Extension Bulletin No. 02/2012

Assessment of Rainfed Technologies Adoption under Semi-arid Regions in South India

K Ravi Shankar, K Nagasree, P Muthuraman, DBV Ramana, GR Maruthi Sankar, MS Prasad BMK Raju and B Venkateswarlu

हर कदम, हर डगर किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch

CRIDA

Central Research Institute for Dryland Agriculture
Hyderabad

Extension Bulletin No. 02/2012

Assessment of Rainfed Technologies Adoption under Semi-arid Regions in South India

K Ravi Shankar, K Nagasree, P Muthuraman,
DBV Ramana, GR Maruthi Sankar, MS Prasad,
BMK Raju and B Venkateswarlu

भाकृअनुप
ICAR

Central Research Institute for Dryland Agriculture
Santoshnagar,Saidabad, Hyderabad – 500 059, A.P., India

Citation:

Ravi Shankar, K., Nagasree, K., Muthuraman, P., Ramana, D.B.V., Maruthi Sankar, G.R., Prasad, M.S., Raju, B.M.K. and Venkateswarlu, B. 2012. Assessment of Rainfed Technologies Adoption under Semi-arid Regions in South India. Extension Bulletin No. 02/2012. Central Research Institute for Dryland Agriculture, Hyderabad. 28 p.

June 2012

500 copies

Published by

The Director
Central Research Institute for Dryland Agriculture
Santoshnagar, Hyderabad - 500 059.
Ph : 040-24530177 Fax : 040-24531802
Website : http://www.crida.in, E-mail : director@crida.in

Cover Design: K.V.G.K. Murthy
Photo Credits: K. Surender Rao

Printed at :
Sree Ramana Process Pvt. Ltd. Ph : 040-27811750

CONTENTS

Preface

New agricultural technologies can contribute to the economic, social, and environmental development of communities, improving their livelihoods and sustainability. The adoption of these technologies can be analyzed from a sociological or economic view point. Understanding the rate of adoption and the factors affecting the adoption are the first steps to understanding why farmers adopt or do not adopt a technology. This allows for better targeting of extension programmes.

Research projects are often formulated not based on clear priorities and constraints of the farming community. Successful extension programmes must be based on an understanding of the variables that affect a farmer's adoption decision. For a technology to be successful, extension efforts and testing the technology with on farm trials need to be done. Farmers with more labour and resources are more likely to adopt the technology. I compliment the efforts of Dr. K. Ravi Shankar and other authors for bringing this important work in usable form. Significant determinants of adoption and nonadoption are characterized in this study. Continued research on adoption determinants helps to improve the knowledge base on local, national and international levels. Evolving technologies that can be implemented by farm households with technical, labour and land constraints, is a challenge for the extension programmes.

B.VENKATESWARLU
Director, CRIDA

Assessment of Rainfed Technologies Adoption under Semi-arid Regions in South India

1. Importance of Rainfed Agriculture

Out of total cultivated area of around 140.30 million hectares in India, only 60.86 million ha. is irrigated and the remaining 79.44 million ha. is rainfed. Rainfed crops account for 48 percent area under food crops and 68 percent of the area under non-food crops. Rainfed areas are generally endowed with fragile resource base and low productivity. Majority of the inhabitants are resource-poor and are obliged to eke out an existence in harsh biophysical and socio-economic environments. They are subjected to climate change through extreme weather events, decrease of water availability and decrease in agricultural productivity. The problem to be addressed is the limited access to and exchange of, information and knowledge related to agriculture and food security at local, national, and regional levels. The productivity improvements in rainfed areas shall be achieved through adoption of established technologies by farmers. This can be done by supporting efforts of researchers, extensionists and farmers working in rainfed areas through increased knowledge exchange and sharing (CRIDA, 2007 and 2009).

