Project Report- September 2012

New Technologies and Farmers in India

Socio-economic Impact Assessment Survey of TEGRA™ Technology in Rice Cultivation in Selected Districts of Tamil Nadu

Project Sponsored by
Syngenta India Limited
Pune, India

Council for Social Development

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PROJECT REPORT

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Socio-economic Impact Assessment Survey of TEGRA^{TM} Technology in Rice Cultivation in Selected Districts of Tamil Nadu

by

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2012

ACKNOWLEDGEMENTS

I wish to extend our thanks to Dr T. Haque, Director, CSD for providing guidance to study team and giving us this opportunity to work on such an exciting project. We are also thankful to Syngenta India Limited for funding this project. Mr David Hosking, Mr Suresh Babu, Mr Ravi K. C. and Mr Pradeep Raj from Syngenta gave useful comments on an earlier draft of this report. We are thankful to Mr Venkatesh G. for his cooperation. Mr Gitesh Sinha played most important role of field work supervision and Data Analysis. We also acknowledge contribution by Mr G. Mani as field coordinator. Mr Shiv Ji and Mr Moksh Keer entered the data into computer. We are thankful to them for this.

Prashant Kumar Trivedi
Principal Investigator

CONTENT

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Given limited agricultural land, it is difficult to meet increasing food requirements of the population at present level of productivity. For enhancement in productivity, several new technologies are proposed by the public as well as private sector. Agricultural companies are also developing new technologies aimed at producing higher crop yields in economical and sustainable ways. The challenge of increasing productivity in all crops is important but it is more so in case of rice which is staple food for large part of country's population especially people living in Eastern and Southern India. It is mainly cultivated in rainfed areas. In large part of India, rice is still cultivated by traditional method in which nursery is maintained by the farmers to grow seedlings and transplanting is done by hand. It requires huge number of labour leading to a shortage of labour during peak season. In areas where considerable diversification of employment opportunities has already taken place, shortage of labour becomes acute. A section of farmers lack technical skills to grow robust seedlings which are resistant to several diseases. This leads to a drop in production.

TEGRA™ is an integrated rice programme launched in response to the challenges faced by the planters in terms of the way the rice seedlings are grown and planted. It is a new seedling technology, adapted for each unique rice ecosystem, delivering proprietary products, mechanically transplanted and supported by Syngenta's comprehensive agronomy consultation services. TEGRA™ has been introduced as a solution for small-scale rice growers. The solution consists of planting high quality seed coated with seed treatment, followed by a new system of mechanical transplanting for the seedlings to reduce labor input.

TEGRA™ Agronomy

The system starts with the selection of the right variety of seeds by the farmer. The next step is to grow the seedlings in the right growing medium in plastic trays. The seeds are treated with crop protection chemicals to make seedlings robust and disease-free. The seeds are germinated in plastic trays suitable for transplanting by machine at the young age of 21 days from sowing. This

is different than the usual practice of farmers to plant seedlings that are 30 days old or older. Usually farmers plant 4 to 6 seedlings per hill whereas in the machine-transplanted system, only two seedlings are planted per hill. Younger seedlings have a longer period during which it can produce more tillers, hence more grain-bearing panicles per hill. The 21-day-old seedlings may produce as many as 50 tillers per hill whereas the older seedlings planted by farmers usually produce only 30 tillers or even less. The mechanical transplanter, is considered equipped in transplanting seedlings in straight rows and at equal distances. The transplanter has the potential to plant four hectares in just eight hours of operation. Only one tractor operator and a helper operate the machine. The farmer is also supplied with customised agronomic practices to cover all aspects of crop care during the growing season. The process ensures that water is used much more efficiently.

The Study Area-Tamil Nadu

Climate

With not much variation in temperature throughout the year, climate of Tamil Nadu is considered tropical. Located closer to the sea, summer is less hot and winter is less cold. The maximum daily temperature rarely exceeds 43°C and the minimum daily temperature seldom falls below 18°C. The State is exposed to both South West and North East monsoons.

Rainfall and its distribution pattern

The average annual rainfall of Tamil Nadu is 925.0 mm. South West Monsoon helps in taking up the rainfed cultivation including dry rice in this State. The State depends mainly on the North East Monsoon rains which are brought by the troughs of low pressure establishing in southern Bay of Bengal between October and December. The following are the normal rainfall during the major seasons of State.

District-wise Distribution of Normal Rainfall

District	South-West (June-Sept)	North-East (Oct- Dec)	Winter (Jan - Feb)	Hot weather (March -May)	Total
Kancheepuram	462.7	697.2	32.1	60.1	1252.1
Thiruvarur	301.8	665.4	57.9	104.8	1129.9
Thiruvannamalai	465.8	439.8	32.8	108.2	1046.6
Vellore	442.0	353.0	20.3	101.7	917.0
Tamil Nadu	**332.8**	**459.2**	**36.8**	**129.6**	**958.4**

Source: Evaluation and Applied Research Department, Government of Tamil Nadu, Chennai.

Among the studied districts Kancheepuram falls in high rainfall region whereas Vellore, Thiruvannamalai and Thiruvarur are considered medium rainfall districts.

Agro-climatic zones

Tamil Nadu State is classified into seven distinct agro-climatic zones delineated as indicated below.

(i) **North Eastern Zone**: Among the studied districts, three Kancheepuram, Vellore and Thiruvannamalai are included in this zone. Other districts of this zone are Tiruvallur, Cuddalore (excluding Chidambaram and Kattumammar koil taluks) and Ariyalur and Perambalur taluks in Perambalur district.

(ii) **North Western Zone**: Dharmapuri district (excluding hilly areas), Salem and Namakkal districts (excluding Tiruchengode taluk) and Perambalur taluk of Perambalur district are part of this zone.

(iii) **Western Zone**: Erode and Coimbatore districts, Tiruchengode taluk of Namakkal, Karur taluk of Karur district and northern parts of Madurai district compose this zone.

(iv) **Cauvery Delta Zone**: Thiruvarur lies in this zone. This zone also covers the Cauvery Delta area in Thanjavur, Nagapattinam, districts and Musiri, Tiruchirappalli, Lalgudi, Thuraiyur and Kulithalai taluks of Tiruchirappali districts, Aranthangi taluk of Puddukottai and Chidambram and Kattumannar koil taluks of Cuddalore District.

(v) **Southern Zone**: This zone includes Ramanathapuram, Virudhunagar, Sivaganga, Thoothukudi and Tirunelveli districts, Dindigul and Natham taluks of Dindigul district, Melur, Tirumangalam, Madurai South and Madurai North taluks of Madurai district and Pudukottai district (excluding Aranthangi taluk).

(vi) **High Rainfall Zone**: This zone consists of Kanyakumari district.

(vii) **Hilly Zone**: This zone consists of the hilly regions the Nilgiris, Shevroys, Elagiri-Javadhi, Kollimalai, Pachaimalai, Anamalais, Palanis and Podhigai malai.

Soil type

Being a tropical plant, rice flourishes comfortably in hot and humid climate. Rice is mainly grown in rain fed areas that receive heavy annual rainfall. That is why it is fundamentally a kharif crop in India. It demands temperature of around 25 degree Celsius and above and rainfall of more than 100 cm. Being a semi aquatic plant rice grows best in soils that have good water retention capacity. In India, it is grown in alluvial, red, lateritic, laterite, black, saline and alkali, peaty and marshy soils and in acid soils. But the Clay and clay loam soils are most suited. Soils having pH range of 5.5 to 6.5 are found suitable for rice cultivation.

Most of the soils in Tamil Nadu are found to be highly deficient in organic matter and micro nutrients content. In different parts of the state nitrogen content remains low whereas phosphorous varies from low to medium. Potassium status ranges between medium to high. In addition, Tamil Nadu soils are found significantly deficient in Zinc and Iron. Copper and Manganese deficiency is not considerable.

