ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2020; 6(7): 512-515
www.allresearchjournal.com
Received: 24-05-2020
Accepted: 26-06-2020

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Socio-economic conditions and adoption of Bhoochetana technology: an empirical study of Ragi production in Tumakuru district of Karnataka

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Abstract
Bhoochetana technology was introduced in 2009 for the purpose of increasing crop productivity. The scheme involves soil testing at agricultural farms and identifies the soil deficiencies in micro nutrients and prepare GIS soil mapping. Based on the soil test results of farm lands soil health cards were issued to the farmers. Farmers were guided to use improved variety of seeds. Adoption of new technology by the farmers was not up to the expected level. In this backdrop, this study is an attempt to ascertain the factors influencing the adoption of BCT based on the primary data collected from 180 respondents. Influence of Socio economic variables like Age, Farm size, Education, Caste category and Extension exposure activities on adoption of BCT was studied by using percentages and chi-square analysis. It was found that farm size, education level of the respondents and extension exposure activities of the farmers were found to have significant influence on the adoption of BCT.

Keywords: Education, adoption, extension, technology, farmers

Introduction

Agriculture is one of the predominant sectors in India. Rain-fed region by occupying sixty percent of the total cultivated land meets forty percent of India's food demand and sixty percent of livestock population. In recent years there is low and unstable productivity in these areas due to degraded soils, uncertainty of rains, unsuitable weather variations, excess usage of manures, non performing crop rotation and continuing poverty of farmers. Crop yields in dry land areas are 1to1.5 tons per hectare which are less by two to five folds of the achievable potential yield largely due to low rainwater use efficiency (Wani *et al*., 2012) [4]. But the productivity in wet lands had reached the peak level. Hence there was scope for enhancing production and productivity in dry land region. Potential of dry land agriculture could be unlocked by using best technology for improving rural livelihoods through sustainable agriculture. Government of Karnataka initiated a novel project called Bhoochetana under Rastriya Krishi Vikas Yojana (RKVY) in May 2009 for a period of four years to improve productivity in rain-fed agriculture. The programme is intended increase average productivity of selected crops by twenty percent in four years. The mission mode programme is being implemented by the Department of Agriculture in association with Watershed Development Department, Universities of Agricultural Sciences and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and community-based organizations such as Raitha Samparka Kendras (RSKs) as Consortium partners. The project aimed at increasing productivity in the rain-fed crops by 20% in all the 30 districts of the state in phased manner within four years. Soil samples were selected from different regions using Stratified sampling scheme and analysis of these samples were conducted in the laboratories. GIS- based soil fertility maps were prepared on the basis of laboratory reports for all the districts and made efforts for capacity building of dry land farmers. Ragi, groundnut, Maize, soyabean, red gram, black gram, green gram, bengal gram, sunflower, jowar, rainfed paddy, cotton and bajra were the major crops in the dry-land region. Department of Agriculture is the nodal department for implementing the project. Technical support/consultancy services and training are being provided by ICRISAT, Hyderabad. State Agricultural Universities assist in identifying suitable high-yielding cultivars of the identified crops as well as appropriate management practices including pest control measures at district