2. Adoption of Rainfed Technologies

Adoption is, "the mental process an individual passes from first hearing about an innovation to final adoption" (Rogers, 1962). It is always an individual decision process. Information and learning are argued to be central to the adoption process. Among other factors, whether to adopt a technology or not depends on the profitability of the technology, farmer education/learning, and other observed and unobserved differences among farmers and across farming systems (Suri, 2009). Risk aversion discourages adoption, as uncertainty will always be greater for the new technology than for the old (Marra *et al*., 2003). Risk is a major factor limiting the adoption of new innovations (Lindner *et al*., 1982; Lindner, 1987; Tsur *et al*., 1990; Leathers and Smale, 1992; and Feder and Umali, 1993). For a new technology to be successful, extension efforts and training /trailing of the technology need to be in place, and the needed inputs must be procured. Designing technologies that can be implemented by households with labour and land constraints, is a continued need of extension programmes (Jones, 2005). Extension, promotion and marketing programmes by government workers and/or the private sector can be positively related to adoption (e.g. Marsh *et al.,* 2000; Llewellyn *et al.,* 2003). Reasons for non-adoption of dryland agricultural technologies were discussed at length and are: irregular and inadequate rains, inadequate finance, non-availability of inputs, lack of improved implements, high cost and complexity of certain practices and lack of guidance (Wasnik, 1988; Farooque, 1990). Age, farming experience were found to be non significant; while education, annual income were positively significant with the adoption of package of improved agricultural practices of dryland farmers in the Bellary district of Karnataka (Padmaiah *et al.*, 1992). Farm size was positively significant with the adoption of recommended dryland agricultural technologies of dryland farmers in Aurangabad district of Maharashtra (Dakhore *et al*., 1993).

3. Methodology

The present study identifies the successful and adopted rainfed technologies of CRIDA along with the feedback from farmers. A detailed assessment has been made in this study about the extent of adoption/non adoption of rainfed technologies and the factors responsible for adoption/non adoption. Adoption index was computed for assessing the extent of technology adoption. Strategies for improved adoption of technologies for livelihood improvement have been suggested.

Based on a field survey and interview carried out with 120 rainfed farmers' in *Nallavelli* and *Manmarri* villages (60 each) of Institute Village Linkage Program (IVLP) representing alfisols and vertisols respectively (IVLP project was launched under the auspices of the National Agricultural Technology Project). IVLP was operational during the period 1999-2004. Assessment and refinement of appropriate rainfed technologies for risk prone and low income categories of farmers on participatory mode in different micro farming situation is the main focal point of the programme. Rainfed technologies can contribute to the economic, social and environmental development of farming communities, improving their livelihoods and sustainability. Hence, the farmers in the above villages were exposed to CRIDA rainfed technologies for five years and later tested in this study for their adoption rates. These villages come under Rangareddy district of Andhra Pradesh state of South India. Rangareddy district is characterized by semi-arid climate, receiving mean annual rainfall of 820 mm. Data inputs were collected using a structured and pre-tested interview schedule containing both closed end and open-ended questions. Focused group discussion and interviews were conducted in the villages to elicit data from farmers and examined for their accuracy. Frequency and Percent analysis were used for analysis of data of each village and soil type. Adoption was derived by assigning scores of 0, 1, and 2 for non, partial and full adoption of technologies respectively. In *Nallavelli* (alfisols), total rainfed technologies listed (recommended) were 20 and hence maximum adoption score that can be obtained is 40, while minimum adoption score that can be obtained by a farmer is 0. In *Manmarri* (vertisols), total rainfed technologies listed were 16 and hence maximum adoption score that can be obtained is 32, while minimum adoption score that can be obtained by a farmer is 0. Adoption indices were computed for assessing the technology adoption. Adoption index is derived by the formula,

Adoption index =

$$\frac{\sum_{i=1}^{k} X_i}{K},$$

where Xi is score on i^{th} technology, K is the number of technologies

Correlation and regression coefficients were computed to find the nature of relationship between different socio-economic variables like age, education, family size, farming experience, farm size, income and adoption. The socio-economic variables for the present study had been selected after extensive review of literature and after examining their relevance, and in consultation with experts and various sources of information.

