Full Length Research Paper

Adoption and consequences of technologies on rural women

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Determinants of adoption of new technology among rice producers in Fars and Mazandaran provinces and study of the impact of these technologies on women are the main objectives of this paper. Three hundred female family labor and 220 female-hired labor were randomly selected with two-stage cluster sampling technique. Findings showed a positive correlation between technology adoption and amount of female family labor activities in seed disinfection and seed selection. The regression findings showed that participation of women in decision makings and access and attending in educational classes were major variables to explain variability in adoption of rice technologies. Female hired labor activities in transplanting had a negative correlation with technology adoption. Mechanical technology adoption reduced women activities in transplanting and harvesting stages and, as a result, decreased women's income.

Key words: Women, adoption of technology, rice, consequences.

INTRODUCTION

There is a considerable potential for increasing the role and participation of women in agricultural research, extension and development. But very little of this potential has been realized. In order to get a better grasp of the challenges facing women in agriculture, we must pay special attention to their role and activities in agriculture and consequences of technologies on their status.

The impact of new agricultural technology on women depends on many factors including the role and position of women in specific agricultural systems; external factors influencing agricultural production; and the nature of technology (Fresco, 1983). The nature of technology is very important and should be analyzed as the following characteristics: technology that is land-saving or labor demanding; post-production or post-harvest labor-saving technology; technology that allows an area increase; and changes in cultivation techniques.

A labor constraint, particularly for women's tasks, may be an obstacle to successful adoption of a technological change. Boserup (1965) in her classic work on women in African agriculture, first drew attention to the gender-specific aspects of distribution of labor input in agriculture and its implications for development strategies. In fact, the choice of technology requires consideration of the labor bottlenecks imposed by women's time constraints.

Kakooza et al. (2005) argued that we must move beyond the single dwelling unit or household. He has emphasized that it is necessary to look inside the "node", that is, investigating intra-household relations and the place of gender in farming systems.

Technological change in rice cultivation is necessary to increase farmers' income and improve the standard of living of rice farmers, especially the poor ones. Two major groups of technologies are used in rice cultivation: mechanical technologies such as transplanting machine, combine and tailor, and non-mechanical technologies such as herbicide. The impacts of these two groups on rural women are different. The technologies with more labor activities, have positive impact to increase women's income. On the contrary, the labor-saving technologies decrease the amount of female-hired labor activity and their income. In sum, these technologies can increase employment opportunities, productivity of land and access to information related to these new technologies (Waggoner, 2004; Doss and Morris, 2001).

New agricultural technologies that increase labor demand on family fields may have an adverse impact on the income controlled by women resulting from the reduction of women's income from private-plot activities (Lilja and Sanders, 1998; Arndt and Trap, 2000). The

extension of second cultivation of rice has increased productivity of production resources, the activity and income of rice-producer women (Naved, 2000). The labor-saving technologies such as transplanting machine and combine have decreased the difficulty of women labor by realization of women (Arndt and Trap, 2000). Waggoner (2004) and Grainger (2003) in Philippine showed that the use of new varieties of rice needs more women labor. This process has increased employment of women in different regions. On the other hand, many researchers have shown that the mechanical technologies such as transplanting machine and combine have excluded the major labor of rice- producing women and have decreased their incomes (Naved, 2000; Lilja and Sanders, 1998; Waggoner, 2004). Based on the study of Tisch and Paris (1994) the use of herbicides has decreased the activities of women in weeding.

If certain groups of farmers are not adopting improved technologies or are adopting them at a lower rate than other groups, then we need to determine why, because only by understanding the reasons will we be able to develop improved technologies that are appropriate for all. More concretely, since women farmers tend to adopt improved technologies at a lower rate than male farmers, we need to understand the reasons behind what appear to be gender-linked differences in technology adoption rates (Doss and Morris, 2001).

