Practicing Precision Agriculture in Dharmapuri District of Tamil Nadu: A Case Study

Ramamoorthy, Dr. R. Ravikumar

Assistant Professor of Economics PSG College of Arts and Science, Coimbatore, Tamil Nadu, India.

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Dr. R. Ravikumar

Assistant Professor of Economics

PSG College of Arts and Science, Coimbatore, Tamil Nadu, India.

Abstract

The Precision Farming Project was first started in Tamil Nadu in Dharmapuri and Krishnagiri during 2004-05. It was implemented initially on 250 acres, then 500 acres in 2005 – 06 and 250 acres in 2006 -07. The Tamil Nadu Agricultural University was the nodal agency that implemented this project with total budget of 720 lakhs for a period of three years. Most parts of the Dharmapuri and Krishnagiri districts are semi-arid tracts with low rainfall and low productivity. In this context, there is a need for studying the impact of technological innovations like precision farming on resource-poor regions and underprivileged farm households particularly the production, income, marketing, under precision farming. To understand the practices at farm level under precision farming In Dharmapuri district. Farmers adopting precision farming methods of cultivation for long period and persistently were considered for the case study. Generally, they are well-respected farm managers, and typically viewed as successful farmers in the local farm community. Certainly the case study farmers should not be thought as representative of all farmers. Still, the information received from the case studies will be instructive for the larger groups. The study found that both farmers were successful in adopting precision method of cultivation in the study area.

Key Words:

Case Study, Production, income, and marketing.

Introduction

Precision Agriculture (PA) is an innovative, integrated and internationally standardized approach aiming to increase the efficiency of resource use and to reduce the uncertainty of decision required to control variation on farms[1]. In other words, right input at the right amount at the right place in the right time used for crop cultivation with the efficient agricultural farm management the concept was called Precision Agriculture (PA).

According to the US Congress that PA is "an integrated information- and production-based farming system that is designed to increase long term, site-specific and whole farm production efficiency, productivity and profitability while minimizing unintended impacts on wildlife and the environment"

The Precision farming could be defined as application of a holistic management strategy that uses information technology to bring data from multiple sources to bear decision associated with agricultural production, marketing, finance and personnel[2].

Precision farming involves the application of technologies and principles to manage spatial and temporal variability associated with all aspects of agricultural production for improving crop performance and environment quality. Precision farming calls for an efficient management of resources through location-specific hi-tech interventions. The advance crop production encompasses a variety of interventions such as micro irrigation, fertigation, protected greenhouse cultivation, soil and leaf nutrient-based fertilizer management, mulching moisture conservation, micro propagation, genetically-modified crops, use of bio fertilizers, vermin culture, high-density planting, hi-tech mechanization, green food, soil-less culture and biological control. Some of the other terminologies used for precision farming are Precision Agriculture (PA), Site-Specific Farming (SSF), Site-Specific Management (SSM), farming-by-the-foot, Variable-Rate Technology (VRT). Utilization of these interventions orchestrated together having the aim of achieving higher output in given time period leads to precision farming, which is largely a knowledge driven.

1 JurgenSchellberg et al. 2008, Precision agriculture on grass land: Applications, perspective and constraints, European Journal of Agronomy, Elsevier, Vol. 29, Pp. 59-71.

2 Jose C. Samuel and H. P. Singh, 2003, Perspective of Hi – Tech Horticulture and Precision Farming, Precision Farming in Horticulture, Pp. 21 – 35.

Precision Farming Technologies

PF is a management philosophy or approach to the farm. It is essentially more precise farm management made possible by modern technology with using various technological tools such as GPS, GIS, Remote Sensing, VRT and Drip Fertigation. The variations occurring in crop or soil properties within a field are recorded, mapped and then management actions are planned and initiated as a consequence of continued assessment of the spatial and temporal variability within that field[3].

Global Positioning Systems (GPS)

Global Positioning Systems (GPS) provide farmers with the capabilities to manage field variability on a site-specific basis. GPS is a constellation of 24 satellites orbiting 12,660 miles above the Earth that is used for determining latitude and longitude (position). When installed on agriculture equipment, a GPS receiver provides position information for soil sampling, crop scouting, applying inputs, planting, harvesting and other applications. A GPS receiver allows farmers to continually return to the same location in a field[4].