4. Results and Discussion

Sorghum + pigeonpea and castor are the important crops grown in alfisol areas, while maize and cotton are predominant crops in vertisol areas of the study during *kharif*. Chickpea and safflower are the major crops grown during *rabi* and summer in both alfisols and vertisols. Among other enterprises, dairying is an important supplementary income generation activity seen in most of the families owning land. Sheep and goat rearing are also important enterprises for 10% of the families in the two villages studied.

a) Socio-economic profile of farmers (alfisols)

From the selected farmers' (60), 53% of them are above the age of 44 and having land holdings up to five acres; 83% had no education; 40% had more than 30 years of farming experience; 70 % were having annual income ranging between Rs.10,000-30,000/-. The cropping systems which are predominant are sorghum + pigeonpea with late sown castor/horse gram/green gram crops. About 87 % had livestock possession in the village.

b) Adoption of Rainfed Technologies in Nallavelli (alfisols)

The different rainfed technologies and their adoption along with reasons for adoption in semi-arid alfisols are given in Table 1. Late sowing of horse gram / castor / green gram was found to have a maximum adoption of 97%, followed by sorghum + pigeonpea intercropping in 5:1 row ratio with 93%, castor intercropped with cowpea (80% adoption), conservation furrows at 1.2 m. interval in sorghum with 73%, and recommended fertilizer for sorghum with 60% adoption. In a study of improved farm practices among women farmers in Osun state of Nigeria, 100% of women farmers had adopted the application of fertilizers based on recommendations (Okunade, 2006).

In case of the technologies with less than 50% adoption, soil and water conservation measures like (field bunds, waste weirs on field bunds, stone checks, etc.) had a maximum of 40% adoption. Summer tillage, ploughing across the slope and field bunds, is mostly adopted by almost all the rainfed farmers. The remaining four technologies from Table 1 had an adoption of less than 10% based on the study. A study on the adoption of improved tree fallows was also found to have labour constraints and had a significant impact on the adoption decision, since the tree fallows are a relatively labor using technology (Franzel, 1999).

Table 1. Adoption of Rainfed Technologies in *Nallavelli* village

Sl. No.	Rainfed Technology	Adoption (%)	Reason for adoption / non adoption as expressed by farmers
A. Technologies with adoption > 50 %			
1.	Sorghum+pigeonpea cropping system in 5:1 ratio.	93	Sorghum comes handy for fodder purpose and pigeonpea for family consumption.
2.	Late sowing (under contingency) of horse gram/castor/ green gram.	97	For fodder as well as consumption purpose.
3.	Conservation furrows at 1.2 m interval in sorghum system.	73	Helps in water retention and aeration.
4.	Recommended dose of fertilizers in sorghum system viz., basal 10-25-0 NPK kg/acre and top dressing of N 20 kg/acre.	60	Convinced of judicious application of fertilizers for realizing higher yields.
5.	Castor intercropped with cowpea.	80	Profitable.

Sl. No.	Rainfed Technology	Adoption (%)	Reason for adoption / non adoption as expressed by farmers
B. Technologies with adoption < 50 %			
6.	Conjunctive use of inorganic N (urea) and organic N (*Subabul* and *Glyricidia* loppings).	10	Non-availability of trees, low awareness and labour problem.
7.	Soil and water conservation measures (field bunds, waste weirs on field bunds, stone checks, etc.).	40	No water recharge and maintenance problem.
8.	Dryland implements.	10	Not working in undulating land except seed cum fertilizer drill and manual weeder. The farmers require more number of implements (to enable custom hiring) in the village.
9.	Urea treatment of rice straw.	10	This is a costly and labour intensive technology and has low awareness.
10.	Urea Mineral Molasses Block feeding to cows and buffaloes.	7	Taste is not acceptable to animals.