Operational Holdings

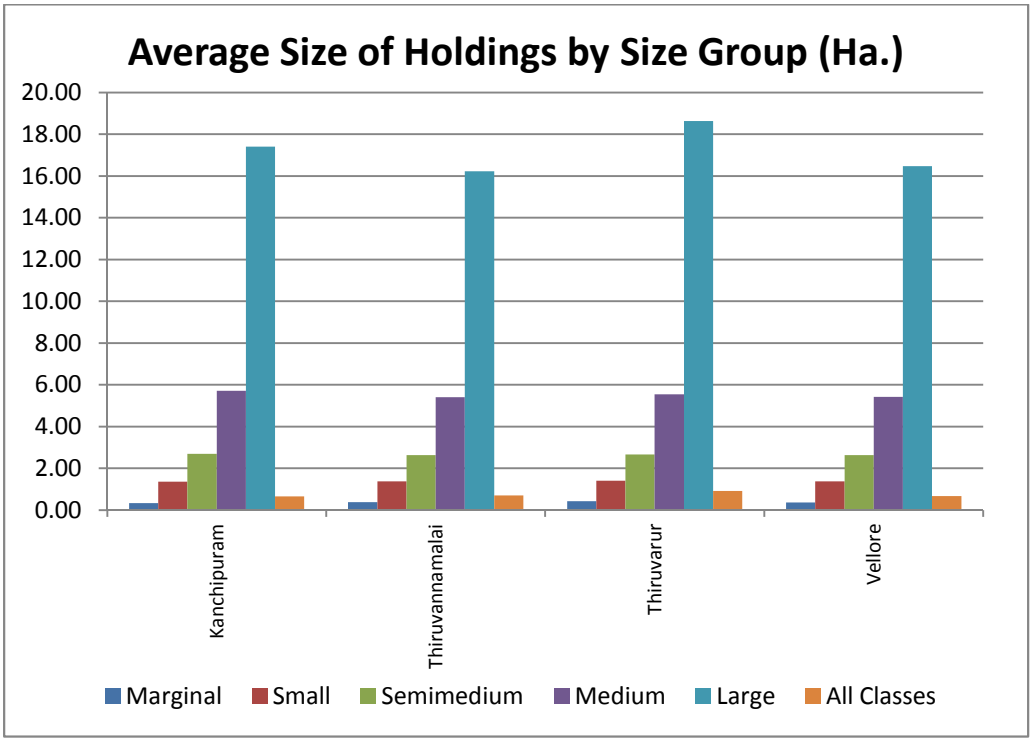
Like most of the Indian states, Tamil Nadu is also dominated by marginal holdings. At the state level, over 3/4th of total holdings fall in this category but they cover only 1/3rd of total cultivated area. This data also reveals wide inequalities as 2 percent medium and 0.24 percent large holdings occupy almost 14 percent and 6 percent area respectively.

District wise Percentage and area of operational holding by size group (2005-06)

Districts	Number/ area (in acre)	MARGINAL	SMALL	SEMI MEDIUM	MEDIUM	LARGE	ALL CLASSES
Kanchipuram	Number	82.35	11.63	4.42	1.37	0.22	100
	Area	40.60	23.84	17.96	11.78	5.83	100
Vellore	Number	80.30	14.00	4.64	1.00	0.06	100
	Area	43.62	28.68	18.24	8.07	1.39	100
Thiruvannamalai	Number	78.64	15.46	4.98	0.88	0.04	100
	Area	43.06	30.36	18.76	6.79	1.03	100
Thiruvarur	Number	70.80	19.03	8.07	1.95	0.15	100
	Area	32.99	29.03	23.32	11.70	2.96	100
Tamil Nadu	**Number**	**76.01**	**15.06**	**6.62**	**2.07**	**0.24**	**100**
	Area	**33.51**	**25.22**	**21.51**	**14.03**	**5.73**	**100**

Source: Agricultural Census, 2005-06

This data also captures inter-district variations. Proportion of marginal holdings is highest in Kanchipuram (82.35%) and lowest in Thiruvarur (70.8%) among studied districts. Area covered by marginal holdings is highest in Thiruvannamalai (43.06%) and lowest in Thiruvarur (32.99%). As a result average area of marginal holdings is highest (0.43 Ha) in Thiruvarur and lowest (0.33 Ha) in Kanchipuram. Large holdings have an average area of 16 to 18 hectares in these districts. Average area of holdings of all classes is again highest in Thiruvarur (0.92 Ha.).



Land Use Pattern

District wise percentage distribution of Land Use in Tamil Nadu (2008-09)

Land use	Kancheepuram	Vellore	Thiruvannamalai	Thiruvarur	Tamil Nadu
Forest Area	5.38	25.46	24.29	1.17	16.17
Barren and Unculturable Lands	2.47	3.55	3.34	0.05	3.78
Land put to Non-agricultural use	33.12	14.52	14.82	17.69	16.68
Cultivable Waste Land	2.42	1.01	1.90	0.92	2.56
PP and Other Grazing Lands	4.13	0.68	0.46	0.37	0.84
Land Under Misc. (Tree Crops and Groves not included in the Net Area Sown)	2.92	0.51	0.35	1.01	1.99
Current Fallows Land	6.95	10.29	15.71	0.81	7.78

Other Fallow Lands	14.37	11.88	4.19	4.28	11.50
Net Area Sown	28.24	32.10	34.95	73.70	38.71
Cropping Intensity	**105.10**	**111.50**	**121.30**	**170.10**	**115.50**
% of Gross area irrigated to Gross area sown	**91.96**	**55.07**	**73.69**	**73.27**	**58.26**
% of Net area irrigated to Net area sown	**91.62**	**51.77**	**69.12**	**96.35**	**58.12**

Source: Evaluation and Research Department, Government of Tamil Nadu, Chennai.

Net sown area in the first three districts Kancheepuram, Vellore and Thiruvannamalai ranges between 30 to 40 percent which is closer to state average. But in Thiruvarur, it is 73 percent. This difference can be partly understood by the fact that in Kanchipuram, land put to non-agricultural use is quiet high (33.12%) whereas forest cover in Vellore and Thiruvannamalai claims close to quarter of total land mass.

Cropping intensity is also highest in Thiruvarur (170.10 %) followed by Thiruvannamalai (121.30%), Kanchipuram (105.10%) and Vellore (111.50%). Perhaps higher proportion of net irrigated area to net area sown in Thiruvarur (96.35%) contributes in enhancing cropping intensity. In all other three districts proportion of gross irrigated area to gross area sown and proportion of net irrigated area to net area sown are not much different from each other.

District wise Percentage of area under important crop to the Gross area sown in each district - 2008-09

Crops	Kancheepuram	Vellore	Thiruvannamalai	Thiruvarur	Tamil Nadu
Paddy	69.04	22.37	38.07	64.96	33.16
Other Cereals	0.00	1.82	3.24	0.00	5.46
Total Cereals	69.10	31.57	44.90	67.73	45.59
Total Pulses	0.20	7.59	2.93	27.46	9.20
Sugarcane	1.47	7.91	9.04	0.90	5.30
Fruits	3.75	9.82	1.62	0.25	6.66
Vegetables	0.21	1.76	1.27	0.14	3.84
Total Food crops	74.80	59.51	59.95	96.58	73.29
Ground nut	16.18	24.09	36.45	0.47	8.41
Coconut	2.44	10.57	0.35	2.04	6.69
Cotton	0.00	3.16	0.36	0.19	1.97
Other non-food crops	6.38	2.44	2.42	0.34	8.55
Total Non-food crops	25.20	40.49	40.05	3.42	26.71