Geographical Information Systems (GIS)

A GIS retrieves, stores, and analyzes spatial data and can be used to generate field and prescription maps for application of crop inputs. GIS data and maps are used for management decisions such as management zone creation, variable-rate application, planting decisions, and targeted soil sampling. Delineated management zones in GIS are used to site-specifically manage cropland according to measured field and crop variation. Farmers are able to use GIS to produce detailed harvest reports, determine trends from harvest to harvest, and compare production capabilities of different varieties and crop inputs. Agriculture GIS software can also serve as valuable accounting, record keeping, and decision support tools for farmers.

Remote Sensors (RS)

This tool are being used to determine crop stress, soil properties, pest incidence, etc. as thetractor or any other mobile device passes over the field, as a scout goes over the field on foot.

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[3] Mandal Debashis and Ghosh K.S., 2000, Precision Farming – The emerging concept ofagriculture for today and tomorrow, Current Science, Vol. 79, December , Pp. 12 – 25.

[4] http://www.aces.edu/anr/precisionag/GPS.php

Measurement of plant and soil properties as the tractor or combine travels over the field is a developing area in precision farming.

Variable Rate Technology (VRT)

Variable-rate technology (VRT) describes any technology which enables producers to vary the rate of crop inputs. VRT combines a variable-rate (VR) control system with application equipment to apply inputs at a precise time and location to achieve site-specific application rates of inputs. A site-specific approach allows growers to apply products only where they are needed in a field. Varying the application of inputs can reduce input and labor costs, maximize productivity, and reduces the impact over-application may have on the environment. Examples of VR applications for agriculture include fertilizer, lime, seeding and pesticides[5].

Drip Fertigation

Traditionally, irrigation water is applied to the entire field, resulting was loss of water. Drip irrigation was a modern irrigation method in which water is delivered directly into the root zone of the plant. Drip systems are also easily integrated in fertigation systems[6].It has many advantages over other irrigation methods, including elimination of surface runoff, high uniformity of water distribution, high water usage efficiency, flexibility in fertilization, prevention of weed growth and plant disease.

Yield Monitoring (YM) and Yield Mapping

This is the most direct method to assess the productivity of land and how it should be better managed. A yield monitor (YM) measures the crop as it is harvested. YMs usually measure crop weight, impact forces by passing an array of light beams that are broken. Other methods are also being investigated that show promise for future yield monitors. As the yield is measured, data are stored on a computer along with the GPS coordinates at the point where the yield was measured. Mapping software can then create a yield map. The yield map can immediately provide two important pieces of information, yield variability, and yield production. Yield variability is illustrated on a map by a change in color, where each color represents a range in yield. As a convention red is suggested to represent low yields and green high yields. The map legend will tell you how to read what each color indicates. In all mapping situations, it is

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5 Srinivasan, Precision farming in Asia: Progress and prospects, Geospatial Analysis Center.

6 http://www.smart-fertilizer.com/articles/drip-irrigation

important to check the legend first. Lack of yield variability would mean that the map shows mostly one color. Yield data can be obtained by calculating the yield for the entire field. Yield monitors are in the development stages. As these systems move from testing to application, hopefully commercial systems will not be far behind[7].

Precision Agriculture in Tamil Nadu

The Precision Farming Project was first started in Tamil Nadu in Dharmapuri and Krishnagiri during 2004-05. It was implemented initially on 250 acres, then 500 acres in 2005 – 06 and 250 acres in 2006 -07. The Tamil Nadu Agricultural University was the nodal agency that implemented this project with total budget of 720 lakhs for a period of three years. An amount of Rs. 75,000 for the installation of drip irrigation and Rs. 40,000 for crop production expenses was given to the farmers. The first crop was taken up under the total guidance of scientists from the university, while the subsequent five crops were taken up by the farmers in three years. In the first year, the farmers were unwilling to undertake this project because of their frustration due to the continuing drought in that area for four years since 2002. But after seeing the success of the first 100 farmers and the high market rate for the produce obtained from this scheme, farmer started registering in the large numbers for the second year (with 90 per cent of subsidy) and the third year (with 80 per cent of the subsidy).

One unit is equivalent to one hectare and a farmer is eligible for one hectare only. Under the project, 100 hectares during 2004 – 05, 200 hectares during 2005 – 06 and 100 hectares during 2006 – 07 were covered. The practicing of precision farming not only the farmers of these two districts, but the farmers of the other districts who were taken too were amazed by what they saw. The farmer-to-farmer mode added strength to the outcome, and all the other districts of the state made a demand for implementing the project.