Sl. No.	Rainfed Technology	Adoption (%)	Reason for adoption / non adoption as expressed by farmers
11.	Balanced nutrition (grazing + concentrate + mineral mixture).	7	Resource is costly. Only bran, green fodder, sorghum stovers are acceptable. Some farmers are giving cake. Partial adoption is predominant.

c) Socio-economic profile of farmers (vertisols)

From the selected farmers' (60), 40 % of them are above the age of 44 and 60 % are having land holdings up to five acres; 47 % had no education; 33 % had 11 to 20 years of farming experience; 63% were having annual income in the range of Rs. 10,000-30,000/-. The cropping systems which are predominant are maize + pigeonpea, cotton and *rabi* chick pea/ coriander. About 60% farmers had livestock possession.

d) Adoption of Rainfed Technologies in Manmarri (vertisols)

The different rainfed technologies and their adoption along with reasons for adoption in the vertisols are given in Table 2. Bt cotton cultivation was found to have a maximum of 100% adoption, followed by maize + pigeonpea cropping system in 5:1 ratio with 90% adoption, only chemical component of pest management for Bt cotton (especially sucking pests) and for non-Bt cotton with 73%, additional N application @ 20 kg/acre after relief of drought in maize system had 68% adoption and recommended dose of fertilizers in maize system viz., basal and top dressing with 57% adoption. In case of the technologies with less than 50% adoption, dryland implements had 13% adoption. Optimum soil moisture content is an important criterion for running the implements in black soils. Too high or too low soil moisture would deter the operation of implements in black soils. The remaining technologies had less than 10% adoption based on the study.

Table 2. Adoption of Rainfed Technologies in *Manmarri*

Sl. No.	Rainfed Technology	Adoption (%)	Reason for adoption / non adoption as expressed by farmers
A. Technologies with adoption > 50 %			
1.	Maize + pigeonpea cropping system in 5:1 ratio.	90	Farmers were previously cultivating in 4:1 ratio, now realizing higher yields with recommended ratio of 5:1.
2.	Recommended dose of fertilizers in maize system viz., 40-44-25 NPK kg/acre basal and N 20 kg/acre top dressing	57	Farmers were previously applying high doses. Now convinced to apply required doses at appropriate times for achieving high yields.

Sl. No.	Rainfed Technology	Adoption (%)	Reason for adoption / non adoption as expressed by farmers
3.	Cultivation of Bt cotton. (CRIDA's role was to inform farmers' about this technology)	100	Farmers were convinced of the benefits like less number of chemical sprays, savings in labour and time and attaining higher monetary returns.
4.	Only chemical component of pest management for Bt cotton especially sucking pests and for non-Bt cotton.	73	Readily available while other management methods labour intensive.
5.	Additional N application @ 20 kg/ acre after relief of drought in maize system.	68	High awareness and understanding among farmers has developed.
B. Technologies with adoption < 50 %			
6.	Soil and water conservation measures like contour bunds and farm ponds.	7	Low water recharge and maintenance problem.
7.	Mulch cum manure technique with *sunhemp* in *kharif* fallows.	7	Non-availability of plant material and labour intensive.

Sl. No.	Rainfed Technology	Adoption (%)	Reason for adoption / non adoption as expressed by farmers
8.	Dryland implements.	13	Require more force to operate due to soil build up in case of planter, weeder. Inadequate availability and require at least one implement for five persons.
9.	Urea treatment of rice straw.	10	Labour intensive method and less preferred by farmers.
10.	Urea Mineral Molasses Block feeding to buffaloes.	7	Taste is unacceptable to buffaloes and farmers are going for alternative feeding mechanisms.

