Factors Affecting the Adoption of Hybrid Maize Varieties in the Irrigated Punjab

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ABSTRACT

Using farm level information about the cultivation of hybrid and non-hybrid maize varieties from various pockets of the cotton-wheat and mixed cropping zones of Punjab, the impact of personal characteristics and farm size on the adoption of hybrid varieties was investigated. Education and farm size were found positively and significantly contributing to adoption whereas age was non-significantly retarding the adoption of the hybrid lines. Although the farming experience had positive effect on adoption but it was non-significant. Substantial potential for increasing maize production through wider adoption of hybrid varieties exists in the mixed cropping zone. Reduction in seed price, credit for inputs and technical guidance can play an important role in this regard. Other farm and crop management related constraints may be included in the adoption model through some in-depth investigations into these factors. Possible effects of expansion of maize cultivation on wheat production and consumption also need to be studied.

Key Words: Factors; Adoption; Hybrid; Maize; Punjab

INTRODUCTION

Maize is the third most important cereal crop after wheat and rice. The production of Maize in Pakistan is mainly concentrated in NWFP and Punjab provinces (GOP, 1998). At present, both hybrid and non-hybrid maize cultivars are being grown in Punjab. The introduction and popularization of hybrid maize varieties in this province is mainly attributed to the efforts of private sector. The hybrid varieties have large yield potential and can be cultivated almost round the year. The diffusion of these varieties can greatly enhance national maize production. However, farmer's choice of variety is one of the most crucial factors affecting the productivity of a crop. This is influenced by many factors that affect the farmer's varietal adoption decision. The present study was, therefore, undertaken to generate the information with the following specific objectives.

•To assess the extent of adoption of hybrid maize varieties in the irrigated Punjab, •To identify factors affecting the adoption of hybrid varieties, and •To suggest policy and research implications from the results obtained.

MATERIALS AND METHODS

The needed data for the present study were collected from purposively selected four tehsils from the cotton-wheat zone-II (Bahawalnagar, Arifwala, Depalpur and Chichawatni) and three tehsils in the mixed cropping zone (Chiniot, Jaranwala and Gojra) of the Punjab. In total, 81 maize growers (34 from cotton-wheat zone-II and 47 from mixed zone) were randomly interviewed using a semi-structured pre-tested questionnaire. The formal survey was conducted by a team which consisted of Agricultural Economics and Rural Sociology experts from the Agricultural Economics Research Unit, Faisalabad. The collected data pertain to the maize crop for the year 1996. The analytical tools used in the present study include descriptive analysis and Qualitative Response Modelling (QRM) using the computer softwares SPSS/PC + and LIMDEP, respectively.

Socio-economic characteristics of the sample farmers. Regarding personal attributes, the average age of sample maize growers was about 43 years with their mean farming experience of about 22 years and more than six years of formal education. In cotton-wheat zone-II, the sampled growers were relatively younger and more educated as compared with the maize growers in the mixed zone (Table I). The average farm size was estimated as 40.3 acres with a significant difference between zones. Regarding land ownership, the sample comprised of about 61% owners, 27% owner-cum-tenants and 12% tenant operators. The proportion of owner operators in the mixed zone was higher as compared with the cotton-wheat zone-II. As far as the use and ownership of traction power was concerned, about two thirds of the sample farmers were using tractor for ploughing (owned or hired) with a significant difference between the zones. The proportion of tractor owners and those hiring tractor services was high in cotton-wheat zone-II as compared with their

counterparts. Majority of the maize growers applied both canal and tubewell (own or rented) irrigations to their crop. About 60% of the farmers supplemented canal water with their own tubewells; whereas about 31% farms had purchased tubewell water for supplementing their canal water (Table II).