Later, the project was scaled up 40,000 hectares across the state with budget support by the Government of India, under the National Development Project (NADP). The university and the departments of agriculture and horticulture jointly set up the project 2007- 08. The states of Kerala, Karnataka, Andhra Pradesh, Orissa and Maharashtra have adopted this project on a large

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7 Srinivasan, 2001, Precision farming in Asia: Progress and prospects, Geospatial Analysis Center, Regional Science Institute, Hokkaido, Japan. September .

www.agrialt.com/groups/precision/wwwboard.html 10. www.agriculture.com/agtalk/

scale, and training has been provided for all the famers to empower technically, economically and socially by the developmental workers at Dharmapuri in Tamil Nadu[8].

Empowerment of Farmers and Farmer's Forum

The TNPFP beneficiary farmers were organized under various commodity forum and ten various associations were formed.

1. Adhiyaman Precision Farmers Association, Dharmapuri,
2. Thiruvalluvar Precision Farmers Association, Dharmapuri,
3. Moulayanoor Precision Farmers Association, Dharmapuri,
4. Mahatma Gandhi Precision Farmers Association, Dharmapuri,
5. Annamalaiyar Precision Farmers Association, Dharmapuri,
6. BagalurBerigai Precision Farmers Association, Krishnagiri,
7. Sarvodaya Precision Farmers Association, Saragapally, Krishnagiri,
8. Sri SathyaSai Precision Farmers Association, Jakkeri, Krishnagiri,
9. V. N. R Precision Farmers Association, Rayakottai, Krishnagiri, and
10. Dharmapuri Precision Farmers Agro Services ltd, Dharmapuri (First Producer Company in Tamil Nadu).

The organization was registered under societies act and they were imparted skill to develop awareness on latest state of art technologies. The forum has helped them to buy the input directly from the manufacturers cutting the cost down to minimum and strengthened their bargaining power while selling their produce.

The result of this experiment has had multiple effects because it not only focuses on maximizing the productivity and enhancing the profitability but also on empowering the farmers socially economically and technically. The emphasis was also on social capital through the strengthening of cluster level associations and district level limited companies.

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8 TNAUAgritech Portal: Tamil Nadu Precision Farming Project, tnau.ac.in.

Review of Literature

Haneklaus and Schnug (1998) [9] observed that precision agriculture is an umbrella terminology which embraces the knowledge and its practical expression which aims to solve the earlier presented contradiction uniformity applied on variability. Success, in this case, is not measured by how constant an operation is, but in how well it can react to varying conditions. Further were of the opinion that offers the opportunity and the challenge for agronomic science to express total potential dimension technically not possible 20 years ago. This gave the farmer a better understanding of soil fertility variable within a field, and how to adjust fertilizer application rates. This origin is probably the reason why, until now, the main focus of PA has been on material substances such as fertilizers, amendments and pesticides, with the goal of reducing the amount needed or decreasing its undesired effects such as environment impact, crop damage and waste due to excessive application.

Atherton, et al., (1999) [10] **Olson(1998)** [11] stated that the term precision agriculture describes the integration of GIS and GPS tools to provide an extensive amount of detailed information on crop growth, crop health, crop yield, water absorption, nutrient levels, topography, and soil variability. This information provides mechanisms to manage areas within fields differently, according to the soil and crop characteristics. Some farmers and researchers assert that precision agriculture technologies assist farmers in managing their farms more effectively. Specific objectives of precision agriculture are to increase profitability, increase production, reduce variable costs, reduce erosion, reduce the environmental impact of chemicals, track and monitor the use of chemicals, and manage large farms by the farmers.

Daily et al., (1998)[12] stated that precision farming was it had recognized by environment sciences as an important part of solution towards sustainable agriculture and a way of

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9 Haneklaus et al., 1998, Impact of Precision Agriculture Technologies on fertilization. Proceedings of the 11th International Symposium of CIEC – Codes of good Fertilizer Practice and Balanced Fertilization, Pp. 95-107.

10 Atherton B. C et al., 1999, Site-specific farming: A perspective on information needs, benefits, and limitations, Journal of Soil and Water Conservation, 54(2), Pp: 455-461.

11 Olson 1998, Sixth Joint Conference Food, Agriculture, and the Environment: Center for International Food and Agricultural Policy, University of Minnesota.