e) Adoption indices for assessing technology adoption

Adoption indices were computed in Table 3 for the sample farmers based on which they were categorized into low (score range <33), medium (33-66) and high adoption (>66) in both vertisols and alfisols. The adoption indices determined for adoption of rainfed technologies in alfisols indicated that there is a mean adoption of 32.5% in low category, a mean adoption of 53.7% with a coefficient of variation (c.v.) of 14.5% under medium category, and a mean adoption of 82.5% with a c.v. of 17.5% under high category. The mean adoption indices in vertisols indicated that there is a mean adoption of 25% with a c.v. of 17.1% under low category, and mean of 48.5 % with a c.v. of 19.1% under medium category, and a mean adoption of 70.3% with a c.v. of 2.6% under high category. The number of farmers with medium adoption index was predominantly observed in both alfisols (52) and vertisols (38). This is because of the reason that for certain rainfed technologies like row ratios, fertilizer recommendations (less deviation from farmers' practices), intercrops and cultivation of Bt cotton; the adoption scores and values were found to be highly significant. The need to access credit can prevent adoption (Bhalla, 1979; Lipton, 1976; Lowdermilk, 1976).

Table 3. Adoption indices of farmers for Rainfed Technologies in Alfisols and Vertisols

Statistic/ Category	Number of farmers	Mean Adoption Index (%)	S.D.	C.V. (%)
Nallavelli (Alfisols)				
Low (<33)	4	32.5	—	—
Medium (33-66)	52	53.7	7.8	14.5
High (>66)	4	82.5	14.4	17.5
Manmarri (Vertisols)				
Low (<33)	18	25.0	4.3	17.1
Medium (33-66)	38	48.5	9.3	19.1
High (>66)	4	70.3	1.8	2.6

Lack of credit limits adoption of technologies even when fixed costs are not large (Bhalla, 1979). Shortage of funds was cited as a major constraint on adoption of divisible technologies (Frankel, 1971; Khan, 1975). Technologies like dryland implements, soil and water conservation, and livestock technologies showed poor adoption rates because of labour problem. Shortages of family labour explained the non-adoption of technologies in India (Harris, 1972). Labour intensive technologies are more readily adopted by households with a higher labour supply (Hicks and Johnson, 1974). Adoption is the outcome from the five-stage process viz., awareness, interest, evaluation, trial and adoption. From farmers' point of view, awareness about technologies is one thing, which has to be supported with resources like finance, material and labour for adoption. In developing an expression for explaining the time lag between stages in the adoption, the time lag between awareness and adoption is related to the variance of actual profit (Linder *et al*., 1979).

f) Estimates of correlation of technology adoption with different socio-economic variables under different soils (alfisols and vertisols)

Based on the estimates of correlation given in Table 4, education and farm size were significantly correlated with the adoption in alfisols, while, farm size and annual income were significantly correlated with adoption in vertisols.

Table 4. Estimates of correlation of technology adoption with different socio–economic variables in different soils

Variable	Alfisols (Nallavelli)	Vertisols (Manmarri)
Age	-0.131	-0.248
Education	0.331*	-0.081
Family size	-0.209	0.170
Farming experience	0.027	-0.165
Farm size	0.346*	0.323*
Annual income	0.241	0.592**

* and ** indicate significance at $p < 0.05$ and $p < 0.01$ level respectively.

Positive and significant relation was reported between annual income and adoption (also between farm size and adoption) of recommended dryland agricultural technologies from dryland farmers in Aurangabad district of Maharashtra state (Dakhore *et al*., 1993). The annual income and land holding of farmers have significantly influenced the level of adoption of recommended cultivation practices at $p< 0.01$ level in Rangareddy district of Andhra Pradesh state (Prasad, 1995).

g) *Regression model of adoption scores with different socio-economic variables*

Based on the regression models of adoption scores (Table 5), through age, education, family size, farming experience, farm size and annual income calibrated for each soil type, the variables of age, education and farm size of farmers under alfisols and farm size, annual income under vertisols were found to be significantly contributing to the adoption of a technology. A maximum and significant predictability (R^2) of 0.45 was found based on the model calibrated for vertisols, while a significant predictability of 0.37 was found for alfisols.

