International Journal of Research (IJR)

P-ISSN: 2348-6848
E-ISSN: 2348-795X
Vol. 8 Issue 9
September 2021

An Analysis of the Factors Influencing the Decision to Adopt Precision Farming in Krishnagar District of Tamil Nadu

Dr. R. Ravikumar* & Dr. A. Jagan Gopu**

*Assistant Professor & Head i/c, Department of Economics, PSG College of Arts & Science Coimbatore -04, Email.ravipsg07@gmail.com Contact: 7667547616

**Assistant Professor, Department of Economics, Guru Nanak College (Autonomous), Chennai -42, jagangopu@gurunanakcollege.edu.in contact: 9444548736

Abstract

The need for reviving, rejuvenating agriculture and placing it on a high growth trajectory has been felt to ensure food security and to reduce import dependence. In this regard, the core advice coming from knowledgeable quarters is that the time has come for switching from the past conventional production approach to a new dynamic of technology and market driven agricultural production in order to meet the growing demand for food production caused by population explosion. Precision farming has been the buzzword of agricultural research around the globe in recent times. It is based on the philosophy of heterogeneity within homogeneity and requires precise information on the degree of variability within field management. The aim is to vary the agricultural inputs in response to the varying conditions within the field in order to achieve the desired productivity. The study was conducted in Krishnagiri district of Tamil Nadu, India with a total sample of 252 and used Garret Ranking Technique and regression models to analyse the data. The study found that the pace of adoption of precision agriculture technologies has been relatively modest and large number of farmers are not familiar and not affordable with these technologies using farm level survey data this study quantifies the role awareness plays in the decision to adopt precision agriculture technology.

Key Words*: Precision Agriculture, Production, Productivity, Efficiency, and Adoptability.*

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 (Jurgen Schellberg et. Al., 2008)[1]. In other word, right input at the right amount at the right place in the right time used for crop cultivation with the efficient agricultural farm management concept was called PA. Precision Agriculture' aims at increasing productivity, decreasing production costs and minimizing the environmental impact of farming.

NRC [1997] [2] the concept of precision farming or precision agriculture is capturing the imagination of many people concerned with the production of food, feed and fiber. It offers the promise of increasing productivity, while decreasing production cost and minimizing the environmental impact of farming **[SKY-Farm, 1999]**[3].

Brief Historical Review of Precision Agriculture in India

The PA technology is started to be developed and disseminated in a regionally differentiated manner through 22 Precision Farming Development Centers (PFDCs) located in different parts of India. PFDCs are working for the popularization of PA and hi-tech applications to achieve increased production in addition to imparting training to a large number of farmers [Dugad et al 2006] [4] . The PFDCs, those involved in the development of regionally differentiated technologies on Plasticulture, will have to work to provide research support and precision farming. But all these PFDCs mainly concentrate on precision irrigation water management. On account of their experience in conducting applied research on Plasticulture application, they have the expertise in terms of manpower and equipment. The PFDCs will have to be equipped further with the necessary hardware

[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] National Research Council (NRC), 1997, Precision Agriculture in the 21st century, National Academic Press, Washington DC, USA, Pp. 149.

[3] SKY Farm, 1999, Opportunities of Precision Farming in Europe updated Report, Pp. 126.

[4] DugadSV et al. 2006, Application of information technology in irrigated agriculture In: Proc of 19th national convention of agricultural engineers on role of information technology in high-tech agriculture and horticulture, Bangalore, India, Pp. No. 197–202.

and software needed for generating information on precision farming techniques at farmers fields. Besides, a few PFDCs would be developed as Centre's for
Excellence for Precision Farming (CEPF). These Institutes will be fully equipped to take up research and development works on precision farming. The CEPFs would function as mother centers for providing technical support to other PFDCs located in the region.
The ultimate goal will be to make available all the needed information to farmers so that they are in a position to apply the necessary inputs. Other organizations like ICAR Institutes and Institutes in private sector will also be involved in technology development.

Present Status of Precision Agriculture in India

Precision farming in the Indian context is still in its infancy stage. A vast amount of data on various aspects like soil characteristics, climatic parameters, topographic features, crop requirement in terms of consumptive use and nutritional requirements have been generated and instruments needed for recording these parameters are also available. There are many other examples wherein a few components of precision farming have been adopted to greater advantages in increasing the returns from the land. Therefore, there is an urgent need to develop a package based on knowledge of soil environment and crop needs to enhance the efficiency of inputs to get higher output in given time frame [H. P. Singh 2003]. Some discrete initiatives have been started towards the application of this technology. PA has been identified as one of the main thrust areas by the Working Groups (WGs) of India–US Knowledge Initiative on Agriculture (KIA) [ICAR 2007][5]. It is expected that PA research will be an important part of the recently launched ambitious agricultural research program, National Agricultural Innovation Project (NAIP), which will focus on innovations in agricultural technology with the announced budget of US$ 285 million [NAIP 2007][6].