12 Daily et al., 1998, Food Production, Population Growth and the Environment Science, Pp. 281, 1291-1292.

maintaining intensive crop production, essential for food security in a growing world population under more restrictive environmental standards[13].

Robert (1999)[14] observed that precision agriculture is the start of a revolution in natural resource management based on information technology that is bringing agriculture into the digital and information age. In fact precision agriculture is based on the use of revolutionary technologies such as Global Positioning Systems (GPS) and Geographic Information Systems (GIS).

Mueller et al., (2000) [15] expressed the enormous growth of advanced information technology, it includes describing variation in soils, plant species and integrating agricultural practices it is to meet site specific requirements. Precision farming aims at increasing economic returns whist at the same time reducing the energy input and the environmental impact of agriculture. This means, managing each crop production, input-fertilizer, lime, herbicide, insecticide, seed, etc. on a site-specific basis to reduce waste, increase profits, and maintain the quality of the environment.

Sparovek et al., (2001)[16] agronomic science, mostly directed to sustainable agriculture issues, deals with agro ecosystem adapting to get an expected crop performance while considering specific environment protection standards and preservation of natural resources, including soil. Further stated that agronomic science has provided knowledge expressed in terms of different practices and treatments, to manage the agro system over a wide range of condition, but uniformity is emphasized where most of this variability is expected the small scale. A plow is designed to operate at a uniform depth and produce in term result over a wide range of soil conditions and the farmer will be happy if, he can count exactly the number of planted seeds from the beginning to the end of his planting day.

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13 Matson et al., 1997, Agricultural Intensification and Ecosystem Properties Science, Pp. 277, 504-509.

14 Robert, 1999, Precision Agriculture: Research Needs and Status in the USA, Proceedings of 2nd European Conference on Precision Agriculture, Denmark, 11-15th July.

15 Mueller et al., 2000, Precision agriculture opportunities for Kentucky: Agronomic research at UK University of Kentucky, Department of Agronomy Research Report.

16 Gerd Sparovek et al., 2001, Soil Tillage and Precision Agriculture A Theoretical case study for Soil Erosion control in Brazilian Sugarcane Production, Elsevier, Soil & Tillage Research, Vol. 61, Pp. 47-54.

Shibusawa (2002)[17] pointed out that precision farming uses a system approach to provide a new solution to contemporary agricultural issues, that is, the need to balance productivity with environmental concerns.

Grissoet al., (2003)[18] **Adrian et al. (2004)**[19] reveals that use of GPS indicates the correct position of each soil or plant sample taken in the field and GIS eases the handling of the data, allowing both graphical representation of the variability of measured parameters and analysis. GPS units are used to guide equipment during chemical and irrigation applications and during harvest.

Samuel and Singh (2003)[20]statedthatprecision farming has attracted the attention of developed countries for increasing productivity by temporal and spatial management of resources using various tools. The concept of precision farming is new to the country and needs appropriate attention for efficient utilization of resources to achieve higher input-use efficiency in given time. Suggested that in order to optimize the use of resources and improve the returns to the farmers, these technologies have to be adopted. Any component of production system ranging from natural resources to plants, production inputs, farm machinery and farm operators that is variable in some way is included in the realm of precision farming.

Gupta (2004) [21]stated thatpesticides being used in agricultural tracts are released into the environment and come into human contact directly or indirectly. Human beings are exposed to pesticides present in environmental media (soil, water, air and food) by different routes of exposure such as inhalation, ingestion and dermal contact. Exposure to pesticides results in acute and chronic health problems. The severity ranges from temporary acute effects like irritation of

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17 Shibusawa 2002, Precision farming approaches to small-farm agriculture, Agro-Chemicals Report, Vol. II, No. 4.

18 Grisso et al., 2003, Precision farming tools: Global Position Systems (GPS). Virginia Cooperative Extension, Pp. 442-503.

19 Adrian, et al., 2004, GIS in agriculture. In J. B. Pick (Ed.), Geographic Information Systems in Business, Pp. 324-342.

20 Jose C. Samuel and H.P. Singh, 2003, Perspective of Hi-Tech Horticulture and Precision Farming, Precision Farming in Horticulture, Pp. 21 – 34.

21 Gupta, P.K. 2004, Pesticide exposure Indian scene, Toxicology, The Andhra Agri Journal, Vol. 198, Pp.83-90.

eyes, excessive salivation to chronic diseases like cancer, reproductive and development disorders[22].

