

DIFFUSION OF AGRICULTURAL INNOVATION: FARMERS' OPINION ON LAND CONSERVATION MEASURES IN PISHIN, PAKISTAN

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ABSTRACT

Land resources in Pakistan are under severe threat of degradation due to population growth. The situation is more serious in the arid and semi-arid areas, where the natural resources, especially the water-resources, are scarce. This paper reviews the study conducted to investigate the farmers' views on land conservation measures in Pishin, Pakistan. Data were collected through survey questionnaires, focus-group discussions and field observations. Increased expenditure, poor extension services and lack of awareness were found to be the major reasons behind the non-adoption of the needed conservation measures. Significant differences were found for adoption of conservation measures by household categories. The study proposes government support and proper assistance to farmers by extension agents for sustainable use of land and water resources.

Keywords: Conservation measures, farmers' views, land degradation

1. INTRODUCTION

Land degradation has affected vast areas of Pakistan (Qasim, et al., 2011). In the past, researchers were merely interested in the assessment of land degradation. Knowing only about the status and causes of degradation cannot solve the problem. This may be analogous to the situation that one has knowledge about the disease but does not know how to treat it.

To avert land degradation and desertification, conservation of land resources is imperative because land is the main source of food for people. The problem of degradation is more severe in arid parts of the country, where soil erosion, unpredictable rainfall and uneven topography make the land productivity very low (Shah, et al., 2012). Farmers from developing countries, including Pakistan, are mostly uninformed about the new technologies for land conservation. Soil and water conservation (SWC) technologies can help enhance agricultural production in water scarce regions. Understanding farmers' opinions on adoption of land conservation bear important policy implications (Lee & Zhang, 2005). This can help identify their concerns regarding adoption of a particular type of conservation measure, as well as their willingness for adoption.

The Balochistan province of Pakistan is the biggest province in terms of land area, but it is most affected in terms of water availability. The farmers in this province are faced with the shortage of water for irrigation. Majority of the farmers from this area only rely on some traditional conservation practices, and they have no access to the modern methods of conservation. Besides these factors, poor extension services, land tenure insecurity, and lack of access to agricultural credits create hurdles in adoption of conservation measures (Qasim, et al., 2011). There has not been any research work done on Soil & Water Conservation (SWC) as far as Balochistan is concerned. There is a pressing need for information dissemination of SWC technologies in arid and semi-arid area for dealing with the land degradation issues. This paper reviews the research focused at analyzing farmers' opinions on adoption of conservation measures, the types of conservation measures and the reasons for non-adoption in Pishin, Pakistan.

2. METHODOLOGY

2.1 Study Area

The Pishin sub-basin was chosen as target area for the research. The area is situated between 29°10' to 31° North latitude and 66°14' to 67°31' East longitudes (Figure-1). It lies to the North-West of Balochistan province of Pakistan (Qasim, et al., 2011). The study area covers about 7,004 Km². The month-wise 30-year average precipitation and average relative humidity of Pishin were 260.75 mm and 46.91, respectively (GoP, 1998a). The area consists of mountains, plateaus and plains. The area is inhabited by the Pashtoons and some Baloch tribes, where elderly male family members have the authority of taking decisions. Due to absence of monsoon rainfall in the area, insufficient and uneven rainfall is received in the winters only. The study area has limited water availability for agriculture purposes. Majority of the farmers from the area are interested in the orchard farming that requires higher inputs. Due to intensive cultivation, the farmers are faced with low soil fertility, lowest crop yields in the country and degradation of their farmlands. The farmers are unable to pay regular attention to their holding due to several socio-economic constraints. If the problems continue in the future, severe consequences on the food security of the area are inevitable. Pishin was selected as a study area based on the fact that the farmers in the area are overdrawing

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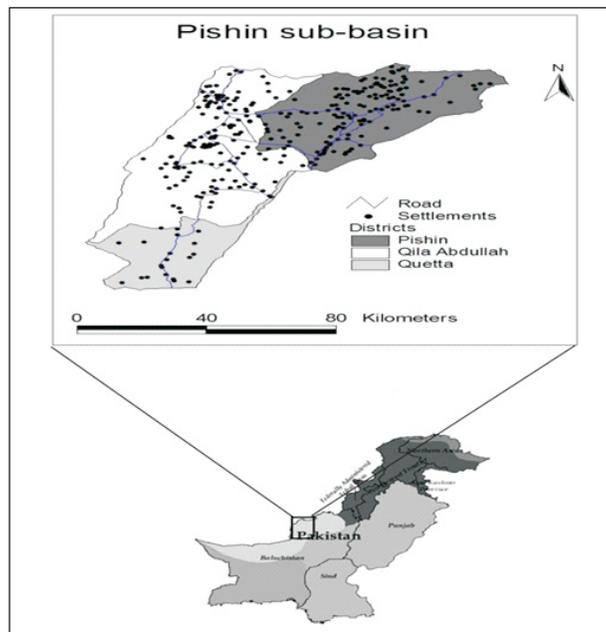


Figure-1: Study area: Pishin Sub-basin

the limited water resources of this ecologically fragile region.