The Project Directorate for Cropping Systems Research (PDCSR), Modipuram and Meerut (Uttar Pradesh state) in collaboration with Central Institute of Agricultural Engineering (CIAE), Bhopal also initiated variable rate input application in different

[5] Anonymous, 2007, India-US knowledge initiative on agriculture-work plan http://www.icar.org.in.
[6] Anonymous, 2007, National agricultural innovation project launched. http://www.dare.nic.in.

cropping systems [shanwad et al 2004] [7] [Swain et al 2004] [8] . National Bank for Agriculture and Rural Development (NABARD) supported a three year project beginning in 1999 by establishing a resource centre for precision farming at JRD Tata Ecotechnology Centre of the MSSRF M.S. Swaminathan Research Foundation [Mssrf, 2007][9]. Arava R&D, Israel, provided technical support for this project. The foundation set up five demonstration farms initially in Tamil Nadu and plan to replicate them in other states. In one of the adopted villages a soil spectral variability map showed at least four types of soil in the area, but the entire village was applying a similar fertilizer dose for their chickpea crops. Therefore, a trail on Variable Rate of Application (VRA) technology has been undertaken [Ray et al 2001][10]. As an example of collaborative effort of private and Govt. agencies, MSSRF at Kannivadi in Tamil Nadu with financial support from the National Bank for Agriculture and Rural Development (NABARD) and works with an objective of poverty alleviation by applying PA technologies. Also, several lowcost GIS based decision support system and farm machinery are attracting wide attention for their use in precision farming [Ancha Srinivasan 2006][1112].

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

[7] Shanwad et al., 2004, Precision farming Dreams and Realities for Indian agriculture. In proceeding of 7th Annual International Map India Conference, January 28-30, New Delhi, India. Available online at: http://www.gisdevelopment.net/application/agriculture /overview /mi04115.htm.

[8] Swain et al., 2004, Precision agriculture for India: Potential, prospects and strategies. Presentation at 38 Annual Convention and Symposium of Indian Association of Agricultural Engineers (ISAE), January 16-18 ,Dapoli, Maharashtra, India.

[9] Anonymous, 2007, Ongoing today: 1998 to 2004. http://www.mssrf.org.

[10] Ray et al 2001. Precision farming in India context. GIS @ Development. November, pp 7. Available online at http://www.gisdevelopment.net/magazine/ gisdev/2001/nov/pfic.shtml.

[11] Ancha Srinivasan, 2006, Handbook of Precision Agriculture, The Haworth Press, Inc, doi:
[12] .130015627_18, Pp No. 513-14.

P-ISSN: 2348-6848
E-ISSN: 2348-795X
Vol. 8 Issue 9
September 2021

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).

The farm land of the Krishnagiri and the Dharmapuri districts are predominantly rain-fed. Elements of extremism are ripe in the general community particularly the youths in certain pockets close to the Andhra Pradesh border and the hills. 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.

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 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[13].

---

[13] TNAU Agritech Portal: Tamil Nadu Precision Farming Project, tnau.ac.in.

Review of Past Empirical Studies

Srinivasan (1999)[14] stated that the growing food demands due to ever-rising human populations forced Asian farmers to adopt resource-intensive and unsustainable practices that increased both economic and environmental costs. Asian farming systemspresent both obstacles and opportunities for adoption of precision agriculture, the current status of Asian agriculture and various constraints to adoption of precision farming. The situations in which precision farming may be the most rewarding and offer the greatest environmental benefits are highlighted. The technical, management, and social issues, and implications for adoption of precision technologies by small farmers, including the role of the private sector and agricultural associations are discussed. The study concluded that many precision technologies are pertinent for application in even small farms, and that favorable policy support by governments would encourage further adoption.