Table 5. Regression model of adoption with socio-economic variables

Soil type (Village)	Regression model	R^2
Alfisols (Nallavelli)	Adoption = 38.15 – 3.68* (Age) + 1.91* (Education) –3.20 (Family size) + 0.18 (Farming experience) + 0.41* (Farm size) + 1.77 (Annual income)	0.37*
Vertisols (Manmarri)	Adoption = 22.77 – 0.53 (Age) – 1.88 (Education) –0.54 (Family size) + 0.02 (Farming experience) + 0.29* (Farm size) + 5.86** (Annual income)	0.45*

* and ** indicate significance at $p < 0.05$ and $p < 0.01$ level
R^2 : Coefficient of determination

The education, farming experience, farm size and annual income were found to have a positive effect, while age and family size had a negative effect on the adoption index under alfisols. Similar positive but insignificant relationship were observed between income, education, and farming experience and adoption in a study of factors influencing the adoption of improved farm practices among women farmers in Osun state of Nigeria (Okunade, 2006). However, farming experience, farm size and annual income had a positive effect, while age, education and family size had a negative effect on the adoption index under vertisols based on the study. The farm size and annual income were found to significantly influence the adoption of a rainfed technology in vertisols. It is evident that older farmers, who are in general less educated than their younger counterparts, are not eagerly adopting new technologies.

5. Conclusion

- Row ratios, intercrops, conservation furrows were the major adopted rainfed technologies.
- Labour and capital intensive technologies were least adopted by the farmers.
- Majority of the farmers (52 out of 60) have medium adoption of rainfed technologies (mean adoption index of 53.7%) in Nallavelli under alfisols.
- Majority of the farmers (38 out of 60) have medium adoption of rainfed technologies (mean adoption index of 48.5%) in Manmarri under vertisols.
- The predictability (R^2) of adoption was 37% in alfisols and 45% in vertisols respectively.

- The study results can be used to design better extension programmes and to make recommendations for policies that will lead to higher rates of adoption for rainfed agricultural technologies.

6. References

Bhalla, S.S. 1979. Farm and Technical change in Indian Agriculture, In *Agrarian Structure and Productivity in Developing Countries*, (Eds Berry, R. and W. Cline.). Baltimore: Johns Hopkins University Press.

CRIDA, 2007. Annual Report 2006-07. Central Research Institute for Dryland Agriculture. Hyderabad. A.P., India p.132.

CRIDA, 2009. Annual Report 2008-09. Central Research Institute for Dryland Agriculture, Hyderabad, A.P., India. p. 130.

Dakhore, K.M., Mahajan, B.S. and Digraskar, S.U. 1993. Adoption of Dryland Technology by Farmers. *Maharashtra Journal of Extension Education*, 12:215-218.

Farooque Mohammed, 1990. A Study on the Adoption Behavior of Farmers of Drought Prone Area, Aurangabad District of Maharashtra State. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad.

Feder, G. and Umali, D.L. 1993. The Adoption of Agricultural Innovations: A Review. *Technological Forecasting and Social Change* 43: 215-239

Frankel, F.R. 1971. *India's Green Revolution-Economic Gains and Political Costs*. Princeton: Princeton University Press.

Franzel, S. 1999. Socioeconomic Factors affecting the Adoption Potential of improved tree fallows in Africa. *Agroforestry Systems* 47: 305-321.

Harris, B. 1972. Innovation Adoption in Indian Agriculture-the high-yielding variety program. *Modern Asian Studies*, 6.

Hicks, W.H. and R. Johnson, 1974. Population Growths and the Adoption of New Technology in Taiwanese Agriculture. Working Paper in Economics no. 1974-E6. Columbia: University of Missouri.

Jones, Kelly Michelle 2005. Technology Adoption in West Africa: adoption and disadoption of soybeans on the Togo-Benin border. M.S. Thesis submitted to the North Carolina State University, Raleigh, NC.