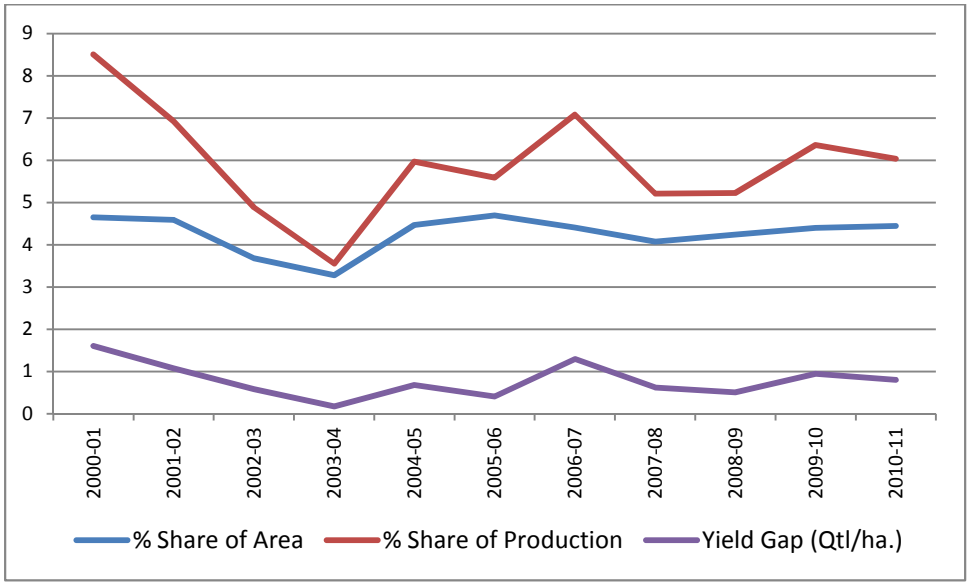
Source: Evaluation and Applied Research Department, Government of Tamil Nadu, Chennai.

Cropping pattern of Vellore looks more diversified with ground nut, pulses, sugarcane and fruits grown along with rice. But in terms of rice cultivation, Kancheepuram and Thiruvarur devote 2/3rd of gross sown area to this particular crop. In Kancheepuram, ground nut occupies second

position after paddy whereas in Thiruvarur pulses are grown in over 27 percent area. In Thiruvannamalai share of ground nut is comparable to that of share of paddy.

Area under Rice, Production and Yield

Share of Tamil Nadu to All India Production and Area under Rice and Yield Gap



Share of state's production to all India production varies with change in area and productivity. Leaving 2002-03 and 2003-04, share of Tamil Nadu to all India area under rice varies between 4-5 percent. In 2003-04, all three curves come to their lowest point. Area remaining almost static, yield remain prime mover of state's contribution to all India production which becomes quite clear from the graph. The curve of share of production and yield gap move almost in tandem with each other. Yield of rice in Tamil Nadu has always been higher than all India average but it has been fluctuating throughout the decade between 2300 to 3500 kg/ha against all India average yield of 1900 to 2200 kg/ha.

	Tamil Nadu			All India		
Year	Area ('000 ha.)	Production ('000 tons)	Yield (Kg./ha.)	Area ('000 ha.)	Production ('000 tons)	Yield (Kg./ha.)
2000-01	2080.00	7366.30	3541.49	44712.00	86621.27	1937.32
2001-02	2060.00	6584.00	3196.12	44904.00	95161.70	2119.23
2002-03	1516.50	3577.10	2358.79	41176.10	73201.20	1777.76

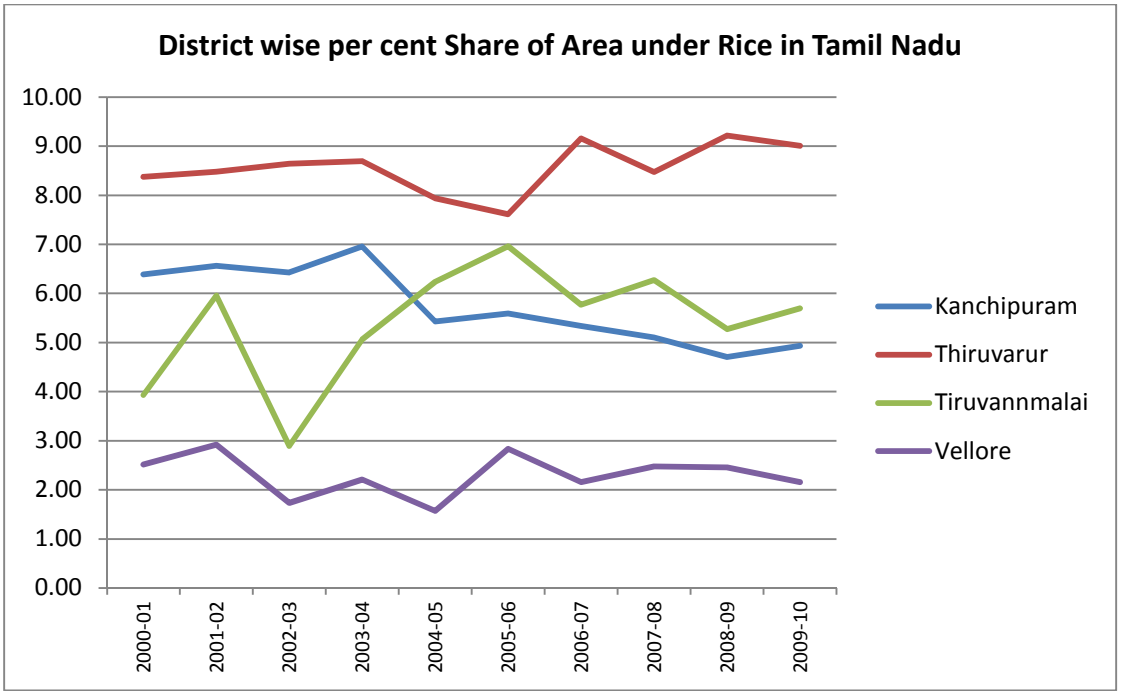
2003-04	1396.60	3222.80	2307.60	42592.50	90836.00	2132.68
2004-05	1872.80	5062.20	2703.01	41906.70	84788.70	2023.27
2005-06	2050.50	5220.00	2545.72	43659.80	93351.40	2138.15
2006-07	1931.40	6610.60	3422.70	43813.60	93355.30	2130.74
2007-08	1789.20	5040.20	2817.01	43914.40	96692.90	2201.85
2008-09	1931.80	5182.70	2682.83	45537.40	99182.50	2178.04
2009-10	1845.50	5665.20	3069.74	41918.40	89092.90	2125.39
2010-11	1905.70	5792.39	3039.51	42862.41	95979.82	2239.25
CAGR (2000-01 to 2010-11)	**0.34**	**0.43**	**0.09**	**-0.07**	**1.26**	**1.34**
CV %	**11.76**	**22.97**	**14.22**	**3.21**	**8.02**	**6.34**

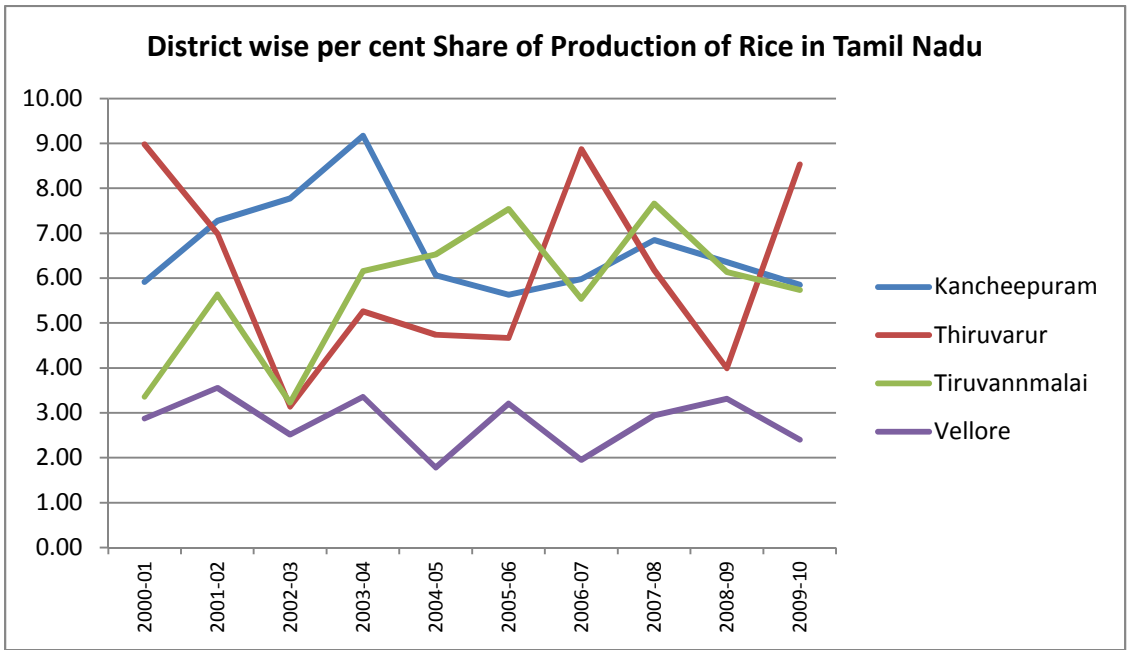
Source: Directorate of Economics and Statistics, Govt of India