levels and provide knowledge and guidance to farmers at state, district and taluk level. Watershed Department is responsible for identifying and converging various watershed development activities in the target districts. SAUs also assist ICRISAT in organising training programmes for the Farmer Facilitators. Crop cutting experiments are conducted and yields of controlled and untreated plots are recorded jointly by Department of Agriculture, ICRISAT, WDD and SAU. Samples are selected from all the four divisions of the grid. Samples are sent to laboratories for examination after enrolling the farmers name, survey number, farm-size and crop details with the help of GPS equipment. Based on the laboratory results, soil health cards are issued to the farmers. The programme conducts soil test and identify the deficiency of the soil in the farmer's fields. They insist a suitable proportion of micro-nutrients namely Boron, Gypsum and Zinc to be used depending upon the soil structure and also advise the type of crop to be grown. Farmers could get variety seeds from the seed bank at discount price. They could avail technology assistance from the programme facilitators namely lead farmers, Watershed development department representatives, ICRISAT representatives, farm facilitators (anavugararu), raitha samparka Kendra, Agricultural universities and Krishi Kendras. Farmers could participate in Extension activities like Training programs, Field Demonstrations, Field Days, Exhibitions, Krishi Mela and Study tour and enrich their knowledge about various modern methods of cultivation and reap the results of enhanced productivity and high income. Improvement in delivery time of services and convergence of all the existing schemes has been one of the visible and positive impacts of Bhoochetana. Scientific approach and technical support through effective extension and timely supply of package of inputs have enabled dry-land farmers to enhance crop productivity significantly. Farmers have appreciated the benefits (higher yield) of balanced application of nutrients and adoption of improved cultivation practices. The farmers' acceptance was widely noticed during the second phase of project implementation. Improvement in measurable indicators has been observed in terms of increase in productivity and corresponding cost benefit ratios. Bhoochetana has also underlined the importance of effectively organizing and utilizing communities for increasing productivity of dry-land agriculture. Ragi cultivation is very popular among arable crops because of its high socio-economic value and importance in tackling food insecurity and poverty (Bamire *et al.*, 2011) [1]. Success of the technology adoption is considered to be associated with socioeconomic status of the farmers. Technologies are, generally, information-intensive and they require a high level of human capital, the farmer' s capacities and abilities clearly influence his/her adoptive decision to use precision agricultural technologies on their farm (Daberkow and McBride 1998) [2]. Socio-economic factors of the farmers like age, farm size, farming experience, educational level, gender of the farmer, family size, membership of organization, household income, land tenure status and farmers' perception or willingness to adopt the scheme and the distance from the RSK etc may be considered for the study. Studies conducted by ICRISAT and other reports reveal that the programme is successful in providing improved yield compared to the traditional method. It is noticed that all farmers have not adopted Bhoochetana technology. Even after providing facilities at the door steps for the welfare of farmers, it is quite interesting to know why still many of the farmers have not adopted the technology. Each stage of the agriculture production requires a number of specific actions or decisions by the farmer (Mittal *et al*., 2010) [3]. So far no study has been taken up to examine the causes for non- adoption of the Bhoochetana programme in the study area. Hence this paper intends to examine the influence of socioeconomic factors of farmers on adoption of Bhoochetana technology in Ragi production in Tumakuru district of Karnataka state.

Methodology

This study is based on primary data collected in Tumakuru district of Karnataka. The district has ten taluks. Three taluks of Tumakuru district namely Kunigal, Gubbi and Thurvekere were purposively selected for the study based on the percentage of gross sown area under Ragi crop. Two stage sampling scheme was used to select the samples. In the first stage, three villages were chosen from each selected taluk using simple random sampling. A list of Ragi growers was prepared for all the selected villages. In the second stage, twenty farmers from each village were selected randomly using the list prepared for the study. Totally 180 respondents were chosen for the study. The data required for the study was collected using a well-designed and pretested schedule. The sample respondents were classified as Adopters and Non-Adopters of Bhoochetana Technology (BCT). Farmers using micro nutrients like Borax, Zinc and Gypsum according to the soil deficiency and possessing soil health card are considered as Adopters of BCT and others as Non- Adopters of BCT. There were 83 respondents from adopters of BCT and 97 respondents from non-adopters of BCT. Information regarding socio economic variables like farm size, age, education level and caste category from adopters and non-adopters strata were collected and the data were presented in the form of tables. Data analysis was performed by calculating percentages. The association between various socio economic variables and adoption of BCT were examined by using chi-square test.

Results and discussion

Farm size is considered as one of the important variable influencing the adoption of technology. BCT adopters and non-adopters were classified across the different category based on the size of the holding and results have been presented in table-1.