Jochinke (2007)[23] observed that the interest in Precision Agriculture (PA) has increased rapidly over recent years. Many farmers have invested in machinery guidance systems and yield monitors, but few are using the technology to manage spatial variability across farming zones. Furthermore, the benefits of this technology to broad acre cropping systems have not been widely demonstrated in many regions. An economic analysis showed the cost of a basic PA system to achieve Site Specific Crop Management with a yield monitor. The justification of this extra cost will depend on the situation, particularly the amount of variation present, efficiency gains, yield increases and the value individual farmers place on factors like reduced operator fatigue, extended working hours and certain environmental benefits. PA technology has decreased in cost since its introduction and if this trend continues, adoption is likely to increase in the future and this will be supported by the ongoing collection of soil, yield and field data. Adoption was likely to be enhanced by farmer, manufacturer and researcher collaboration to demonstrate the benefits of this technology on a commercial scale. Before investing heavily in PA tools, interested farmers can evaluate the technology, whilst estimating the degree of variation present in fields and the potential benefits.

Oliver (2010)[24] observed that the cropping fields often have poor-performence. In an attempt to increase production, farmers may apply additional fertiliser without economic or scientific justification. An approach to integrating farmers knowledge, precision agriculture tools and crop simulation modelling to evaluate management options for poor-performance.In such cases the best intervention may be to lower crop inputs to better match the water limited yield potential of such poor performing areas. The economic costs and benefits of differential zone management were examined. This approach provided farmers with a robust and credible method for making decisions about spatial management of their fields.

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22 Yassi et al., 2001, Basic environmental health, World Health Organization, Oxford University Press, Vol. 5 Pp.135-141.

23 David C. Jochinke et al., 2007, The adoption of precision agriculture in an Australian broad acre cropping system—Challenges and opportunities, Field Crops Research, Vol. 104, Issues 1–3, Pp. 68-76.

24 Oliver et al., 2010, Integrating farmer knowledge, precision agriculture tools, and crop simulation modeling to evaluate management options for poor-performing patches in cropping fields, European Journal of Agronomy, Vol. 32, (1), Pp. 40-50.

David Mulla (2013)[25] stated that the precision agriculture dates back to the middle of the 1980's. Remote sensing applications in precision agriculture began with sensors for soil organic matter, and have quickly diversified to include satellite, aerial, and hand held or tractor mounted sensors. A variety of spectral indices now exist for various precision agriculture applications, rather than a focus on only normalized difference vegetation indices. At present there was considerable interest in collecting remote sensing data at multiple times in order to conduct near real time soil, crop and pest management.

Statement of the Research Problem

Dharmapuri is drought prone and most backward district in Tamil Nadu that is predominantly rain-fed. But still majority of the people of the district engage in agriculture and allied activities. The government of the Tamil Nadu has under taken the task of implementing the Precision Farming Project on 400ha as a turnkey project, with the main focus on a 40 – 60 per cent enhanced yield and effective market linkage.

The Precision Farming Project was first started in Tamil Nadu in Dharmapuri and Krishnagiri during 2004-05. It was implemented initially on 250 acres, then 500 acres in 2005 – 06 and 250 acres in 2006 -07. The Tamil Nadu Agricultural University was the nodal agency that implemented this project with total budget of 720 lakhs for a period of three years. Most parts of the Dharmapuri and Krishnagiri districts are semi-arid tracts with low rainfall and low productivity. In this context, there is a need for studying the impact of technological innovations like precision farming on resource-poor regions and underprivileged farm households particularly the productivity, income, employment, and adoption behaviour of precision farmers comparing with non – precision farmers at farm level in the study area.

Objectives of the Study

1. To understand the farm practices, crops cultivated, resource use, yield and income in depth at farm level, and
2. To suggest suitable policy measures related to the study.

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[25] David J. Mulla, 2013, Twenty five years of remote sensing in precision agriculture: Key advances and remaining knowledge gaps, Bio systems Engineering, Vol. 114, (4), Pp 358-371.

Methodology

Case study was conducted to understand the farm practices, crops cultivated, resource use, yield and income in depth at farm level. After having had discussion with the official at Krishi Vigyan Kendra (KVK) Papparapatti, Dharmapuri district two farmers from Semmanahalli village in Papparapatti block were indentified for the study. The following information were collected from the two sample respondents considered for the case study; land holding, crops cultivated, irrigation pattern, manures and pesticides, cost of cultivation, yield, income and their opinion about the adoption of precision of precision method of farming.