District-wise percent share of area and production under Rice in Tamil Nadu

	Area				Production			
Year	Kanchipuram	Thiruvarur	Tiruvannamalai	Vellore	Kanchipuram	Thiruvarur	Tiruvannamalai	Vellore
2000-01	6.39	8.38	3.93	2.52	5.91	8.98	3.36	2.87
2001-02	6.56	8.48	5.96	2.92	7.27	6.99	5.63	3.56
2002-03	6.42	8.64	2.89	1.73	7.77	3.14	3.23	2.51
2003-04	6.95	8.70	5.06	2.21	9.17	5.26	6.16	3.36
2004-05	5.43	7.94	6.24	1.57	6.07	4.74	6.53	1.78
2005-06	5.59	7.61	6.96	2.84	5.63	4.66	7.54	3.21
2006-07	5.34	9.16	5.77	2.16	5.98	8.87	5.54	1.95
2007-08	5.11	8.47	6.27	2.48	6.85	6.18	7.66	2.94
2008-09	4.70	9.22	5.27	2.45	6.35	3.99	6.13	3.32
2009-10	4.93	9.01	5.70	2.15	5.85	8.53	5.74	2.40

Source: Directorate of Economics and Statistics, Government of India





Looking at two figures, the most interesting case that emerges is of Thiruvarur. This district's contribution to the state in terms of area devoted to rice cultivation does not vary too much. Normally, it remains in the range of 8-9 percent. But contribution to production varies between 3 to 9 percent. Although these are relative figures but it appears that productivity of this district fluctuates too much. In the initial years of last decade, Thiruvannmalai witnessed sharp fluctuations in share of area under rice with a corresponding change in share of production. But in the later half, its share in area and share in production more or less stabilizes around 6 percent and 7 percent respectively. In case of Kancheepuram, both the graphs do not move in tandem with each other. A little fluctuation in the first has reflects into a sharper change into the second. But movements of graphs of Vellore are more or less in tandem with each other.

District-wise Area, Production and Yield of Rice by Seasons (2008-09)

Districts		Kancheepuram	Vellore	Thiruvarur	Thiruvannamalai	Tamil Nadu
Area of Rice (in ha.)	Kar/Kuruvai / Sornavari	17044	10230	30932	18540	345004
	Samba / Thaladi / Pishanam	61791	18110	143724	40212	1441304
	Navarai / Kodai	12039	19077	3384	43134	145295
	Total	90874	47417	178040	101886	1931603
Production of Rice	Kar/Kuruvai / Sornavari	75880	37472	129358	63221	1356211

(in tonnes)	**Samba / Thaladi / Pishanam**	206444	66337	62807	117499	3332295
	Navarai / Kodai	46880	68067	14521	137209	495601
	Total	329237	171887	206526	317986	5180559
Yield of Rice (kg./ha.)	**Kar/Kuruvai / Sornavari**	4452	3663	4182	3410	3931
	Samba / Thaladi / Pishanam	3341	3663	437	2922	2312
	Navarai / Kodai	3894	3568	4291	3181	3411
	Total	3623	3625	1160	3121	2682

Source: Evaluation and Applied Research Department, Government of Tamilnadu, Chennai

In Kanchipuram and Thiruvarur, area under Samba rice is many folds higher than area under two other seasons. Area covered by Samba and Navrai is almost equal in Vellore and Thiruvannamalai. Area under Samba varies with variation in rainfalls. Sonavari area in Thiruvarur largely depends on canal water provided by Mettur Dam. Productivity of rainfed Samba remains generally lower than other seasons but area under it becomes huge in a year of normal rain conditions. In Delta districts such as Thiruvarur torrential rains sometime devastate entire crop as evident from the very low yield figure given in the table. Sonavari generally gives highest yield. Good temperature conditions are helpful to farmers in enhancing Sonavari yield.

The Study

The survey was carried out in 15 villages of these 4 districts. A total of 299 farming households were surveyed for this study. Out of this 133 were adopters of TEGRA technology and rest 166 were those farmers who have been either continuing with traditional practices of own nursery and manual transplanting or have adapted other agronomy practices such as SRI, Direct Seedlings etc. For the purpose of this study all farmers except those who have adapted to TEGRA agronomy have been categorized as non-adopters. Largest number of TEGRA famers were surveyed in Kancheepuram (49) closely followed by Thiruvarur (41), Vellore (23) and Thiruvannamalai (20). Navrai of 2011-12 agricultural year in North Tamil Nadu and Samba of 2011-12 in South Tamil Nadu were taken as reference period for categorizing famers into adopters and non-adopters, cost of cultivation, production, yield and other related data.

Objectives of the Study

- To analyze the nature and extent of adaption of TEGRA™ technology in survey region.
- To analyze the impact of various agronomic practices on rice productivity in areas where TEGRA™ technology is adapted.
- To conduct a cost of cultivation analysis of rice cultivation of both adopters and non-adopters of the TEGRA™ technology.
- To find the net economic implications for farmers, communities and rural economy of adopters vis-à-vis non-adopters of the TEGRA™ technology.
- To see changes in social development indicators like education and health of farming families of adopters vis-à-vis non-adopters of the TEGRA™ technology.
- To undertake a decomposition analysis to see the role of different factors such as yield, and cost on income from rice cultivation using TEGRA™ technology.
- To analyze constraints to adoption of TEGRA™ technology by farmers.
- To investigate impact of this technology on environment including water usage, usage of fallow land, soil health etc.
- To assess impact of mechanization on labour
- To study perceptions of adopters, non-adopters, dropouts (if any) and women SHGs on the impact of TEGRA™ technology on income, employment, education, health, environment etc

Methodology

The study was carried out with the help of a primary survey. TEGRA™ technology was adopted by 856 farming households spanning 292 villages across 7 districts of Tamil Nadu in 2011-12. A household survey was conducted in three districts of North Tamil Nadu viz. Kanchipuram, Vellore, Thiruvanamalai and one district of South Tamil Nadu Thiruvarur. These districts have been selected as they have the largest number of farmers practicing the TEGRA™ technology. The target groups for the survey was rice growing farmers both adopters and non-adopters of the TEGRA™ technology. The numbers of sample households from adopters and non-adopters category in each village were roughly comparable to each other. A detailed interview schedule was prepared for the collection of primary data. Besides household survey,

Focused Group Discussions were conducted in each district to ascertain perceptions of the stakeholders and to get qualitative data.