Stafford (2000)[15] observed that the precision agriculture has generated a very high profile in the agricultural industry over the last decade of the second millennium-but the fact of 'within-field spatial variability', has been known for centuries. With the advent of the satellite-based Global Positioning System, farmers gained the potential to take account of spatial variability. The topic has been 'technology-driven' and so many of the engineering developments are in place, with understanding of the biological processes on a localized scale lagging behind. Nonetheless, further technology development is required, particularly in the area of sensing and mapping systems to provide spatially related data on crop, soil and environmental factors. Precision agriculture is 'informationintense' and could not be realized without the enormous advances in networking and computer processing power. Precision agriculture, as a crop management concept, can meet much of the increasing environmental, economic, market and public pressures on arable agriculture.

[14] Ancha Srinivasan, 1999, Precision Farming in Asia: Progress and Prospects, The American Society of Agronomy, Inc. Crop Science Society of America, Inc. Soil Science Society of America, Inc. 5585 Guilford Rd., Madison, WI 53711 USA.

[15] John V. Stafford, 2000, Implementing Precision Agriculture in the 21st Century, Journal of Agricultural Engineering Research, Volume 76, Issue 3, Pp 267-275.

By the end of the new decade, most arable enterprises will have taken on the concept on a whole-farm basis.

Maohua (2001) [16] pointed that the concept of precision agriculture, based on information technology, is becoming an attractive idea for managing natural resources and realizing modern sustainable agricultural development. It is bringing agriculture into the digital and information age. The practice has smoothly extended into some developing countries.

Mondal et. al., (2007)[17] in a comprehensive study stated that precision farming concept is spreading rapidly in developed countries as a tool to fight the challenge of agricultural sustainability. With the progress and application of information technology in agriculture, PF has been increasingly gained attentions worldwide. Huge work has been started in different corners of the world on this subject knowledge on present developments helps to foresee the forthcoming challenges. Though some research works earlier in the 20th century (Linsley and Baver., 1929) drilled the first seeds of PF, but it was mainly (Johnson et al., 1983) and (Mathews, 1983) etc. Who initiated the work of today's PF (Stafford 2000). Luo et al.(2006) with the progress and application of information technology in agriculture and IT revolution in developing countries like India, China and others. PA has been increasingly gained attention worldwide. A good amount of work on PF has been started in different countries. Further, concluded that, the knowledge on present status of PA helps to visualize the future challenges (Pinaki et al., 2007).

Peter Howlett & Aashish Velkar (2008)[18] observed that the core technology space the physical technology of drip irrigation and fertigation tank, which were new to most

[16] Wang Maohua, 2001, Possible Adoption of Precision Agriculture for Developing Countries at the Threshold of the New Millennium, Computers and Electronics in Agriculture, Vol. 30, Issues 1 – 3, Pp. 45 – 50.

[17] PinakiMondel et al. 2007, Present Status of Precision Farming: A Review, International Journal of Agricultural Research, Vol. 2 (1), Pp. 1-10.

[18] Peter Howlett & AashishVelkar, 2008, Agri-Technologies and Travelling Facts: Case Study of Extension Education in Tamil Nadu, India, Working Papers on The Nature of Evidence: How Well Do 'Facts' Travel?, Economic History Working Papers from London School of Economics and Political Sciene, Department of Economic History, No. 35/08.

farmers in the scheme, travelled extremely well to the beneficiary farmers. No evidence or statement, from either beneficiary or non-beneficiary farmers, of a farmer abandoning the drip irrigation and fertigation tank. The reason for this was not however the technology itself or the facts embodied in it, the reason was money. In this case the subsidy ensured successful travel. Indeed, it seems subsidy was a necessary condition of travel there was a lot of prior knowledge about the benefits of precision farming but farmers were still unwilling or unable to invest in drip irrigation and or fertigation tanks. This is underscored by the evidence from non-beneficiary farmers, most of who were convinced that the technology worked due to the success of the TNPFP. They adopted some of the secondary technologies, but were largely unable to make the initial investment required to install the fertigation system. In this instance, it would seem that economic facts trumped scientific facts. Further, conclude that although facts about precision farming travelled well, the technologies themselves travelled once certain institutional barriers were overcome. This involved not only overcoming the farmers' financial inability to invest in a relatively expensive technology, but also fostering cooperative behaviour and improving individual bargaining power through the formation of local farmers associations. Their model of an extension education had a strong demonstration effect that encouraged the travel of critical facts about precision farming.

