has been taken up by State Animal Husbandry Department for upscaling with BAIF. In 2008, to strategically expand the outreach of the RGR Cell, a first set of five projects were initiated in Tamil Nadu. Subsequently, in 2011, the RGR Cell, Regional Centre was set up to intensify project and state-level RGR Cell engagement in Tamil Nadu.

RGR Cell, Regional Centre, Tamil Nadu: Tamil Nadu is faced with topographically varied agrarian issues and hence, the need to have area specific interventions becomes a necessity,

[10] The RGR Initiative is supported by the Sir Ratan Tata Trust and NavajbaiRatan Tata Trust.
[11] The Johl Committee was setup in the wake of the severe agricultural issues arising in the post Green Revolution era.

especially if a sustainable and replicable model is to be developed. Drawing on this, the RGR Cell, Regional Centre focuses on the following key areas with an overall livelihood building and integrated development approach: (i) Integrated Pest and Disease Management (IPM and IDM); (ii) promoting technology for enhancing pulse production; (iii) promoting technology specially developed for rainfed, drought-prone and hilly areas; (iv) Natural Resource Management (NRM) and Water Resource Development (WRD); (v) Idea Incubation for new technologies; (vi) scaling up of proven technologies through partnership development; and (vii) market linkage development. Of the initial projects, two have been scaled up and an additional two will be taken up for further up-scaling as well.

Perambalur district, Tamil Nadu

The maximum area under Cotton in Tamil Nadu is in Perambalur district. Here, Cotton is grown under total rainfed conditions and the total area under cotton is approximately 24,000 hectares. Approximately, 7,000 hectares (33 Panchayat villages) of this is located in Veppur block. In Phase II a "cluster approach" has been adopted and 20 out of 33 (60%) Panchayat villages, located in a contiguous cotton growing area have been selected for project implementation. In addition, a village youth (Scout) from each village has been recruited and trained in the IPM-Cotton PoP. This Scout functions as a village level technical advisory service provider and maintains the Village Information Center (VIC) set up in each village. The VIC is kept open so that farmers can walk in and get technical information at their convenience. Linkages have been developed with the local TNAU Cotton Research Station, Veppanthatai for technical information and District Department of Agriculture for implementation support.

Kharif 2014

During Kharif2014,the project was operationalised by covering approximately 2000 farmers in 20 villages of Veppur block, Perambalur district with 220 direct contact farmers. The names of the villages are as under:

(i) Periyammapalayam; (ii) Othiyam; (iii) Perali (North); (iv) Moongilpadi; (v) Vailapadi; (vi) Puduvettaikudi; (vii) Kunnam; (viii) Paravai (East); (ix) Thenur; (x) Keelaperambalur; (xi) Perali (South); (xii) Sithali (West); (xiii) Nannai; (xiv) Olaipadi; (xv) Kolapadi; (xvi) Periyavenmani; (xvii) Anthur; (xviii) Thungapuram; (xix) Karambiyam; and (xx) Chinnavenmani. The project is being directly implemented by Reviving Green Revolution (RGR) Cell with a field team consisting of a Project Lead (Extension); Consultant (IPM-Cotton); Field Officer; and Scouts. The project is overall overseen by Sr. Development Officer, Tata Trusts. Innovative mechanisms of communication such as Village Boards, Wall Paintings, Days After Sowing (DAS) flyers in VIC's and tea shops, pest/disease identification and control cards etc. were taken up in the last season to further spread the outreach of the project. Regular trainings are conducted by the Scientists from Cotton Research Station (CRS), Veppanthattai and project Consultant to ensure correct technical information dissemination. During the season, pest and disease monitoring sheets were regularly maintained by the Scouts and the Field Officer. In addition, mechanical harvesting of Cotton through mobile solar harvesters has been demonstrated during the Field Day.

Objectives of the Assignment:
To undertake an impact assessment for the IPM-Cotton Phase II project being implemented in 20 villages of Veppur block, Perambalur district.