Improvement of water management, using tailor and tractor, introducing new varieties, chemical fertilizers and herbicides, non-chemical procedures and second cultivation in rice lands have raised to increase rice productivity in Iran in recent three decades. Application of these technologies has had different impacts on rice-producer women. Determinants of adoption of new technology among rice producers and investigating the impact of these technologies on women are the main objectives of this paper. The specific goals of the research are:

(i) To determine the relationship between independent variables and adoption of technologies;
(ii) To determine the relationship between adoption of technologies and activities among two women groups (female family labor activity and female-hired labor activity);
(iii) Comparison the impacts of technologies on women.

RESEARCH METHODS

This study was conducted using survey research. A two-stage cluster sampling technique was used to collect data using questionnaire. Forty-two villages from Mazandran and 18 villages in Fars provinces (two provinces in Iran) were randomly selected. Fars and Mazanderan located in south and north of Iran, respectively. The provinces are leading in rice cultivation in country. Rural women are contributing to rice activities in these provinces. Three hundred female family labor and 220 female-hired labor were randomly selected at the second stage of sampling for interview. A package of 10 technologies for rice cultivation was used as index

for adoption. The technologies consists of using transplanting machine and combine, new varieties, seed disinfection prior to cultivation, using a complex of salt and water to choose seeds, herbicides, chemical management, second cultivation in rice production and integrated pest management.

The independent variables were number of households in village, rice producing households in village, age of women, family size, education level of women, education level of men, the land under cultivation of rice, total land of family, yield of rice, background in rice cultivation, income from rice cultivation, number of agricultural loans obtained, amount of agricultural loans obtained, attending in educational classes, number of contacts with extension agents, access and use of TV programs related to rice cultivation and participation in household decisions.

FINDINGS AND DISCUSSION

Adoption of technology in rice producing households

There is a significant relationships between technology adoption and 'the amount of rice producing households in village', 'education of women', 'education of men', 'yield of rice', 'the amounts of loans obtained', 'number of loans obtained', 'attending in educational classes', 'contact with extension agent', 'access and use of TV programs related to rice cultivation' and 'participation in households decisions' (Table 1).

The relationships between technology adoption and education of women ($r = 0.3$) and education of men ($r = 0.4$) were significant and positive at 0.001 level. These findings lend support with the findings of Waggoner (2004), Alamgir Hossain and Crouch (1992), Grainger et al. (2003), Hossain et al. (1994) in Pakistan and Doss and Morris (2001).

There is a positive and significant correlation between technology adoption and yield of rice at 0.001 level. This finding lends support to Arndt and Trap (2000), Pingali (1992) and Naved (2000).

There are positive and significant correlations between technology adoption and the number of agricultural loans obtained ($r = 0.4$) and the amount of agricultural loans obtained ($r = 0.5$) at 0.001 level. These are comparable with the findings of Kerketta (1992) in India and Waggoner (2004).

The relationships between technology adoption and attending in educational classes ($r = 0.6$) and number of contacts with agricultural extension agents ($r = 0.6$) are positive and significant. These findings indicate that how much higher contacts with extension agent and attending in educational classes, there is higher rate of technology adoption. These are comparable with the findings of Naved (2000), Kerketta (1992) in India, Lilja and Sanders (1998), Hossain et al. (1994) in Pakistan and Grainger et al. (2003). Also, the relationship between technology adoption and access to agricultural television programs related to rice cultivation and participation rate of household women in household decisions are significant (Table 1). Naved (2000) suggests that group-based programs targeting women have a greater potential to

Table 1. Correlations between technology adoption and independent variables.

Independent variables	Correlation coefficient
Number of households in village	0.14
Rice producing households in village	0.34**
Age of women	-0.1
Family size	-0.1
Education level of women	0.3**
Education level of men	0.4**
The land under cultivation of rice	-0.04
Total land of family	0.1
Yield of rice	0.3**
Background in rice cultivation	0.1
Income from rice cultivation	0.1
Number of loans obtained	0.4**
Amount of loans obtained	0.5**
Attending in educational classes	0.6**
Number of contacts with agents	0.6**
Access and use of television programs	0.6**
Participation in household decisions	0.7**

** Significant at 0.001 level.

Table 2. Stepwise multiple regression of independent variables on adoption of rice technologies.