2.2 Methods

Before the field survey, a reconnaissance survey was arranged for the area to know about the problems of the farmers. The study used questionnaire, focused group discussions (FGDs) and field observations as information gathering tools for collection of primary data. There were an estimated 72,752 families with about 471,316 family members in Pishin (GoP, 1998b). Using sample size estimation following Yamane (1967), a sample size of 200 farm households was chosen for the study. The questionnaire contained both close and open ended questions on SWC. Two students of M.Sc (Geography) were hired for getting the questionnaire filled from the respondents. The focused group discussions (FGDs) were also carried out with the elder members in the area to get information about the use and rights of the natural resources and the facilities provided by the extension agents in the area. Further, photographs were also taken to record the conservation measures used by the farmers.

This study uses land users' opinions, an important method for the assessment of conservation measures. Studies have shown that the views and interests of the land users are imperative for policy implications because they are the principle

stakeholders of the land. The male heads of the households were consulted for survey and FGDs because the females were not permitted to give their opinions due to cultural and religious norms.

The statistical software, SPSS version 16 was used to analyze the collected data for quantitative analysis and drawing inferences. Descriptive statistics and chi square were employed to analyze data. Family size and land holding sizes were divided into different categories, to find the adoption of conservation measures by the family and establish land holding categories. Cross-tabulation in SPSS was used for this purpose.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Profile of the Respondents

Results revealed that majority of the respondents (>75%) were uneducated. The average age of the respondents was 57 years. The average household size was nine. With the minimum and maximum values of 5 and 14, respectively, the household size was divided into three categories of small (1-5), medium (6-10), and large (11-15). Majority of the respondents belonged to the medium category of household size. The average land holding size was 46.51 acres. The land holding sizes were divided into five classes of marginal (0-25), small (26-50), medium (51-75), large (76-150) and very large (151-300). A large majority of

Table-1: Adoption (by Family Size)

Family size	Non-adoption	Adoption	Total
	% respondents		
Small (1-5)	1.8 (2)	8.9 (8)	5.0 (10)
Medium (6-10)	79.1 (87)	74.4 (67)	77.0 (154)
Large (11-15)	19.1 (21)	16.7 (15)	18.0 (36)
Total	100.0 (110)	100.0 (90)	100.0 (200)
Chi Sig. Level	P=0.07		

Note: Number of Observation is shown in Parentheses. (Source: Field survey)

the respondents was engaged in agricultural activities. Nearly half of the respondents were facing problems of land tenure insecurity. It was found that only 15% respondents were receiving help from extension agents.

3.2 Adoption and Non-adoption of Conservation Measures

Land is an important resource as it provides necessary means for food and other basic necessities. This resource, however, requires proper care. Like in any other developing country the adoption of conservation measures in Pakistan has socio-economic consequences. In majority of cases, large families not only over cultivate their lands in order to feed their family members but they also have limitations when spending on conservation of their lands. The study revealed that only 45% farmers of Pishin had adopted a few conservation measures. It was found that most of the small size families were taking conservation measures. This may be for the reason that the small families had least domestic expenditures and were able to spare more funds for conservation of their lands. On the other hand, adoption by medium and large-size families did not show much difference ($2 p > 0.00$) (Table-1). Of the non-adopters, bulk (71.8%) of the farmers, reported increased expenditures for non-adoption. 24.5% showed lack of awareness and 3.7% reported rented land for non-adoption. This means that the problems of land conservation are more prominent in areas where the farmers have poor socio-economic status, land tenure insecurity and lack of awareness. The farmers are still unaware of the modern methods and technological improvements, despite the availability of relevant research publications and media advertisements.

Out of the adopters, majority (77.8%) attributed the reason for adopting conservation measures to indigenous knowledge; some (14.4%) mentioned neighboring farmers, while 7.8% gave extension agents the credit for adoption of conservation

measures. The extension agents can play a key role in disseminating the latest methods of soil water conservation. The results of this study revealed that only few farmers received assistance from the extension agents. This could be one of the main reasons behind the non-adoption and that is why the farmers are faced with the problems of land degradation.