Maheswari et al. (2008) [19] study pointed out that PA aims at increasing productivity, decreasing production costs and minimizing the environmental impact of farming. The study had been undertaken to understand the impact of precision farming on resource-poor regions and underprivileged farmers. Specifically, has looked into productivity, income, employment, and adoption behavior of technology in precision farming in the Dharmapuri district. The study found that adoption of precision farming has led to 80 percent increase in yield in tomato and 34 per cent in brinjal production. Increase in gross margin has been found as 165 and 67 percent, respectively in tomato and brinjal farming. The contribution of technology for higher yield in precision farming has been

[19] Maheswari et al., 2008, Precision farming technology, adoption decisions and productivity of vegetables in resource-poor environments, Agricultural Economics Research Review, Vol. 21. Pp. 415 – 425.

33.71 per cent and 20.48 per cent respectively in tomato and brinjal production. The elasticity of 0.39 for the adoption in tomato and 0.28 in brinjal has indicated that as the probability of adoption increases by 10 per cent, net return increases by 39 per cent and 28 per cent in tomato and brinjal cultivation. Lack of finance and credit facilities have been identified as the major constrains in non adoption of precision farming. Study has suggested that providing of subsidies for water-soluble fertilizers and pump-sets will increase adoption of precision farming.

Liaghat and Balasundram (2010)[20] stated that the precision agriculture is an emerging farm management strategy that is changing the way people farm. This approach at present, there is an increasing commitment to reduce reliance on excessive chemical inputs in agriculture. Numerous technologies have been applied to make agricultural products safer and to lower their adverse impacts on the environment, a goal that is consistent with sustainable agriculture. Precision agriculture has emerged as a valuable component of the framework to achieve this goal.

Paxton et.al., (2010)[21] investigated factors affecting the number of specific types of precision agriculture technologies adopted by cotton farmers. Particular attention was given to the influence of spatial yield variability on the number of precision farming technologies adopted, using a count data estimation procedure and farm-level data. Results indicated that farmers with more within-field yield variability adopted a larger number of precision agriculture technologies. Younger and better educated producers and the number of precision agriculture technologies were significantly correlated. Finally, farmers using computers for management decisions also adopted a larger number of precision agriculture technologies.

[20] Liaghat, S. and S.K. Balasundram., 2010, A Review: The Role of Remote Sensing in Precision Agriculture, American Journal of Agriculture, Biological Science, Vol. 5, Pp.50-55.

[21] Kenneth W. Paxton et al. 2010, Precision Agriculture Technology Adoption for Cotton Production, No 56486, Annual Meeting, February 6 – 9, Orlando, Florida, Southern Agricultural Economics Association.

Pandit et.al., (2011)[22] comprehensive research used survey data collected from cotton farmers in 12 southern U.S. states to identify factors influencing cotton farmers' decisions to adopt precision farming. Using a seemingly unrelated ordered probit model, they found that younger, educated and computer literate farmers chose precision agriculture for profit reason. Farmers who perceived precision agriculture to be profitable adopt it to be at the forefront of agricultural technology. Further, they also found that farmers who were concerned with environment emphasize precision agriculture adoption as a reason to improve environmental quality. Results also indicate that farmers in coastal states such as Alabama, Mississippi, and North Carolina chose environmental benefits as a reason for precision agriculture technology adoption.

Antoni et.al., (2012) [23] pointed out that the precision agriculture technology overall, profitable investments for farmers, as previous literature has established. However, what has not been investigated was whether or not farmers perceive these technologies as such. It postulated that cotton farmers must see potential for higher profits as a result of adopting precision technologies in order to adopt it. Using the 2009 Southern Cotton Precision Farming Survey and multinomial logit model used to investigates farmers perception of precision agriculture and how those perceptions impact adoption of the GPS. It was found to be significant and positively related to the perceived future importance of precision agriculture as well as farmers' ranking of input cost savings relative to other attributes of the GPS technology.

Statement of the Research Problem

At present, Agriculture encounters problems of scarcity of water, shortage of labour, interrupted power supply, higher cost of fertilizer and pesticides, lower rate for agricultural products, interference declining interest in agriculture. A survey by National Sample

[22] Mahesh Pandit et al., 2011, Reasons for Adopting Precision Farming: A Case Study of U.S. Cotton Farmers, No 98575, Annual Meeting, February 5 – 11, Orlando, Florida, Southern Agricultural Economics Association.

[23] Jeremy M. D'Antoni et al., 2012, Farmers' perception of precision technology: The case of autosteer adoption by cotton farmers, Computers and Electronics in Agriculture, Vol. 87, Pp. 121-128.