Table 1: Farm Size Category of the Sample Ragi Farmers

S. No.	Farm Size Category	Number of Farmers		Chi-square Value
		Adopters of BCT	Non-Adopters of BCT	
1	Marginal Farmers (< 2.5acre)	18 (21.7)	36 (30.0)	11.215*
2	Small Farmers (2.5 to 5 acre	29 (34.9)	40 (38.3)	
3	Medium Farmers (5 to 10 acre)	24 (28.9)	16 (22.2)	
4	Large Farmers (> 10 acre)	12 (14.5)	5 (9.4)	
5	Total	83 (100.0	97 (100)	

Note: Figures in parenthesis are percentage to the total respondents
** indicate the significance at one percent probability levels

Marginal farmers comprise of farmers with farm size below 2.5 acre, small farmers are those with land holdings between 2.5 and 5 acres, medium farmers possess the land between 5 to 10 acres and farmers with greater than 10 acres are considered as large farmers. The table reveals that highest proportion of respondents was small farmers having 34.9% in adopters group and 38.3% in nonadopters category. It is followed by medium farmers (28.9%) from adopter strata and marginal farmers (30.0%) from non-adopters group. Also marginal and small farmers put together form 56.6% for adopters group and 78.4% for non- adopters category. Medium and Large farmers are more in adopters group when compared to non-adopters group. Hence adoption of BCT increases with increase in farm size. Association between farm size and adoption of BCT was examined with chi-square test. Calculated value of chi-square (11.215) is greater than table value of chi-square at 3 degrees of freedom and at 5 percent probability level. Therefore farm-size and adoption of BCT are statistically significant. This infers that the size of the holding has significant influence on the adoption of BCT. Age of the farmer may have significant influence on the adoption of new innovations in the farming practices. Respondents were classified into three groups based on their age. They are; i) the respondents whose is below 35 years, ii) respondents in the age group of 35 to 50 years and iii) respondents with above 50 years of age. Table-2 shows the distribution of adopters and non-adopters of BCT across the different age group.

Table 2: Age group of the Respondents and adoption of BCT in Ragi

Age group of Respondents	Number of Farmers		Chi-square Value
	Adopters of BCT	Non-Adopters of BCT	
< 35	15 (18.1)	20 (20.6)	0.866
35 -50	36 (43.4)	46 (47.4)	
>50	32 (38.6)	31 (32.0)	
Total	83 (100)	97 (100)	

Note: Figures in parenthesis are percentage to the total respondents

Chi-square value was calculated to test the significance of association between the adoption of BCT and age of the respondents. The calculated value of chi-square was less than the table value of chi-square at 2 degrees of freedom and at 5% level of significance. It means that age does not influence adoption of Bhoochetana programme.

Education plays a vital role in the adoption of new technology in agriculture production. Education of farmers helps them in realizing the superiority of new technology over the traditional technology. Based on the education level respondents could be classified under four category. They are; i) the respondents who did not have formal education, ii) respondents who have education up to 7 standard were classified under the respondents with primary education, ii) respondents who had education between 8 standard to 10 standard could be categorized under secondary education and iv) respondents who had education more th than the 10 standard were categorized under college education. Distribution of BCT adopters and non-adopters across the different levels of education is given in table-3.

Table 3: Education level of the Respondents and adoption of BCT in Ragi

Education level of the Respondents	Number of Farmers		Chi-square Value
	Adopters of BCT	Non-Adopters of BCT	
Uneducated	30 (36.1)	44 (45.4)	8.565*
Primary	28 (33.7)	30 (30.9)	
Secondary	13 (15.7)	20 (20.6)	
College	12 (14.5)	3 (3.1)	
Total	83 (100)	97 (100)	

Note: Figures in parenthesis are percentage to the total respondents
* indicate the significance at 5 percent probability level

Significant difference between adopters and non-adopters could be found in uneducated and college education category. In the uneducated category non-adopters of BCT (45.4%) was significantly more compared to adopters of BCT (36.1%). revers in the respondents with college education. In the category of respondents with college education, adopters of BCT (14.5%) was significantly more compared to the non-adopters of the technology (3.1%). Chi-square test was applied to verify association between adoption of technology and level of education. It was found to be significant at 5% probability level. Calculated value of chi-square i.e., 8.565 is greater than table value of chi-square at 3 degrees of freedom and at 5% probability level. Hence it can be inferred that education level of farmers will greatly influence the adoption of technology. Responds with higher level of education are more likely to adopt the BCT. Most of the studies related to the adoption of technology have assessed the influence of caste category on the adoption of new technologies in the agriculture production. Whether adoption of technology is restricted to certain caste categories only or it is open to all caste categories of the farmers is to be verified. For this purpose, respondents have been categorized under two groups; I) SC/STs and ii) others. Frequency distribution of adopters and nonadopters across the different caste categories is given in table-4