3.3 Main and Sub-types of Conservation Measures and Farmers' Views on their Advantages

Based on the learnings of World Overview of Conservation Approaches and Technologies (WOCAT), a questionnaire was developed for the respondents to learn about their preferred conservation measures, (i.e. agronomic, vegetative, structural and management). The results showed that about 80% respondents applied agronomic measures on their farms. This may be due to the reason that the agronomic measures were economical. 17.7% farmers applied structural measures, and vegetative measures (windbreaks) were used by only 2.7% farmers. The structural measures are very expensive, and the farmers were unable to adopt such conservation techniques because of their low economic status. Management measures, such as fencing rangelands, cut and carry of fodder and rotational grazing, were totally absent in the area. The focused group discussion revealed that overgrazing does not bring any problems to the rangelands. The farmers that used compost and fertilizers mentioned that they use it for maintaining soil fertility. The results of the focused group discussion further revealed that the farmers did not apply the amounts and the types of chemical fertilizers required by their farms, and they were also unaware about the harmful effects of excess use of fertilizers. About 5% of the farmers used flood irrigation (Figure-2) for wheat (Figure-3) and also for water-melon. Flood irrigation in the area is being used since ancient times. This is a good practice to augment cultivated land resulting in higher crop-yield. However,



Figure-2: Flood Water Harvesting for Wheat Cultivation



Figure-3: Wheat Crop Grown on Flood Water



Figure-4: Stone-walled Terraces Used for Fruit Trees



Figure-5: Terraces Used for Wheat Crop



Figure-6: Wind Breaks



Figure-7: Compost use before sowing crops

Table-2: Types of Fertilizers used by farmers

Type	Frequency	%
DAP	31	34.4
Urea	29	32.2
Nitrophos	30	33.3
Total	90	100

Source: Field survey

Table-3: Fertilizer Use by Farm Size

Farm size (acres)	Amount	
	Kg/acre	% of farm size
Marginal (0-25)	179.69±81.18 (32)	35.56
Small (26-50)	153.45±59.66 (29)	32.22
Medium (51-75)	208.33±101.88 (12)	13.33
Large (76-150)	193.33±113.18 (15)	16.67
V. Large (151-300)	200.0±0.00 (02)	2.22
Total	177.78±84.17 (90)	100
F.Sig.Level	0.327	

Note: Average amount in kilogram/acre ± standard deviation;
Number of observation is shown in parentheses. (Source: Field survey)

Table-4: Compost Use by Farm Size

Farm size (acres)	Amount	
	Kg/acre	% of farm size
Marginal (0-25)	721.88±554.59 (32)	35.56
Small (26-50)	1,041.38±1,430.16 (29)	32.22
Medium (51-75)	791.67±554.66 (12)	13.33
Large (76-150)	630.00±538.45 (15)	16.67
V. Large (151-300)	1,175.00±1,167.73 (02)	2.22
Total	828.89±936.97 (90)	100
F.Sig.Level	0.327	

Note: Average amount in kilogram/acre ± standard deviation;
Number of observation is shown in parentheses. (Source: Field survey)

this irrigation practice has a shortcoming that it is dependent on climatic situation, i.e., availability of flood water. Therefore, sometimes the farmers face uncertain situations in terms of crop yield. An equal number of respondents used terraces for fruit trees (Figure-4) and also for wheat (Figure-5). The terraces were used in the mountainous part of Pishin, known as Barshore. The farmers in this area were faced with severe soil and water related issues. However, the farmers have learned to construct stone-walled terraces as shown in Figure-4. The farmers knew how advantageous the conservation measures were for their farms. For example, they reported that flood

irrigation increases crop production, and terraces help manage soil erosion and conserve water. Very few of the respondents (1.5%) used wind breaks (Figure-6) on their farms. The farmers knew that using windbreaks protects their crops from grazing animals and strong winds.

3.4 Management of Crop Remains

The crop residue is an important source, which can be used for conservation of lands, especially in areas having serious threats of soil and water erosion. Besides controlling soil erosion, crop residue helps

Table-5: Starting time for flood irrigation

Time	Frequency	% age
15 years ago	1	10
25 years ago	2	20
Over 25 years ago	7	70
Total	10	100

Source: Field survey

Table-6: Farmers' views on support needed to adopt SWC

Support type	Frequency	%*
Technology and training	200	38.8
Alternate livelihood opportunities	192	37.3
Financial support	80	15.5
Construction of dams	43	8.3

Note: *Multiple response percentages. Source: Field survey

increase soil fertility, if it is burnt in the farms before cultivation of next crop. However, the results of this study revealed that the farmers were neither burning crop remains in the fields nor were leaving those in their fields to get it decomposed, ultimately adding to soil fertility. All the farmers using crop remains replied that they stored it for using it as livestock feed. The results suggest that either the feed resources for livestock were insufficient or the farmers were unaware of the proper use of crop residues.