Survey Organization (NSSO, 2005) reveals that 41 percent of farmers want to leave agriculture if any other option was available. Even in agriculturally progressive state like Punjab 37 percent of farmers wants to quit agriculture. Definitely the percentage must have risen high now 95 percent of farming community has no access to finance and insurance. 56 percent still borrow from informal sources and 70 percent had no deposit account in banks. Crop insurance also covers only 4-6 percent of farmers. This is because agriculture is not economically rewarding and intellectually stimulating.

The need for reviving, rejuvenating agriculture and placing it on a high growth trajectory has been felt to ensure food security and to reduce import dependence. In this regard the core advice coming from knowledgeable quarters is that the time has come for switching from the past conventional production approach to a new dynamics of technology and market driven agricultural production in order to meet the growing demand for food production caused by population explosion. Precision farming has been the buzzword of agricultural research around the globe in recent times. It is based on the philosophy of heterogeneity within homogeneity and requires precise information on the degree of variability within field management. The aim is to vary the agricultural inputs in response to the varying conditions within the field in order to achieve the desired productivity.

It is expected to result in saving of valuable resources like water and energy cost cutting and qualitative enhancement in the final produce. Minimal application of fertilizers and pesticides is expected to result in avoidance of soil degradation. Direct marketing and price negotiations are enabled through group formation among farmers and branding of the produce.

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 adoption behaviour of precision farmers at farm level in the study area. Hence the present study.

Objectives of the Study

1. To analyse the factor that influence the decision to adopt precision methods of farming in the study area,
2. To suggest suitable policy measures related to the study.

Methodology

The research design of the present empirical study is descriptive and analytical in nature. It made use of primary data. Precision agriculture method was highly practiced and first launched in Dharmapuri and Krishnagiri districts of Tamil Nadu, India in the year 2004-05. In Krishnagiri district a total of 1,240 farmers adopted precision farming during 2012-13, out of which 1000 farmers trained under NADP. A total of six blocks implemented namely Hosur, Kaveripatinam, Kelamangalam, Mathur, Thally and Uthangarai. Three blocks that is Hosur, Kelamangalam, and Thally were selected based on the high number of beneficiaries. These three blocks had a total of 840 beneficiaries from the total 20 percent were selected that are 168 sample respondents who adopt precision method of farming and a total of 84 non-precision farmers (50 percent of precision sample farmers) were taken for the comparative analysis. First hand information was collected from the total sample respondents (252) for this purpose a well structured interview schedule was used. The data, thus collected, were analyzed by using simple statistical tools such as percentage, average, besides regression analysis and Henry Garrett Ranking Technique.

Regression Model

The formula used is;

$$\mathbf{Y = \beta_0 + \beta_1.X_1 + \beta_2.X_2 + \beta_3.X_3 + \beta_4.X_4 + \beta_5.X_5 + \beta_6.X_6 + \beta_7.X_7 + \beta_8.X_8 + e}$$

Y = Total Revenue β_0

= Constant

X_1 = Ploughing Cost

X_2 = Seed Cost

X_3 = Fertilizer Cost

X_4 = Weed Cost

X_5 = Pesticide Cost

X_6 = Farm Yard Manure

X_7 = Broker Cost

X_8 = Transport Cost, and

e = error term

Henry Garrett's Ranking Technique

To find the most significant factor influencing the sample farmers for adoption of precision farming, Garrett's Ranking Technique is employed. It is calculated as percentage score and the scale value is obtained by employing Scale Conversion Table given by Henry Garrett. The percentage score is calculated as under the following formula:

$$\textbf{Percentage Score} = \frac{100\,(R_{ij} - 0.5)}{N_j}$$

Where,

R_{ij} = Rank given for i^{th} item j^{th} individual

N_j = Number of items ranked by j^{th} individual.

Results and Discussion

The focus of the study is to analyse the factors that influence the adoption of precision farming in the selected area of Krishnagiri district, Tamil Nadu. The empirical evidences attained from the statistical analysis presented and discussed below.

Table 2, derived from table 1 to find the most significant factor influencing the sample farmers for adoption of precision farming, Garrett's Ranking Technique is employed. It is calculated as percentage score and the scale value is obtained by employing Scale Conversion Table given by Henry Garrett. The percentage score for each rank from 1 to 10 are calculated. The scale value of first rank to tenth rank is presented in the table

5.6. The highest (1st rank) mean score response was 65.68 for input subsidy. The detail is shown in chart 1.

P-ISSN: 2348-6848
E-ISSN: 2348-795X
Vol. 8 Issue 9
September 2021

Table 1: Details of Factor Influencing to Adopt Precision Farming Frequencies of Henry Garrett Ranking Model