Village wise sample size under TEGRA and Non-TEGRA farmers

District	Village	No. of TEGRA Farmers	No. of Non-TEGRA Farmers
Kanchipuram	Keelperumanallur	9	6
	Palur	8	6
	Putheri	9	7
	Ramapuram	16	0
	Sevizhimedu	7	7
	Kanchipuram	49	26
Thiruvannamalai	Kadaisikulam	10	10
	Kaveripakkam	10	16
	Thiruvannamali	20	26
Thiruvarur	Edakeezhayur	10	19
	Edamelayur	8	24
	Edanavasal	10	10
	Peraiyur	8	19
	Rayapuram	5	18
	Thiruvarur	41	90
Vellore	Panapakkam	7	8
	Peruvalayam	8	8
	Sithenji	8	8
	Vellore	23	24
Total		**133**	**166**

Percentage distribution of respondents as per choice of technology for rice cultivation

District	SRI	Direct Seedling	TEGRA	Manual
Kancheepuram	10.52	-	65.79	23.68
Thiruvannamalai	-	36.96	43.48	19.57
Thiruvarur	9.16	50.38	31.30	9.16
Vellore	-	-	51.06	48.94

Source: Primary Survey, CSD, 2012

If we look at technologies other than TEGRA, SRI has started picking up in Kancheepuram and Thiruvarur. But inspite of several government schemes to promote this agronomy, farmers of other two districts are still dependent on traditional way of manual transplanting or direct seedling method. The later method is used by almost half of Thiruvarur and over one third of Thiruvannamalai farmers.

District wise average size of net cultivated area under both categories (in acre)

District	Average size of NCA (in acre)	Average area under TEGRA (in acre)	Average area under Non-TEGRA (in acre)
Kancheepuram	4.86	4.46	4.04
Thiruvannamalai	3.91	3.45	4.43
Thiruvarur	5.10	5.58	4.86
Vellore	8.21	7.25	4.50

Source: Primary Survey, CSD, 2012

Average net cultivated area under TEGRA is slightly lower than non-TEGRA in all the districts. It possibly happens due to two factors. One, adopters are cultivating larger part of their operational holding using traditional means, two, holdings of non-adopters are slightly larger than adopters' part of holding for which TEGRA has been adopted. It is generally seen that famers adopt TEGRA for better part of their holdings in terms of irrigation and fertility.

Survey Results

The main concern of the survey was to see the impact of TEGRA technology adaption on socio-economic lives of the farmers. It investigated cost of cultivation, yield, gross and net income from the sale of the crop to study economic dimension of change experienced by farmers. Besides, information regarding change in socio-cultural life in terms of drudgery reduction, leisure time etc were collected through qualitative discussion with the respondents.

Percentage distribution of awareness of TEGRA Technology

Districts/State	Awareness of TEGRA	Source of information		
		Co-farmer	Agri-input dealers	Syngenta Field personnel
Kanchipuram	100.00	98.68	1.32	-
Thiruvannamalai	100.00	63.04	8.70	28.26
Thiruvarur	100.00	67.94	6.87	25.19
Vellore	100.00	-	52.08	41.91
Tamil Nadu	100.00	64.12	12.96	22.92

Most of the agriculture surveys have revealed 'seeing is believing' phenomenon in dissemination of newer agriculture practices. Same is true with TEGRA too. Taking this phenomenon into cognizance, demo-fields of 1 acre are being set up by TEGRA team in each

village where this package is offered. All respondents in surveyed villages were aware of TEGRA technology. And around two third of them got to know about this through their co-farmers. Apart from peer-group effect, company's field personnel are second most important source of information for these farmers.

Reasons for adaption to TEGRA agronomy

Percentage distribution of respondents on the basis of reasons for adapting TEGRA technology in each district

Reasons		Kanchipuram	Thiruvannamalai	Thiruvarur	Vellore	Tamil Nadu
Saves nursery time	Yes	63.83	100.00	97.56	52.17	79.43
	No	36.17	0.00	2.44	47.83	20.57
Less incidence of pest & diseases	Yes	59.57	100.00	90.24	0.00	65.25
	No	40.43	0.00	9.76	100.00	34.75
Labour Shortage	Yes	59.57	100.00	95.12	43.48	75.89
	No	40.43	0.00	4.88	56.52	24.11
Higher Yield	Yes	14.89	0.00	0.00	13.04	7.09
	No	85.11	100.00	100.00	86.96	92.91
Less Cost	Yes	12.77	0.00	0.00	0.00	4.29
	No	87.23	100.00	100.00	100.00	95.71

In traditional farming, arrangements for nursery and growing of seedlings takes around 3-4 weeks. Saving of this time seems to be most important motivating factor for the adoption of TEGRA agronomy. Equally important point from the perspectives of the farmer is labour shortage during peak season. Farmers living in nuclear families having lesser number of working hands and farming families whose members have migrated out to for employment in non-agriculture sector especially emphasize this point. Farmers report that TEGRA team supplies treated robust seedlings that are less prone to diseases and it is one of the major points of consideration for adapting to this newer agronomy.

Cost of Cultivation

Non-TEGRA Paddy: Cost of Cultivation (Rs./acre)

	Kanchipuram	Thiruvannamalai	Thiruvarur	Vellore	Tamil Nadu
Area (Acre)	**4.04**	**4.43**	**4.86**	**4.50**	**4.46**
Yield (Qtl/acre)	**26.71**	**31.17**	**29.67**	**25.42**	**28.24**
Nursery Area (Cent)	9.11	4.88	4.87	4.83	5.92
Nursery Duration (Days)	26.66	29.56	28.73	29.54	28.62
Seed Cost (Rs.)	647.29	734.00	705.62	1145.83	808.19
Nursery Labour Cost (Rs.)	112.50	219.50	361.26	369.58	265.71
Total Nursery Cost	759.79	953.50	1066.88	1515.42	1073.90
DAP (Rs.)	1055.12	1365.00	1600.10	1325.00	1336.31
Urea (Rs.)	308.99	258.59	264.59	361.25	298.36
Potash (Rs.)	10.71	79.69	159.59	293.75	135.93
NPK Mixture (Rs.)	80.00	275.00	256.25	400.00	252.81
Farm Yard Manure (Rs.)	1324.17	0.00	0.00	677.78	500.49
Weedicide (Rs.)	405.00	300.00	223.33	0.00	232.08
Pesticide (Rs.)	0.00	190.00	177.92	228.42	149.09
Insecticide (Rs.)	300.00	350.00	200.50	0.00	212.63
Gypsum (Rs.)	300.00	0.00	250.00	250.00	200.00
Input Cost (Rs.)	3273.99	2355.78	2609.77	3369.53	2902.27
Land Preparation (Rs.)	955.36	329.13	564.04	720.83	642.34
Transplanting (Rs.)	1660.48	1175.06	1405.36	991.88	1308.19
Manures & Fertilizer application (Rs.)	66.67	96.63	260.40	400.00	205.92
Chemicals application (Rs.)	222.92	93.63	238.91	500.00	263.86
Hand Weeding (Rs.)	417.26	238.50	92.80	700.00	362.14
Machine Weeding (Rs.)	0.00	97.81	244.88	0.00	85.67
Sparying Pesticides (Rs.)	254.46	154.50	195.35	557.74	290.51
Irrigation (Rs.)	6.07	47.94	216.79	0.00	67.70
Harvesting (Rs.)	558.45	243.44	380.01	1189.58	592.87
Total Labour Cost (Rs.)	4141.67	2476.63	3598.53	3993.36	3552.55
Land Preparation (Rs.)	940.83	938.13	929.75	1652.08	1115.20
Harvester (Rs.)	1322.92	887.50	830.14	1200.00	1060.14
Transportation of Farm Produce (Rs.)	671.25	712.50	750.28	450.00	646.01
Machine Labour Cost (Rs.)	2935.00	2538.13	2510.18	2202.08	2546.35
Cost of Cultivation (Rs./Acre)	11110.45	8324.03	9785.36	11080.40	10075.06

TEGRA Paddy: Cost of Cultivation (Rs./acre)