Results of Case Study

Farmers adopting precision farming methods of cultivation for long period and persistently were considered for the case study. Generally, they are well-respected farm managers, and typically viewed as successful farmers in the local farm community. Certainly the case study farmers should not be thought as representative of all farmers. Still, the information received from the case studies will be instructive for the larger groups.

Case Study – 1

Mr. Manoharan, Semmanahalli Village, Dharmapuri, Tamil Nadu is a full time farmer operating a total land of 3.5 acre he is aged 35 and lives with his wife and 2 children. He has farmed for 18 years and practicing precision farming methods for more than 5 years producing radish in 1.5 acres of land and papaya in 2 acres of land with annual sales of Rs. 5, 50,000 - Rs. 6, 50,000. Mr. Manoharan began using precision farming technologies in 2010 with the adoption of drip irrigation, fertigation, bio-fertilizer and crop and soil management. He has got training in various centres like Krishi Vigyan Kendra (KVK) Paparapatti, Dharmapuri district, farmer producers organisation, Dharmapuri, Regional Research Institute (RRI), Krishnagiri and Tamil Nadu Agricultural University (TNAU), Coimbatore on various methods of precision technology and farm management. His biggest success with precision farming has been better overall input management that has directly led to higher yields and increased profits. His weakness was lack of technical knowledge and credit support. However he is mostly satisfied with his overall precision system. The details are presented in table 1.

Table 1 Details of Case Study- I

Sl.No	Particulars	Remarks / Value
1	Name	Mr. Manoharan
2	Age	35 Years
3	Education	High School
4	Family Members	5 (Male – 3 & Female - 2)
5	Total Land Holding	3.5 Acres
6	Crop I	
	a. Radish	1.5 Acres
	b. Crop Duration	3 Months
	c. Cost of Cultivation	Rs. 40,000
	d. Yield	300 Bags (50Kgs/ per bag &Rs. 500/bag
	e. Revenue	Rs. 1,50,000
	f. Profit	Rs. 1,10,000
7	Crop II	
	a. Papaya	2 Acres
	b. Crop Duration	2 Years
	c. Cost of Cultivation	Rs. 70,000
	d. Yield	40 Tonnes (Rs.10 per Kg)
	e. Revenue	Rs. 4,00,000
	f. Profit	Rs. 3,30,000
8	Total Cost	Rs. 1,10,000
	Total Revenue	Rs. 5,50,000
	Profit	Rs. 4,40,000
9	Strength / Success of Manoharan	Adoption of precision technology including drip irrigation, bio-fertilizer, soil management and overall input management – directly led to higher yields and increase profits
10	Weaknesses	Lack of technical knowledge and credit support
11	Overall observation	Manoharan is mostly satisfied with his overall precision farming system

Source: Primary Data.

Case Study II

Mr. R. Velappan aged 55 years and studied middle school is a full time farmers, farming 38 years with a total land holding of 6.80 acres located in Semmanahalli village, Dharmapuri district, Tamil Nadu. His wife and two sons were also taking on active role in the year 2008 onwards. He installed drip method of irrigation in 2 ha with a subsidy of Rs. 2,50,000 (75 % subsidy), and bio-fertilizer, vermin composite for his farm. He is producing papaya and guava in 2 acres each with annual sales of Rs. 7,00,000 to Rs. 10,00,000. Mr. Velappan has got training about precision farming in KVK and TNAU. He was of the opinion that reduced use of fertilizers will reduce cost of cultivation hence the yield and revenue is increasing. This was considered to be his best success and it was interesting to note that he was well aware of the degradation of soil fertility and environment by the use of high quantity of chemical fertilizers and pesticides. The details of farming of R. Velappan is presented in Table 2.