Sl.No	Factors / RanksScale	I 82	II 70	III 63	IV 58	V 52	VI 48	VII 42	VIII 36	IX 29	X 18	Total Freq.	Total Score (frequencies X Garrett's Score)	Mean Score	Rank
1	Input Subsidy	2542	3220	2520	1566	780	336	42	0	29	0	168	11035	65.68	1
2	Increase profit	1209	1794	1600	945	135	21	2	0	0	0	168	5706	33.96	3
3	Water scarcity	1755	1404	1800	805	117	9	4	1	0	0	168	5895	35.09	2
4	Yield increase	1260	900	1080	1104	390	27	4	2	0	0	168	4767	28.38	7
5	To reduce cost of cultivation	532	325	288	1200	1650	207	30	10	0	0	168	4242	25.25	8
6	To reduce crop loss	95	52	48	100	1045	920	735	70	0	25	168	3090	18.39	10
7	To manage morefarm land	0	12	8	8	152	880	1764	560	108	700	168	4192	24.95	9
8	Protected methods of cultivation	0	3	0	4	64	286	468	2360	1053	896	168	5134	30.56	6
9	To reduce labour	0	1	0	2	48	104	364	1357	2067	1504	168	5447	32.42	4
10	To reduce financial risk	0	0	0	1	30	320	560	529	2332	1645	168	5417	32.24	5
	Total	168	168	168	168	168	168	168	168	168	168				

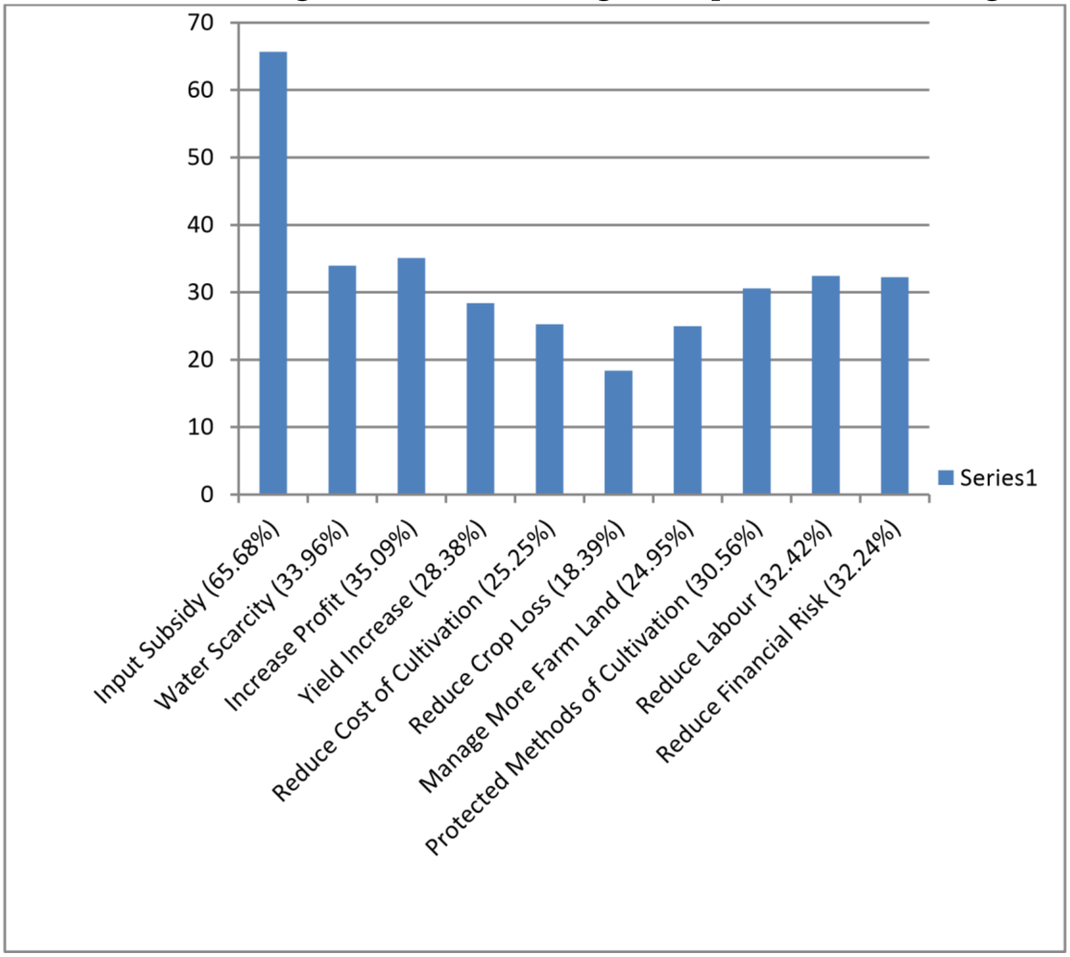
P-ISSN: 2348-6848
E-ISSN: 2348-795X
Vol. 8 Issue 9
September 2021