Khan, M.H. 1975. *The Economics of the Green Revolution in Pakistan*. Frederick A. Praeger, New York.

Leathers, H.D. and M. Smale. 1992. A Bayesian approach to explaining sequential adoption of components of a technological package. *American Journal of Agricultural Economics*, 68: 519-527.

Lindner, R.K. 1987. Adoption and diffusion of technology: an overview. In: *Technological Change in Post harvest Handling and transportation of Grains in the Humid Tropics,* (eds. B.R. Champ, E. Highly, and J.V. Remenyi). *ACIAR Proceedings Series*, Australian Centre for International Research, No. 19: 144-151.

Linder, R.K., Fisher, A. and Pardey, P. 1979. "The Time to Adoption." *Economic Letters* 2: 187-90.

Lindner, R.K., Pardey, P.G and Jarrett, F.G. 1982. Distance to information source and the time lag to early adoption of trace element fertilizers. *Australian Journal of Agricultural Economics,* 26: 98-113.

Lipton, M. 1976. Agricultural Finance and Rural Credit in Poor Countries. *World Development,* 4: 543-554.

Llewellyn, R.S., Lindner, R.K., Pannell, D.J., Powles, S.B. 2003. Effective information and the influence of an extension event on perceptions and adoption, Paper presented at the 47th Annual Conference of the Australian Agricultural and Resource Economics Society, Fremantle, Western Australia, February 12-14, 2003.

Lowdermilk, M. 1976. Diffusion of Dwarf Wheat Production Technology in Pakistan's Punjab. Ph.D. Dissertation, Cornell University.

Marra, M., Pannell, D.J. and. Ghadim, A.A. 2003. The Economics of Risk, Uncertainty and Learning in the Adoption of New Agricultural technologies: Where Are We on the Learning Curve? *Agricultural Systems*, 75(2/3): 215-234.

Marsh, S., Pannell, D., Lindner, R. 2000. The impact of agricultural extension on adoption and diffusion of lupines as a new crop in Western Australia, *Australian Journal of Experimental Agriculture,* 40, 571-583.

Okunade, E.O. 2006. Factors Influencing Adoption of Improved Farm Practices among Women Farmers in Osun State, *Journal of Human Ecology*, 19(1): 45-49.

Padmaiah, M., Rammohan Rao, M.S., Chittaranjan, S. and Selvaraj, S. 1992. Impact of Watershed Management Programme on Knowledge, Attitude and Adoption Behaviour of Farmers in Joladarasi Watershed of Bellary District, Karnataka, *Indian Journal of Soil Conservation*, 20 (1&2): 37-43.

Prasad, M.S. 1995. Adoption of Dryland Agricultural Technologies by Farmers of Rangareddy District (A.P.): A Retrospective Analysis. Ph.D. Thesis, Department of Agricultural Extension Education, University of Agricultural Sciences, Dharwad.

Rogers, E.M. 1962. *Diffusion of Innovations*. Macmillan Company, USA.

Suri, T. 2009. Selection and Comparative Advantage in Technology Adoption. National Bureau of Economic Research, Working paper No. 15346, www.nber.org/papers/w15346 Accessed 14 April, 2010.

Wasnik, S.M. 1988. Adoption of Dry farming Technology in Progressive and non-progressive Villages. *Maharashtra Journal of Extension Education*, 7:201-204.

Tsur, Y.M. Sternberg, and E. Hocham. 1990. Dynamic Modeling of Innovation Process adoption with risk aversion and Learning. *Oxford Economic Papers* 42:336-355.

-- ❄ --

CRIDA

Central Research Institute for Dryland Agriculture

Santoshnagar, Saidabad, Hyderabad- 500059 (A.P.)
Ph:040-24530157/161/163 Fax:040-24531802
E-mail: root@crida.in Website: www.crida.in