Scope of Services
(1) Literature review: Collect and review relevant documents in order to understand the outline of the project and identify the information gaps to be filled by the present survey.

(2) Analysis of the socio-economic and environmental parameters confronting farmers in the study areas before and after the interventions by ways of Participatory Rural Appraisals (PRAs), meetings and interviews. A 15% (approximately 20 farmers/village) representative sample size from the 20 villages can be selected and it is recommended that the questionnaire formulated be pre-tested and then finalized to ensure quality data collection. The Consultant will be primarily responsible for ensuring quality data collection with facilitation support from the RGR Cell, Regional Center, Tamil Nadu.
(3) Identify key performance indicators to measure the performance and impact of the project and assess impact of project interventions on livelihood improvement of participating farmers and lateral impact of interventions on the whole village. Details would include, but not limited to Area, production and productivity details of Cotton and other crops grown in the project villages; income per acre, measures taken for critical irrigation; and mode of marketing and problems faced therein.
(4) The Consultant would be required to visit the project villages, meet with farmers, scouts, agro-input traders, credit providers, private and government institutions for primary and secondary data collection.
(5) Comparative analysis of impact of adoption of 13:0:45, Cobalt Chloride and TNAU recommended Package of Practices such as phosphobacter, trichodermaviride, azospirilium, micronutrient mixture on productivity of Cotton vis-à-vis farmers practice. Also, comparative control achieved in participatory farmers plot for prodenia attack vis-à-vis farmers practice.
(6) Data from a non-project village and atleast 5 farmers from non-participating farmers in the project villages needs to be collected and comparatively analysed with that of participating farmers, specifically on the following indicators: (i) reduction in use of pesticide; (ii) increase in yield; and (iii) income per acre.
(7) Assess increase in awareness of proper sowing time, cultural control practices and economic threshold level, growing of non Bt as refuge crop, type of pesticides used and decision making channel, identification of natural enemies, awareness about host plants, level of benefits accrued from Scouts/dissemination material, visits to local village information centres etc. Also, source of information for agro-advisory, credit/loans availed, alternate sources of income and education levels.
(8) Identify avenues for expanding the impact of the IPM-Cotton programme to surrounding areas and increasing the benefits accruing to farmers.

Before initiating the study, the consultant needs to submit a detailed research plan and key tasks to be undertaken as part of the study.

A detailed draft report would be submitted by the consultant to the Trust within 15 days of the completion of the mission. On review of the draft reports, and receipt of Trust feedback on the document, the consultant would be requested to submit the final report within 15 days.

Appendix II

Questionnaire for Field Survey

1. General Details

Village Name					Type of the sample		
Farmer Name					Address		
Father Name							
Age		Education		Farm Size		Phone No:	
Farming Experience					Cotton Experience		

1a. Household details

Total HH members		Children		
Literate		No of persons Involved in Agriculture		
Adult_Econ_Active		No of people engaged in Non - Farm activities		

1b. Details on economically active adults in the household

S.No	Name	Age	Education	Job Title	Salary/Wage	Active period

1c. Land holdings

S.No.	Particulars	Wet land	Garden land	Dry land	Total
i)	Owned				
ii)	a. Leased in b. Leased out				
iii)	Total Operational Area				

1d. Cropping pattern

No of Parcels:		No of parcel with irrigation:				
Year	Irrigation	Season				
2013-14						
2014-15						

1e Irrigation Source:

Source	Year of excretion	Depth	Area coverage	Motor Type	Availability

1f. Livestock components

S.No	Type of livestock	No of animals	Year purchase	Usage interval	No.of sales in the previous year

2. Whole farm crop economics

Wage: A: B: Fertilizer

S.No	Particulars						
1	Land Preparation						
2	Basal Fertilizer						
3	Seed Material						
4	Sowing_Labour						
5	Weeding_Times						
6	Labour per weeding						
7	Fertilize_times						
8	Fertilizer_Qty	N					
		P					
		K					
9	Fert_App_Lab						
10	No of Irrigation						
11	Irrigation_Lab						
12	Harvest_Nos						
13	Harvest_Lab						
14	Main Product						
15	By Product						
16	Post_Har_Prac						
17	Transportation						