Table 2: Details of Factors Influencing Adoption of Precision farming with Henry Garrett Ranking Model

Sl. No	Particulars	Mean Garrett Score	Rank
1	Input Subsidy	65.68	1
2	Water Scarcity	35.09	2
3	Increase Profit	33.96	3
4	To Reduce Labour	32.42	4
5	To Reduce financial Risk	32.24	5
6	Protected Method of Cultivation	30.56	6
7	Yield Increases	28.38	7
8	Reduce Cost of Cultivation	25.25	8
9	To Manage More Farm Land	24.95	9
10	To Reduce Crop Loss	18.39	10

Source: Computed from Primary Data

Chart 1- Ranking of factors Influencing to Adopt Precision Farming



International Journal of Research (IJR)

P-ISSN: 2348-6848
E-ISSN: 2348-795X
Vol. 8 Issue 9
September 2021

Table 3: Results of Regression Analysis

Sl. No	Variables	Un standardized Coefficient		Standardized Coefficient	t	Sig.
		B Value	Std. Error	Beta		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	(Constant)	8.838	3.685	-	23.982	0.000
2	Land Preparation	-28.058	0.665	-0.809	-42.218	0.002
3	Seed Cost	3.864	0.568	0.302	6.802	0.004
4	Fertilizer Cost	4.497	0.179	0.563	25.134	0.001
5	Weed Cost	-0.804	0.214	-0.045	-3.759	0.000
6	Pesticides Cost	0.168	0.044	0.041	3.782	0.003
7	FYM Cost	9.970	0.599	0.606	16.642	0.000
8	Transport Cost	-2.215	0.577	-0.051	-3.840	0.005
9	Broker Cost	-10.935	0.344	-0.433	-31.769	0.000

Dependent Variable: Total Farm Revenue

F Value	R Square
1.456	0.88

Regression coefficient was estimated taking yield income as dependent variable and independent variables are preparation cost, seed cost, fertilizer cost, weed cost, pesticides cost, transport cost and broker cost. There is a significant linear relationship between revenue and cost.

The co-efficient of values of weed cost, farm yard manure cost and broker costs were significant at 1 per cent level. Remaining all cost coefficients was significant at 5 percent level.

R square value of model shows 88 per cent goodness fit to model with the F – Value of 1.456.

Major Findings

- Found that the most significant factor influencing the sample farmers for adoption of precision farming was subsidy. This was done by percentage score and the scale value is obtained by employing Scale Conversion Table given by Henry Garrett. The percentage score for each rank from 1 to 10 are calculated. The highest (1^{st} rank) mean score response was 65.68 for input subsidy.
- Found out that the share of cost in the case of precision farmers was highest for human labour 27.17 per cent, followed fertilizer 19.11 per cent and farm yard manure (FYM) is 9.10 per cent. Within the cost of human labour 65.51 per cent 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, accounting 27.38 per cent followed by plant protection chemical 16.59 per cent, fertilizer 15.76 per cent, nursery and planting and farm yard manure (FYM) constitute 8.29 per cent each respectively.
- 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), biofertilizer (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.

Suggestions

The following suggestions may further upscale the adoption of precision farming in more successful manner.

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. The research and development should focus attention for further development of precision farming technologies for food crops thus will be remunerative.
3. 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.
4. 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.
5. 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.

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 and large number of farmers are not familiar and not affordable with these technologies using farm level survey data this study quantifies the role awareness plays in the decision to adopt precision agriculture technology and allows us to explore the productivity, resource use efficiency and employment structure under precision farming. Regression and Henry Garrett ranking model was used to analyse the awareness to adopt precision agriculture and the productivity.

Garrett's Ranking Technique revealed that the most significant factor influencing the sample farmers for adoption of precision farming was input subsidy with mean score 65.68. Found that the share of cost in the case of precision farmers was highest for human labour 27.17 per cent, followed fertilizer 19.11 per cent and farm yard manure (FYM) is 9.10 per cent. Within the cost of human labour 65.51 per cent 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, accounting 27.38 per cent followed by plant protection chemical 16.59 per cent, fertilizer 15.76 per cent, nursery and planting and farm yard manure (FYM) constitute 8.29 per cent each respectively.