3.5 Fertilizer Quantifies Used for the Crops

Fertilizers mostly used by farmers were Diammonium Phosphate (DAP), urea and nitrophos. Table-2 shows the fertilizer quantities used by farmers. The average amount of fertilizer used per acre of land was higher for the medium farm categories, followed by very large, large, marginal and small categories. However, the fertilizer amount for the farm categories did not differ significantly (F-test $P > 0.32$) (Table-3). The results suggest that farmers were unaware of the suitable type and required quantities of fertilizers for use.

3.6 Compost use by Farm Size

Compost use is more advantageous than chemical fertilizers because the agricultural products from compost have no side effects on human health. Most of the people in developed countries prefer vegetables produced through organic farming. Generally farmers in the study-area were using compost (Figure-7) to

maintain fertility of their farm lands. Table-4 shows the compost quantity used in farms of different holding sizes. The quantity was higher for the very large farms, followed by small, medium, marginal and large categories. However, there was no statistical difference for the average amount of compost by different farm categories (F-test $P > 0.32$) (Table-4). The farmers in the area also rear livestock. The majority of the farmers prefer goat and sheep for rearing. Cows and bulls were also being reared but buffaloes were not reared as they require more feed resources. The kitchen wastes and the wastes of these animals were used for compost making. The compost quantitative supplied to the farms was not sufficient. A few of the farmers managed to buy compost to maintain the fertility of the soils.

3.7 Flood Irrigation

Flood irrigation also called 'Sailaba irrigation' in native language is being used in the region since ancient times. In the past, due to low population and low demands, the 'Karez system' of irrigation was used. As the population in Pakistan increased and the production did not remain sufficient, there has been a sharp increase in the electric tubewells since 1970. With further increase in population, the farmers of the area tried to cultivate even on the marginal lands. Of the farmers who used flood water for irrigation, majority (70%) mentioned that they had been using flood water for irrigation for more than 25 years; 20% of them mentioned about 25 years, while 10% mentioned

the use of flood water harvesting since last 15 years (Table-5). The farmers also mentioned that their crops were affected by the uncertain climatic conditions and sometimes they cannot even cultivate if there is no rainfall.

3.8 Using Drip and or Sprinkle Irrigation and their Perceived Advantages

The micro-irrigation technology is used throughout the world, especially in the arid and semi-arid areas in order to augment water supply for the crops. However, the results of this study revealed that not a single farmer from the target group had reported the use of drip and sprinkle irrigation on their farms. The farmers were asked to give reasons for not using this technology, to which about 52% mentioned lack of awareness, 37% reasoned increase in expenditures and 11% considered that the technique is not advantageous. It can be concluded that majority of farmers were willing to adopt this technology, but they were unable to do so because of ignorance and lack of support from the governmental organizations.

3.9 Farmers' Views on Support they Need for Adoption of Conservation Measures

To combat land degradation, the farmers should be given proper assistance by the government to adopt soil and water conservation techniques. The results revealed that majority of the responses were encouraging introduction of latest technology and trainings, followed by alternate livelihood opportunities, financial support and construction of delay action dams. Overall results revealed that the farmers from the area were inclined to learning about new technologies and trainings to increase the agricultural production (Table-6).

4. CONCLUSIONS

This paper based on a field survey and focused group discussion was written to help understand the farmers' opinions on land conservation in Pishin (Balochistan), the reasons behind adoption and non-adoption of conservation techniques, and the support the farmers' require to adopt conservation measures. Illiteracy, insecurity of land tenure and poor extension services were the major hurdles in adoption of modern soil water conservation measures. In this modern age, the farmers from the area were found using only traditional measures for conservation of land. It was found that agronomic and a few structural measures were mostly used by the farmers in the area. Increase in

expenditures and lack of awareness seem to be the major hurdle in conservation of land resources. Extension workers should be directed to train the farmers to adopt the latest methods of drip or sprinkle irrigation, mulching, water harvesting, crop residue management, as well as proper use of fertilizers and no-tillage techniques. Government and non-governmental organizations should provide financial support in case of expensive drip and sprinkle irrigation equipments. Balochistan being the major province of the country in terms of land resources can play a key role in enhancing the agricultural productivity of Pakistan, if proper trainings are given to the farmers for sustainable land management. The results of this study provide important policy actions not only for Pakistan, but also for other areas that have similar arid and semi-arid environmental conditions.

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