2a Credit Profile

S.No	Loan Purpose	Source of Information	Source of Credit	Type of credit	Interest	Procuring Installments	Payment Installments

2b. Marketing Profile

S.No	Crop	Known Selling points	Distance from farm	Mode of transportation	Source of Information

2c. Livestock Economics

S.No	Particulars				
1	Numbers				
2	Green Fodder				
3	Dry Fodder				
4	Concentrate				
5	Doctor Consultation				
6	Lab_ Maintenance				
7	Main Product				
	Qty _ Sold				
	Price				
	Point of sale				
8	By Product				
	Price				
	Point of Sale				
	Total				

2d. Other Sources of Income

S.No	Particulars	Unit	Nos. / Value (Rs)	Annual income (Rs)
i)	Rental value from leased out land	Acres		
ii)	Hiring out of family labour	M.D		
iv)	Hiring out of machineries	Hours		
v)	Interest from deposits	Rs		
vi)	Income from non-farm / Other sources	Rs		
	a)Govt programme			
	b)			

3. Technology Adoption

Particulars			**Cotton**			
			Qty	Price	Timeliness	Cash/credit
Land preparation Basal fertilizer FYM (5tn/ac) TNAU Micro Nutrient (3kg/ac)						
Nutrient	Var (kg/ac)	Hybrid				

N	16	36	
P	8	18	
K	16	18	
Seed material (Variety/Hybrid) Main Crop Intercrop Border Crop			
Gap filling Seed material			
Thinning			
Fertilizer (Topdressing)			
45-65 DAS			
Type	Nut	Per cent	
Spraying	Urea	0.5	
Spraying	KCl	1	
While flowering and fruit bearing			
Spraying	Cotton Plus	2.5kg in 200 lit of Water/ac	
Presence of Nutrient deficiency Which Nutrient At what stage Who did you refer What is the recommendation			
Plant protection chemicals Presence of Pest At what stage Who did you refer What is the recommendation			

Presence of disease At what stage Who did you refer What is the recommendation	
Where did you buy you inputs Payment type Timeliness	
Irrigation numbers Interval	
Harvesting Start date No of harvest Do you store the products	
Post - harvest Practices	
Where did you get information about IPM? Scouts/KVK/Pamplets/training/Display Boards/Wall Paintings etc…	
Total production	
Point of Sale Do you have any formal/informal agreement with the traders? If yes what kind of agreement? Reasons behind the agreement	
What kind of help do you need in addition to this?	

5. Constraints in adoption / Reasons for not adopting IPM – Cotton

S.No.	Problems	Remarks
i)	Technology not available	
ii)	High cost	
iii)	Lack of access to credit	
iv)	Farm size	
v)	Lack of knowledge/ training	
vi)	Non Availability of Seeds	

vii)	Seed drill sowing	
viii)	Manures and Fertilizers	
ix)	Marketing of Produces	
x)	Others (Specify)	

6. Extent of exposure to various technologies:

S.No	Technologies / Programs	Awareness	Did you ever Adopt?	Year of Adoption	Why did you stop/continue adopting
1	Crop Insurance				
2	Water Conservation (Farm Ponds)				
3	Farmer Producer Org				
4	Others				

Notes by the interviewer:

Appendix III

Details of Field Visits and Interactions

Date	Particulars
26-27 Feb 2015	Interaction with Field Officer - Scouts and select farmers – finalising approach for the study- Pre testing the questionnaire – Discussion with KVK, cotton research centre, Department of Agriculture, Director of Agriculture.
13-15 March 2015	Participated in the Field day - Discussion with KVK, cotton research center, Govt dept officials
17 to 25 March 2015	Field visits for interaction and data collection from the selected farmers – Scouts - TNAU researchers - Other stakeholders such as traders input dealers etc.
13-14 May 2015	Revisit to selected farmers – Group discussions – interactions with Field officer and Scouts - Validation of the observations and research findings.