	Kanchipuram	Thiruvannamalai	Thiruvarur	Vellore	Tamil Nadu
Area (Acre)	**4.46**	**3.45**	**5.58**	**7.25**	**5.19**
Yield (Qtl/acre)	**28.55**	**31.40**	**30.91**	**25.11**	**28.99**
No. Seeding Tray (per acre)	69.62	71.90	71.87	68.04	70.36
Per Tray Price (Rs./tray)	66.60	71.15	70.69	70.48	69.73
Tray Cost (Rs/acre)	4628.11	5115.30	5081.06	4729.76	4888.56
DAP (Rs.)	1157.38	1107.50	1118.50	1205.06	1147.11
Urea (Rs.)	331.28	230.75	266.14	426.49	313.66
Potash (Rs.)	45.22	215.63	181.77	314.58	189.30
NPK Mixture (Rs.)	700.00	0.00	300.00	332.22	333.06
Farm Yard Manure (Rs.)	1520.63	0.00	0.00	675.00	548.91
Grwoth Harmons (Rs.)	900.00	0.00	0.00	0.00	225.00
Weedicide (Rs.)	642.50	0.00	0.00	0.00	160.63
Pesticide (Rs.)	192.50	162.25	174.97	189.67	179.85
Insecticide (Rs.)	0.00	0.00	181.50	0.00	0.00
LimeCost	250.00	0.00	0.00	0.00	0.00
Input Cost (Rs.)	3749.87	1716.13	1873.97	2918.03	2564.50
Land Preparation (Rs.)	1105.88	519.75	1048.38	706.19	845.05
Manures & Fertilizer application (Rs.)	96.41	345.50	304.58	0.00	0.00
Chemicals application (Rs.)	83.13	399.25	238.63	557.74	319.69
Weeding (Rs.)	243.41	410.25	374.75	0.00	0.00
Sparying Pesticides (Rs.)	173.37	0.00	37.05	561.90	193.08
Irrigation (Rs.)	11.56	351.75	261.58	0.00	0.00
Harvesting (Rs.)	751.98	387.50	402.45	1200.00	685.48
Total Labour Cost	2465.73	2414.00	2667.40	3025.83	2643.24
Land Preparation (Rs.)	989.41	405.00	326.70	1965.48	921.65
Harvester (Rs.)	1411.71	1100.00	1198.50	1195.24	1226.36
Transportation of Farm Produce (Rs.)	752.27	1060.00	1059.50	490.28	840.51
Machine Labour Cost (Rs.)	3153.40	2565.00	2584.70	3650.99	2988.52
Cost of Cultivation (Rs./Acre)	13997.12	11810.43	12207.13	14324.61	13084.82

Per acre cost of cultivation is higher for TEGRA farmers as compared to non-TEGRA farmers. There are variations from district to district in cost of cultivation (CoC) for both the categories of farmers. Cost is lowest in Thiruvannamalai for TEGRA (Rs 11810 per acre) as well as non-TEGRA (Rs 8324 per acre) famers. It is highest in Vellore for TEGRA farmers. For non-TEGRA, it is highest in Kanchipuram and Vellore. Average difference of CoC between both the systems for the state is around three thousand rupees. Gap is lowest in Thiruvarur (Rs 2422) and highest in Thiruvannamalai (Rs 3486).

Major difference between two systems in CoC arises at the level of maintenance of nursery and transplanting. If we add up cost of nursery and transplanting in non-TEGRA system, it comes between 2128 to 2506 per acre in different districts whereas cost of tray and transplanting by machines costs in the range of Rs 4628 to Rs 5115. After transplanting, CoC does not differ too much between two systems. In fact, input cost is lower for TEGRA farmers in all the districts. Difference is highest in Thiruvarur (Rs 736 per acre).

Yield

On an average TEGRA farmers have got better yield of Paddy than non-TEGRA farmers. At the state level, paddy yield of the former category stands at 28.99 Q/acre against 28.24 Q/acre of the later. The difference between them is highest in Kanchipuram (1.84Q/acre). Average yield of paddy for both the groups is highest in Thiruvannamalai at 31.40Q/ acre for TEGRA and 31.17 Q/acre for non-TEGRA.

Maximum & minimum yield of Paddy under TEGRA & Non-TEGRA

Adopter	Yield		No. of farmers having 30 Qtl/acre & above Yield	
	(Max)	(Min.)	Nos.	(%)
TEGRA	35	16	87	65.41
Non-TEGRA	35	20	82	49.40
Total	**35**	**16**	**169**	**56.52**

Yield of TEGRA farmers vary between 16 and 35 Q/acre and non-TEGRA varies between 20 to35 Q/acre. In both the systems, maximum achieved yield is same. But if we look at farmers who have been able to achieve more than 30 Q/ acre, larger proportion of TEGRA farmer occupy place in this category. Around 2/3rd TEGRA farmers fall in this category of high achievers than around 50 percent of non-TEGRA farmers.

Gross and Net Returns

Average Gross & Net Return form Paddy cultivation for Adopter and Non-adopter of Tegra Technology (Rs. Per acre)

	Kanchipuram	Thiruvannamalai	Thiruvarur	Vellore	Tamil Nadu
	Adopter TEGRA Tech				
Gross Return (Rs./Acre)	26182.97	22429.60	22664.78	24957.40	24058.68
Net Return(Rs./Acre)	12146.93	10619.18	10457.65	10632.80	10964.13

	Non-Adopter				
Gross Return (Rs./Acre)	24678.02	22549.81	21652.57582	25317.70	23549.53
Net Return (Rs./Acre)	13567.58	14225.78	11867.21612	14237.30	13474.47

Average gross returns are higher of TEGRA adopters than non-adopters mainly due to higher yield. Returns for TEGRA adopters are highest in Kanchipuram at Rs 26, 182 per acre. In the same district, non-TEGRA famers could generate only Rs 24, 678 per acre. In two districts (Kancihpuram and Thiruvarur) TEGRA farmers are getting higher returns, in one (Thiruvannamalai) both the groups are getting almost equal gross returns but in Vellore non-TEGRA farmers are able to earn higher returns.

Besides, TEGRA famers are also getting higher rate for their produce. On an average TEGRA farmers are able to sell their produce at a rate of Rs 877/Q against Rs 826/Q of non-TEGRA. Inspite of TEGRA farmers getting higher gross return, net returns are higher for non-TEGRA farmers because their CoC is lower than TEGRA farmers. Average difference between both the groups in net returns at the state level is around Rs 2510/acre.

Land Class wise Yield and Cost of Cultivation

In all land size classes, average yield of TEGRA farmers is higher than that of non-TEGRA farmers except large farmers having more than 10 acres of land. As number of farmers in this category is so small, it is difficult to draw a meaningful interference out of this data. Input cost is higher in TEGRA farming than non-TEGRA farming for all classes of farmers.

Land class wise Yield and Cost of Cultivation in Tamil Nadu under TEGRA technology

Land Class	No. of Households under TEGRA Tech.	Yield (Qtl/acre)	Cost of cultivation of Rice under TEGRA (Rs./acre)
Marginal (upto 2.00 acre)	23	29.13	12207
Small (2.01 to 4.00 acre)	45	29.47	12046
Medium (4.01 to 8.00 acre)	48	29.44	12238
Semi-Medium (8.01 to 10.00 acre)	10	28.80	12960
Large (above 10.01 acre)	7	24.14	13144

Land class wise Yield and Cost of Cultivation in Tamil Nadu under Non-TEGRA technology

Land Class	No. of Households under Non-TEGRA Tech.	Yield (Qtl/acre)	Cost of cultivation of Rice under Non-TEGRA (Rs./acre)
Marginal (upto 2.00 acre)	24	28.58	7947
Small (2.01 to 4.00 acre)	54	28.50	8011
Medium (4.01 to 8.00 acre)	74	29.04	8457
Semi-Medium (8.01 to 10.00 acre)	8	28.38	8918
Large (above 10.01 acre)	6	28.00	9364

Willingness to continue with TEGRA agronomy

In the context of mixed results about the benefits of TEGRA agronomy, the research team was interested to know opinion of farmers regarding continuation with the newer agronomy. Farmers generally take decision regarding continuation with newer technologies considering input cost, yield, hassle free management, etc. It was presumed that if they decide to continue that would indicate their overall satisfaction with the newer package. At the state level, more than 83 percent plans to continue with this. In Thiruvannamalai and Thiruvarur, almost all of them want to continue with it.