Table 2 Details of Case Study II

Sl.No	Particulars	Remarks / Value
1	Name	Mr. R. Velappan
2	Age	55 Years
3	Education	Middle School
4	Family Members	4 (Male – 3 & Female - 1)
5	Total Land Holding	6.8 Acres
6	Crop I	
	a. Papaya	2 Acres
	b. Crop Duration	2 Years
	c. Cost of Cultivation	Rs. 70,000
	d. Yield	40 Tonnes (Rs.10 per Kg)
	e. Revenue	Rs. 4,00,000
	f. Profit	Rs. 3,30,000
7	Crop II	
	a. Guava	2 Acres (220 plants)
Sl.No	**Particulars**	**Remarks / Value**
	b. Yielding period	After 3-4 years to 8-10 years
	c. Cost of Cultivation	Rs. 1,50,000
	d. Expected Yield	50 – 100 kg per plant (75 kg x 220 plants & Rs. 10 – 30.
	e. Expected Revenue	Rs. 4,95,000
	f. Expected Profit	Rs. 3,45,000
8	Total Cost	Rs. 2,20,000
	Total Revenue	Rs. 8,95,000
	Profit	Rs. 6,75,000
9	Strength / Success of Mr. Veleppan	He was of the opinion that reduced use of fertilizers will reduce cost of cultivation hence the yield and revenue is increasing. This was considered to be his best success and it was

		interesting to note that he was well aware of the degradation of soil fertility and environment by the use of high quantity of chemical fertilizers and pesticides.
10	Overall observation	Mostly satisfied with his overall precision farming system

Source: Primary Data.

Major Findings

- Found that the source of information about precision agriculture was neighbor progressive farmer, TNAU and local agro input dealers.
- It was noted that the most significant factor influencing the sample farmers for adoption of precision farming was subsidy.
- Found out that the share of cost in the case of precision farmers was highest for human labour, followed by fertilizer and farm yard manure (FYM). Within the cost of human labour large portion was paid out to hired labour majority of them female labour and rest of imputed value of family labour. In conventional farming, human labour was found to be the major input,
- There was a new type of irrigation methods has taken place in the study area that, where ever the ground water level was totally abandoned the farmers buying water for crop cultivation through the tractor water dripper costing Rs. 400 to 600 per dripper. Majority of the crop cultivation were high value crop such as capsicum and rose.
- Found out that farmers use four types of fertilizer they are, straight fertilizers (urea, potash), farm yard manure (cow dung, poultry manure and vermin compost), bio-fertilizer (trichoderma) and water soluble fertilizer (19-19-19, Multi K). The FYM and bio- fertilizer cost are recently increasing trend due to scarcity of cattle and awareness about the importance of FYM on soil quality. The high price of WSF and scarcity of FYM is led to deviated farmers to use straight fertilizers on their farm. Thus leads to degradation of the fertility of land.
- It was revealed that labour scarcity has taken places and labourers give preference to work MGNREGA 100 days employment programme at the wage of Rs. 120. The farmers

were of the opinion that the laour force may channelized to use for cultivation purpose under the same scheme in the form of Public Private Participation (PPP), thus the labour force may be used for productive purpose.

Conclusion

Precision Agriculture (PA) technologies have been practiced in Tamil Nadu Since 2004 onwards. It was implemented as a turnkey project in Dharmapuri and Krishnagiri districts. Both districts are largely agricultural based and drought prone districts where source and methods of irrigation are very poor. The pace of adoption of precision agriculture technologies has been relatively modest this study quantifies the role awareness plays in the decision to adopt precision agriculture technology and allows us to explore the production, cost, resource use efficiency and marketing under precision farming.

From opinion of the case study I, adoption of precision technology including drip irrigation, bio-fertilizer, soil management and overall input management – directly led to higher yields and increase profits. Lack of technical knowledge and credit support. Manoharan is mostly satisfied with his overall precision farming system.

Mr Velappan was of the opinion that reduced use of fertilizers will reduce cost of cultivation hence the yield and revenue is increasing. This was considered to be his best success and it was interesting to note that he was well aware of the degradation of soil fertility and environment by the use of high quantity of chemical fertilizers and pesticides. Mostly satisfied with his overall precision farming system

Suggestions

1. In the study area farmers are preferred to cultivate HVC crop than food crop under precision farming methods, the PA technology be extended to food crops also to support nation food and nutritional security.
2. Where the water scarcity is more the adoption of precision farming methods of crop cultivation is more suitable but still farmers in this region prefer flood system of irrigation. Hence, farmers may be given awareness and training on saving water and electricity.

3. It is suggested that the Government should properly regulate the supply of electricity and bore well motor power installed capacity should reduce at minimum level to save the ground water level.
4. Suggested that subsidy may be given for soluble fertilizer as of straight fertilizer to encourage the farmers rearing more cattle especially to the land less poor in the rural household to ensure the availability of FYM and also bring equality between the resource rich farmers and resource poor landless.

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