Independent variables	Multiple regression	R^2	Adjusted R^2	R^2 changed
Participation in household decisions	0.72	0.529	0.527	0.529
Access and use of TV programs	0.77	0.605	0.603	0.076
Attending in educational classes\	0.798	0.637	0.633	0.032
Yield of rice	0.809	0.655	0.650	0.018
Total land of family	0.814	0.662	0.656	0.007
Education level of men	0.817	0.668	0.662	0.006
Rice producing households in village	0.820	0.673	0.665	0.005
The land under cultivation of rice	0.824	0.679	0.670	0.006
Family size	0.826	0.683	0.673	0.004

address gender relations within the household and society than do programs targeting women as individuals. In male-dominated societies where women have limited access to internal or external support networks, programs targeting women as individuals that do not also provide alternative sources of support are bound to fail in their gender goals.

The results of multivariate regression (stepwise method) of independent variables on adoption of rice technologies have been presented in Table 2. As we see the F-test is significant (F= 67.67, p = 0.00001). The adjusted R square shows that the entered variables on model explain 67.3% of the variance in adoption of rice technologies by women. Table 2 shows that the R^2 changed of participation of women in household decisions is 0.527 that is the most important factor in explaining the variability of adoption. Also, access to television programs related to rice cultivation and number

of training classes explain 0.76 and 0.032% of variability in the adoption of rice technologies, respectively. As it is clear in Table 2, the power of variables yield of rice, total land of family, education level of men, rice producing households in village, land area of rice cultivation and number of family members to explain the variability of adoption of technologies is little.

The value of Beta in Table 3, shows that one standard deviation change in participation of women in household decisions causes a 0.447 standard deviation change in adoption of rice technologies. Also, one standard deviation change in number of family members and number of training classes increase 0.217 and 0.204 standard deviation in adoption of rice technologies by women, respectively. As it is clear in Table 3, a one standard deviation increase in number of family members and land area of rice cultivation decreases the adoption of technologies by 0.145 and 0.079 standard deviations,

Table 3. Stepwise multiple regression of independent variables on adoption of rice technologies.

Independent variables	b	Standard error	Beta	Significance	Partial correlation
Participation in household decisions	0.232	3.6	0.447	0.0000	0.7
Access and use of TV programs	0.354	3.3	0.192	0.0000	0.6
Attending in educational classes	0.710	3.17	0.204	0.0000	0.6
Yield of rice	0.297	3.10	0.113	0.0013	0.3
Total land of family	0.171	3.07	0.125	0.0009	0.1
Education level of men	0.096	3.05	0.076	0.041	0.4
Rice producing households in village	0.008	3.03	0.217	0.031	0.34
The land under cultivation of rice	-0.270	3.01	-0.079	0.031	-0.04
Family size	-0.009	3	-0.145	0.047	-0.1

Constant = -3.484, F= 67.67,   significance = 0.0000.

Table 4. Relationships between technologies adoption of rice cultivation and the activities of women.

The stages of rice cultivation	Correlation coefficients with female family labor activity	Correlation coefficients with female-hired labor activity
1.Land preparing	-0.1	0
2.Seed disinfection	0.3**	0.03
3.Seed selection	0.35**	0.001
4.Wetting of seeds	-0.02	0.02
5.Providing of treasury	0.13	0
6.Transplanting	-0.3*	-0.3*
7.Fertilizer to farm	0.2	0
8.Sprier	0.003	0
9.Weeding	0.11	0
10.Harvesting	0.10	0.1
11.Threshing	-0.05	0

* Significant at 0.01 level,** significant at 0.001 level.

respectively.