Percentage distribution of farmers willing to continue with TEGRA for next agriculture season

District	Continue with TEGRA	
	Yes	No
Kanchipuram	86.67	13.33
Thiruvannamalai	94.74	5.26
Thiruvarur	94.74	5.26
Vellore	47.83	52.17
Tamil Nadu	83.20	16.80

Constraints to adaption

1. In the entire process of rice cultivation, TEGRA intervenes at the point of nursery management and transplantation. Before that land preparation is done by famers themselves. A section of farmers feel that coordination between these two parts of the process becomes difficult for those who do not have their own equipments. TEGRA team fixes a particular date/s for every village for transplantation and communicates it to farmers well in advance. Farmers are advised to keep their land prepared by that day.

Firstly, it becomes difficult to follow the deadline for those farmers who have to hire agricultural equipments for land preparation and irrigation. Secondly, in case if farmer has kept land prepared and watered and transplanting is delayed by more than two days for some unavoidable circumstances, the whole cost of land preparation goes waste and land preparation is done again. Although these type of incidences are rare but they remain part of farmers perception.

2. TEGRA adopters have to make payment in advance for seedlings and transplantation. TEGRA trey costs around one third of total cost of cultivation. Many farmers find it difficult to raise required funds.
3. Few farmers complain about gaps left by the transplanting machine between hills. In some fields visited by research team in Kanchipuram, these gaps were quite visible. Such gaps lead to two problems, one, they bring down total cropped area and two, space is left for weeds consequently increasing expenditure on weedicide. If these gaps are filled by TEGRA team few days later after receiving feedback from concerned farmer, then in the same field they have plants of different ages. This makes it difficult for them to decide when to apply fertilizer, or level of water etc. To address this issue, Syngenta has started employing manual labour along with transplanting team. They fill in these gaps just after mechanized transplanting. Besides, one free weedicide is also provided to the farmers as part of TEGRA package.

Strength of TEGRA Technology

1. Those Farmers who have followed TEGRA agronomy protocol have been able to enhance their yield considerably. Although in these initial years, proportion of such farmers is not substantial but their higher yield results have lead other farmers believe that they can also increase their yield by following TEGRA agronomy protocol.
2. In places where considerable diversification of employment opportunities has taken place, labour shortage becomes acute during peak season. To address this problem, a section of farmers is looking forward to newer technologies. TEGRA provides a suitable alternative to these farmers.
3. In traditional transplanting method, maintenance of nursery and transplanting consumes around one month. Besides, farmers have to toil in putting several things in place.

TEGRA saves this time and reduces their drudgery. It is particularly found useful by those farmers who live in nuclear families and have less number of working hands. Non-resident land owners also find it helpful as most cumbersome part of rice farming is managed by the TEGRA team.

4. Qualitative observations reveal that by adapting TEGRA technology farmers save almost a month of their time. Some of them use this time to generate additional income from other sources. A TEGRA farmer in Kanchiupuram who is also into famous Kanchipuram Silk Sari business says that in this one month, additional income generated is not only enough to compensate for extra input cost of TEGRA but also he saves money.
5. Another set of farmers report to have enjoyed better socio-cultural life than before. The time saved allows them to visit their relatives and attend social gatherings.
6. One of the most important point that comes out in discussion with the farmers is that TEGRA facilitates them in hassle free cultivation. This helps them to continue with agriculture. A few of them who were thinking of quitting agriculture has postponed their plans as they want to give a chance to this new technology.

Recommendations

1. Lack of access to institutional credit is one of the biggest problems faced by farmers. Lack of funds and dependence for it on informal sources renders them incapable of investing in newer technologies. For several years situation is getting worse. The government will have to ensure that farmers' access to institutional credit is enhance to bring them out from vulnerable condition.

2. The cost of the technology needs to be brought down to make it more accessible.

3. Coordination between pre-transplanting land preparation and transplanting needs to be fine-tuned. It could also be done by inclusion of land preparation as part of package. Local vendors could be involved for land preparation.

4. The offer package should also be enlarged to include in it advisory about marketing of produce.

Socio-economic Benefit Survey of TEGRA Technology in Rice Cultivation at Tamil Nadu

Household No. _____

1. Village Information

1.1 State:_____ **1.2 District:_____**

1.3 Taluk: _____ **1.4 Block:_____**

1.5 Village Name: _____

2. Particulars of Farming Household

a.	**Name of informant**	
b.	**Age**	
c.	**Gender** (Male-1; Female -2)	
d.	**Educational Status Education:** 1- Illiterate, 2- Primary Education(Class 1 to 5), 3- Middle (Class 6 to 8), 4- Secondary Education(Class 9 to 10) , 5- Higher Secondary Education(Class 11 to 12), 6- Technical Education/Diploma, 7- Graduation,8- Post Graduation, 9- Others (Specify)	
e.	**Main occupation** (1-Agriculture; 2-Non-Agriculture)	
f.	**Subsidiary occupation (**Agricultural-1; House wife-2; Salaried (Govt.)-3; Salaried (Private.)-4 Domestic Work-5; Own Business-6; Student-7; Retired/pensioner/too old-8; Unemployed-9; Other(Specify……)-10; No Subsidiary Work-11)	

3. Adoption awareness of **TEGRA** technology

3.1 Which technology you adopt for Rice Cultivation? [ ] [ ] [ ]
(Samba – SRI method -1; Kuruvai – SRI method -2; Direct Seeding -3; TEGRA-4, Manual-5)

3.2 Are you aware of the **TEGRA** technology in your village? [ ]

3.3 From which source you got to know about **TEGRA** technology? [ ]
(Co-farmers-1, Extension workers-2, Agri-Input dealers-3, Media – TV-4, Radio, Newspapers-5, Syngenta Field personnel-6, Any other-7, Don't Know-8)

3.4 In which year **TEGRA** started in your village? [ ]

4. In case you attended Farmers' Meeting on **TEGRA** technology for rice cultivation**:**

a) How many meeting took place? [ ]

b) Did you attend any of their meetings? (Yes-1, No-2) [ ]

c**)** Whether any expert was called for training? (Yes-1, No-2) [ ]

d**)** If 'Yes' give the name of the organization he belonged to [ ]
(1-State Department of Agriculture; 2-State Agricultural University; 3-Indian Council for Agricultural Research (ICAR); 4-Krishi Vigyan Kendra; 6- Syngenta Team; 5- NGO)

e) Were you provided any training material? (Yes-1, No-2) [ ]

f**)** Were these training helpful? (Yes-1, No-2) [ ]

g) If 'no' give suggestions for improvement of training _____

5. Land Ownership in Agricultural (Acres)- (**Asset positioning)**

Land Particulars	**Irrigated (Ac)**	**Unirrigated (Ac)**	**Total (Ac)**
1. Owned area			
2. Area leased in			
3. Area leased out			
4. Uncultivated area including permanent pastures (fallow land)			
5.Total operational holding (1+2 -3)			

6. Crops Cultivated in Last Agricultural Year (Year April 2011-March 12)

Crops	**Season* (Use Code)**	**Area (Ac)**			**Yield (Qtl/Ac)**		
		Irrigated	**Unirrigated**	**Total**	**Irrigated**	**Unirrigated**	**Total**

***Season:** 1-Early Samba; 2-Late Samba; 3-Navarai; 4-Thaladi/Pishanam

7.a. If you are not doing crop rotation, then why? _____

_____

7.b Area sown and yield under Rice cultivation**:**

Year	**TEGRA technology (Ac)**		**Non-TEGRA technology (Ac)**	
	Area	Production	Area	Production
2008-09				
2009-10				
2010-11				
2011-12				

8. Cost of Cultivation of Rice **(Under TEGRA technology) (Navari in North; Samaba in South)**

S.No.	Cost of Cultivation: RICE – TEGRA (all as per acre)					
		Period (1- Samba; 2-Navari)		**Sowing Period**		**Harvesting Period**
1	**A)** Season					
2	Area under TEGRA Rice cultivation					
3	**Total Production (Bag/AC) Bag=80kg**					
	B) TEGRA Support					
4	No. of Seedling Tray					
5	Price of Seedling Tray					
6	Free Weedicide (Yes-1, No-2)					
	C) Inputs required (Kg/Acre)	**Quantity (Per acre)**		**Unit Price**		**Total Cost**
7	DAP					
8	Urea					
9	Potash					
10	NPK Mixture					
11	Farm Yard Manure					
12	Growth Hormones/ Regulators/ Injections					
13	Weedicide					
14	Pesticides					
15	Insecticides					
16	Gypsum (Sulphur Compound)					
17	Lime (Chuna)					
	D) Labour required (Mandays)	**Male**	**Wage Rate (Rs./Day)**	**Female**	**Wage Rate (Rs./Day)**	**Total Cost**
18	Land Preparation					
19	Manures & Fertilizers application					
20	Chemicals application					
21	Weeding					
22	Spraying Pesticides					
23	Irrigation					
24	Harvesting					
	E) Machinery Hiring	**Own machine**	**Hired machine**	**Unit Price**		**Total Cost**
25	Land preparation equipment					
26	Harvester					
27	Transport of Farm Produce					

9**.** What kind of other benefits you are getting from technology supplier for adoption of **TEGRA** technology?