Table 4: Caste Category of the Respondents and adoption of BCT in Ragi

Caste Category	Number of Farmers		Chi-square Value
	Adopters of BCT	Non-Adopters of BCT	
SC/ST	34 (41.0)	41 (42.3)	0.031
Others	49 (59.0)	56 (57.7)	
Total	83 (100)	97 (100)	

Note: Figures in parenthesis are percentage to the total respondents of respective caste

The data shows that majority of the respondents belong to other caste category for both adopters (59%) and non-adopters (57.7%) group. Caste category and adoption of BCT was found to be insignificant by chi-square test. This reveals that caste category has not significant influence on the adoption of BCT. Therefore there is no impact of caste on the adoption of BCT.

Extension exposure reported to be one of the most significant factors influencing the adoption of new technologies. Some of the extension activities considered for this study includes; i) Agriculture trainings, ii) field demonstrations or field days, iii) exhibition or Krishi Mela, iv) visit to RSK and v) Consultation with AO' s. Scores were allotted for frequently, rarely and never exposed to each of the extension activity separately. If the farmers attended agricultural trainings frequently, the score was fixed as 2 and for rarely visiting farmers the score was 1 and 0 for farmers who never visited any agricultural training. Similar scoring pattern was followed for all the other extension activities. The total score for all the five extension exposure activities was calculated and termed as extension exposure score of the respondents. The extension exposure score ranged between 0 and 10. It was categorized as low degree if the total score is below 4, medium degree if the score is between 4 to 7 and high level if the score is above 7. The data about extension exposure score and adoption of BCT was consolidated and presented in table-5. The percentage of respondents in the high score category was considerably more among the adopters of BCT (28.9%) compared to the no adopters of the BCT (13.4%). Contrary to the above, the percentage of respondents in the low score category was significantly more among the non-adopters of the BCT (47.4%) compared to the adopters of BCT (27.7). Thus extension exposure level is observed to be relatively more among the BCT adopters compared to the no adopters of BCT.

Table 5: Extension Exposure of the Respondents and adoption of BCT in Ragi

Extension Exposure Score	Number of Farmers		Chi-square Value
	Adopters of BCT	Non-Adopters of BCT	
Low	23(27.7)	46 (47.4)	9.962*
Medium	36 (43.4)	38 (39.2)	
High	24 (28.9)	13 (13.4)	
Total	83 (100)	97 (100)	

Note: Figures in parenthesis are percentage to the total respondents
* indicate the significance at one percent probability level

Association between adoption of technology and extension exposure of respondents were examined by chi-square test. It was found that calculated value of chi-square (9.962) exceeds table value of chi-square distribution at 1% probability level. Hence it is statistically significant at one percent level of significance. Therefore it shows that participation in extension exposure activities promotes adoption of technology.

Conclusion

Bhoochetana technology was introduced by Government of Karnataka for the purpose of increasing average productivity of selected crops in the rain fed areas by 20%. The scheme involves soil testing, identification of deficiencies in soil micronutrients like Borax, zinc and zypsum, prepare GIS mapping and issue of health cards to the farmers. Farmers were guided to use improved variety of seeds available at the seed banks and to produce crop suitable to the soil fertility. In spite of the efforts, still many farmers have not adopted the technology. This study is an attempt to ascertain the factor hampering the adoption of BCT. Influence of Socio-economic variables like Age, Farm size, Education, Caste category and Extension exposure activities and adoption of BCT was studied by using percentages and chi-square analysis. It was found that farm size, education level of the respondents and extension exposure activities of the farmers were found to be influencing adoption of BCT.

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