Technology adoption and rice-producing women activity

The Pearson correlation test was used to identify relationships between technology adoption in rice cultivation and the activities of rice-producing women (Table 4). The amount of activities of rice-producing women in seed disinfection, seed selection had positive and significant relationships with technology adoption. On the contrary, the use of transplanting machine had negative impact on their activities. We see that transplanting had negative relationship with the activity of women (-0.3). The women have not any activities in land preparing, treasury providing, fertilizer, sprier, weeding and threshing (Table 4).

The consequences of technologies on women labor

The use of transplanting machine has decreased the activity of women in the transplanting stage. The t-test was used to compare the activities of women (female-family labor and female-hired labor) in two types of farms (transplanting with machine and by hand). The findings were provided in Table 5. There is a significant difference between two groups in two types at 0.001 level. As we see in Table 5, the women activities in transplanting by hand are higher than transplanting by machine.

The use of combine has substituted the men and women labor in harvesting stage. The t-test was used to compare the activity of two groups of women (harvesting with the use of combine and traditional harvesting by hand) (Table 6). As we see, the use of combine has decreased the activity of women in this stage. The difference of two groups is significant at 0.001 level.

CONCLUSIONS AND RECOMMENDATIONS

Government policy makers in developed and developing countries are often technological optimists, believing in continued technological change, the ability of technology to substitute for scarce natural resources and improve

Table 5. The comparison of activities of women in mechanical and traditional transplanting.

	Type of transplanting		T	P
	By hand	By machine		
Female-family	2.36	0.12	7.46	0.001
Female-hired	9.2	0.11	9.09	0.001

Table 6. The comparison of activities of women in mechanical and traditional harvesting.

	Type of harvesting		T	P
	By hand	By machine		
Female-family	1.06	0.035	7.02	0.001
Female-hired	1.11	0.17	3.69	0.001

human welfare. The application of modernity has changed the agricultural activities. Application of modern technologies has caused different impacts in villages. Diffusion of rice technology in rural areas has different consequences. Reduction of women activities in rice production is one of the possible consequences of adoption of new rice technologies. The entered variables on model in the study explained 67.3% of the variance in adoption of rice technologies by women. Participation of women in household decisions was the most important factor in explaining the variability of adoption. Also, access and use of television programs related to rice cultivation and attending in educational classes explained part of variability in the adoption of rice technologies. Findings of this study showed a positive correlation between technology adoption and amount of female family labor activities in seed disinfection and seed selection. There was a negative correlation between technology adoption and female family labor activities in transplanting stage. Female hired labor activities in transplanting had a negative correlation with technology adoption. Mechanical technology adoption reduced women activities in transplanting and harvesting stages and, as a result, decreased women's income. The recommendations of this study are as follows:

(i) Agricultural policy makers should prepare especial training about new technologies to rice-producing women. There is necessity to provide extension training in the use of new technologies to rice-producing men and women. It is emphasized to provide television programs in relation to mechanical cultivation of rice. A major point is attention to content of these programs. The consequences of the technologies on women are a major topic of the programs;
(ii) Providing loans and facilities for adoption of new technologies among women is vital to improvement of agricultural development. Women are neglected in development programs especially in access to loans. The related organizations should pay special attention to this factor.
(iii) The study showed the vital role of women in family and rice cultivation decision making. It is necessary to increase their involvement in decisions related to family and agricultural activities. (v) (v) Establishment of women cooperatives is the major recommendation for women employment. Providing facilities and loans to these cooperatives is of great importance for self-employment;
(iv) Also, the cooperatives are of great importance to increase women self-sufficiency. Extending the rural industries in villages to employment of hired women will improve the economic and social status of women. In this regard, development of processing industries in villages to involvement of hired women is very important for rural women;
(v) The research to prepare rice-technologies with less negative impacts on rice-producing women is a special recommendation for future.

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