_____

_____

10. Cost of Cultivation of Rice **(Under Non-TEGRA technology) (Navari in North; Samaba in South)**

S.No.		Period (1- Samba; 2-Navari)	Sowing Period	Harvesting Period
1.	**A)** Season:			
2.	Area for Nursery:(Acre)			
3.	Nursery duration: (Days)			
4.	Total Area under Rice cultivation(Acre)			
5.	**Total Production (Bag/AC) Bag=80kg**			
	B) Seed Use			
6.	Variety of Seed: (1-Hybrid; 2-HYV; 3-Local)			
7.	Seed Used :(Quantity in Kg.)			
8.	Seed Cost :(Rs/Kg)			
9.	Seed purchased : (1-Market rate;2-Subsidised Rate)			

	C) Inputs required (Kg/Acre)	Quantity (Per acre)	Unit Price	Total Cost
10.	DAP			
11.	Urea			
12.	Potash			
13.	NPK Mixture			
14.	Farm Yard Manure			
15.	Growth Hormones/ Regulators/ Injections			
16.	Weedicide			
17.	Pesticides			
18.	Insecticides			
19.	Gypsum (Sulphur Compound)			
20.	Lime (Chuna)			

	D) Labour required (Mandays)	Male	Wage Rate (Rs./Day)	Female	Wage Rate (Rs./Day)	Total Cost
21.	Land Preparation					
22.	Transplanting					
23.	Nursery					
24.	Manures & Fertilizers application					
25.	Chemicals application					
26.	Weeding – Hand weeding					
27.	- Mechanical weeding					
28.	Spraying Pesticides					
29.	Irrigation					
30.	Harvesting					

	E) Machinery Hiring	Own machine	Hired machine	Unit Price	Total Cost
31.	Land preparation				
32.	Harvester				
33.	Transport of Farm Produce				

11. Irrigation on Rice Cultivation:

Operations	TEGRA technology				Non TEGRA technology			
	No. of irrigation	Hrs. per day	Rate per Hrs.	Source of Irrigation*	No. of irrigation	Hrs. per day	Rate per Hrs.	Source of Irrigation*
Own								
Hired								

*Source of Irrigation-1: Canal-2, Rainfed-3, Bore well-4, Sprinkler-5; Diesel pump sets-5; Community Generator-5; Any Other_____ (Please Specify)

12. 1 Do you follow the protocol for rice cultivation? (1-Fully; 2-Partialy; 3-Not at all) [ ]

12.2 If partially, which Agronomy Delivery Potential Protocol application you follow? [ ] [ ] [ ]

(1-Disease management; 2-Pest Management; 3-Water Management; 4- Nutrient management)

12.3 If you do not follow all protocols, than why? _____

_____

13. Other Farm Assets / Implements

S.No.	Items	Owned	Maintenance Charges (Rs/Year)	Rented	Rental Value
1.	Tubewells				
2.	Electric Pumpsets				
3.	Tractor				
4.	Power Tiller				
5.	Tractor Trolley				
6.	Knapsack Sprayers				
7.	Other 1 ……				
8.	Other 2 ……				

14. Marketing of Produce

Crops	Quantity Produced(Qtls)	Quantity Sold (Qtls)	Selling Price (Rs/Qtl)	Compensation Paid (if crop Loss)	Place of Sale	Home Consumption (Qtl)

15. Annual Net Family Income from (Rs/Year)

Particulars	Annual Net Family Income from (Rs/Year) = (Gross Revenues - Gross costs)
1. Income from Crop cultivation	
2. Income from allied activities of agricultural	
3. Income from Wage	
4. Income from Salary	
5. Other Business (Pl. Specify)……..	

16. Availability of Credit/Loan (Yes-1; No-2) [ ]

Source of Loan taken in 2010	**Amount taken (Rs per Season/Year)**	**Rate of interest (%)**	**Purpose of Taking Loan**	**Has the Loan been Repaid? (1-Yes/2-No)**	**Overdue? (if any)**
1. Commercial bank					
2. Cooperative bank					
3. Money lender					
4. Self-Help Group					
5. Relatives / Friends					

17. Reason for adopting **TEGRA** technology

Particulars	**1-Yes; 2-No**
1. Saves nursery maintaining Time	
2. Less incidence of pest and diseases	
3. Labour Shortage	
4. Higher yield	
5. Less cost	
6. Others	

17.a. In the case of using TEGRA technology for rice cultivation, Are you able to save time on Nursery Management? (Yes-1; No-2) [ ]

17.b. If yes, What were activities you had taken-up during that period? _____

_____

18. Do you wish to continue TEGRA technology for next agricultural season? (Yes-1; No-2) [ ]

19 A. If not, then what are the reasons?

……

20. Qualitative changes in the farmer's household due to adoption of **TEGRA** technology

Sl. No.	**House and Amenities**	Facilities before **TEGRA** Technology	Facilities added After **TEGRA** Technology
1.	**House construction** (yes-1, no-2)		
2.	**Type of house*** (Thatched/Kachcha-1, Semi-pucca-2, Pucca-3, Others-4 (Specify……)		
3.	**No. of rooms in house** (1 rooom-1, 2 room-2, 3 room-3, 4 room and above-4, others-5 (Specify ……)		
4.	**Access to electricity** (yes-1, no-2)		

5.	**In-house toilet** (yes-1, no-2)		
6.	**Access to safe drinking water within your premise** (yes-1, no-2)		
7.	**Access to better health facilities** (yes-1, no-2)		
8.	**Increase in expenditure on child education** (yes-1, no-2)		
9.	**Purchase of new vehicles** (1-Cycle; 2-Motor Bike; 3- Four wheel Drive; Other-5)		
10.	**Purchase of new Livestock** (yes-1, no-2)		

21. Economic Impact due to **TEGRA** technology

Item	**Impact**
1. Yield improvement (qtl/acre)	
2. Price increase (Rs./qtl)	
3. Cost reduction (Rs./ac)	
4. By-product use	
5. Other(Specify……..)	

22. Environment Impact due to **TEGRA** technology *(Please tick (**✓**)*

Parameter	**Tick most appropriate**	**If yes, how?**
1. Water saving	Yes/No	
2. Water table in the area	Rising/Constant/Falling	
3. Soil health	Positive/ No impact/Negative	
4. Air pollution	Positive/ No impact/Negative	
5. Human health hazards	Positive/ No impact/Negative	
6. Pest problem	Positive/ No impact/Negative	

23. Mention the major constraints in the **TEGRA** technology and Non-TEGRA

Sl. No.	**TEGRA**	**Non-TEGRA**

24. If not taken **TEGRA** technology assistance so far, which of the assistance would you like to take up in future:

Assistance component to be taken in future	**Reasons**

25. For Non-Adopters of **TEGRA** technology

a) Why have you not adopted the **TEGRA** technology for Rice Cultivation?