References

1. Ancha Srinivasan, 2006, Handbook of Precision Agriculture, The Haworth Press, Inc, doi:

10.130015627_18, Pp No. 513-14.

2. Ancha Srinivasan, 1999, Precision Farming in Asia: Progress and Prospects, The American Society of Agronomy, Inc. Crop Science Society of America, Inc. Soil Science Society of America, Inc. 5585 Guilford Rd., Madison, WI 53711 USA.
3. Anonymous, 2007, India-US knowledge initiative on agriculture-work plan http://www.icar.org.in.

P-ISSN: 2348-6848
E-ISSN: 2348-795X
Vol. 8 Issue 9
September 2021

4. Anonymous, 2007, National agricultural innovation project launched. http://www.dare.nic.in.
5. Anonymous, 2007, Ongoing today: 1998 to 2004. http://www.mssrf.org.
6. DugadSV et al. 2006, Application of information technology in irrigated agriculture In: Proc of 19th national convention of agricultural engineers on role of information technology in high-tech agriculture and horticulture, Bangalore, India, Pp. No. 197–202.
7. Jeremy M. D'Antoni et al., 2012, Farmers' perception of precision technology: The case of autosteer adoption by cotton farmers, Computers and Electronics in Agriculture, Vol. 87, Pp. 121-128.
8. John V. Stafford, 2000, Implementing Precision Agriculture in the 21st Century, Journal of Agricultural Engineering Research, Volume 76, Issue 3, Pp 267-275.
9. JurgenSchellberg et al. 2008, Precision agriculture on grass land: Applications, perspective and constraints, European Journal of Agronomy, Elsevier, Vol. 29, Pp. 59-71.
10. Kenneth W. Paxton et al. 2010, Precision Agriculture Technology Adoption for Cotton Production, No 56486, Annual Meeting, February 6 – 9, Orlando, Florida, Southern Agricultural Economics Association.
11. Liaghat, S. and S.K. Balasundram., 2010, A Review: The Role of Remote Sensing in Precision Agriculture, American Journal of Agriculture, Biological Science, Vol. 5, Pp.5055.
12. Mahesh Pandit et al., 2011, Reasons for Adopting Precision Farming: A Case Study of U.S. Cotton Farmers, No 98575, Annual Meeting, February 5 – 11, Orlando, Florida, Southern Agricultural Economics Association.
13. Maheswari et al., 2008, Precision farming technology, adoption decisions and productivity of vegetables in resource-poor environments, Agricultural Economics Research Review, Vol. 21. Pp. 415 – 425.
14. National Research Council (NRC), 1997, Precision Agriculture in the 21st century, National Academic Press, Washington DC, USA, Pp. 149.
15. Peter Howlett & Aashish Velkar, 2008, Agri-Technologies and Travelling Facts: Case Study of Extension Education in Tamil Nadu, India, Working Papers on The Nature of Evidence: How Well Do 'Facts' Travel?, Economic History Working Papers from London School of Economics and Political Sciene, Department of Economic History, No. 35/08.
16. Pinaki Mondel et al. 2007, Present Status of Precision Farming: A Review, International Journal of Agricultural Research, Vol. 2 (1), Pp. 1-10.
17. Ray et al 2001. Precision farming in India context. GIS @ Development. November, pp 7. Available online at http://www.gisdevelopment.net/magazine/gisdev/2001/nov/pfic.shtml.
18. Shanwad et al., 2004, Precision farming Dreams and Realities for Indian agriculture. In proceeding of 7th Annual International Map India Conference, January 28-30, New Delhi, India. Available online at: http://www.gisdevelopment.net/application/agriculture /overview /mi04115.htm.
19. SKY Farm, 1999, Opportunities of Precision Farming in Europe updated Report, Pp. 126.

20. Swain et al., 2004, Precision agriculture for India: Potential, prospects and strategies. Presentation at 38 Annual Convention and Symposium of Indian Association of Agricultural Engineers (ISAE), January 16-18 ,Dapoli, Maharashtra, India.
21. TNAU Agritech Portal: Tamil Nadu Precision Farming Project, tnau.ac.in.
22. Wang Maohua, 2001, Possible Adoption of Precision Agriculture for Developing Countries at the Threshold of the New Millennium, Computers and Electronics in Agriculture, Vol. 30, Issues 1 – 3, Pp. 45 – 50.