Table I. Socio-economic characteristics of sample Maize growers by cropping zones

Characteristics	Cropping Zones		
	CW Zone-II	MC Zone	All Zones
Personal Characteristics			
Age (years)	39.6	45.2	42.8
Education (years)	8.6	4.6	6.3
Farming Experience (years)	17.9	24.2	21.6
Farm Characteristics			
Farm Size (acres)	66.7	21.2	40.3
Tenancy Status			
Owner (%)	44.1	72.3	60.5
Owner-Cum-Tenant (%)	41.2	17.0	27.2
Tenants (%)	14.7	10.6	12.3
Traction Power Source			
Own Tractor (%)	47.1	23.4	33.3
Rented Tractor (%)	41.2	27.7	33.3
Bullocks+Own Tractor (%)	5.9	10.6	8.6
Bull.+Rented Tractor (%)	5.9	38.3	24.7
Irrigation Source			
Canal (%)	-	10.6	6.2
Canal+Own Tubewell (%)	67.6	55.3	60.5
Canal+Rented T.Well (%)	26.5	34.0	30.9
Own Tubewell (%)	5.9	-	2.5

CW= Cotton-Wheat; MC= Mixed Cropping

Identification of the factors affecting adoption of hybrid Maize varieties. The farmers who did not allocate any area to hybrid maize varieties were termed as the non-adopters and others were defined as the adopters. The multivariate relationships were investigated by using the logit and probit regression models[1] given the dichotomous or binary dependent variables involved. The logit and probit models are well presented by Maddala (1986), the estimation procedure

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[1]Malik *et al.* (1991) used probit analysis to study the role of credit in agricultural development of Pakistan. Hussain *et al.* (1994) used it to study the impact of training and visit (T & V) extension system in the irrigated Punjab, Pakistan. Ahmad *et al.*, 1996 used probit analysis to study the incidence of Cotton Leaf Curl Virus in Punjab, Pakistan. Sumner (1982), Robinson *et al.*, (1982), Shand and Chew (1986), Jenesen and Salant (1986) and Jamal (1995) are other studies used this method for analyzing factors affection off-farm work decision of farm household head.

in LIMDEP software (Nagy & Ahmad, 1993). The dependent variable was defined as: ADOPTION = 0 If the farmer did not allocate any area to hybrid varieties, and ADOPTION = 1 Otherwise. The variables mentioned in Table III were used as explanatory variables in our analysis. For comparison, the coefficients of Linear Probability Model (LPM) and logit model were modified; whereas coefficients of probit model were left unchanged. The coefficients of LPM and logit model were adjusted as • the coefficients of logit model were multiplied by 0.625, and • all the coefficients of LPM were multiplied by 2.5 and 1.25 was subtracted from the constant.

RESULTS AND DISCUSSION

Area under Maize and its varieties. The per cent area under a crop is one of the indicators of relative profitability of that crop. A lower proportion implies less profitability which may be due to technical, institutional or social constraints. Overall, the maize crop occupied about one fourth of the farm area on the sample farms. The farmers of the cotton-wheat zone planted maize on more than 30% of their farm area; whereas the mixed zone farmers planted this crop on 12.3% of their operational holdings. Regarding the ratio of the area under hybrid and non-hybrid varieties, the hybrid varieties were planted at more than 85% of total maize area. The farmers in the cotton-wheat zone had mainly sown hybrid varieties (about 98% of maize area); whereas the mixed zone farmers allocated only 16% of total maize area to these varieties. The proportion of area under hybrid varieties was observed rising with increase in farm size. For non-hybrid varieties, the situation was just converse (Table II).

Table II. Per cent area under different Maize varieties by zones and farm size categories

Zones/Farm Size Groups	Hybrid varieties	Non-Hybrid varieties
Cropping Zones		
Cotton-Wheat Zone-II	97.5	2.5
Mixed Cropping Zone	16.0	84.0
Farm Size Groups		
Small (upto 12.5 acres)	28.5	71.5
Medium (> 12.5 - 25 acres)	48.6	51.4
Large (> 25 acres)	95.3	4.7
Overall	**85.2**	**14.8**

Factors affecting adoption of hybrid Maize varieties. Age, education, farming experience and the size of the

operational holdings were significantly different between the adopters and the non-adopters (Table III). These may be the determinants of adoption of hybrid maize varieties.

Table III. Personal and farm characteristics of sample farmers by adopter categories of hybrid Maize

Variable	Adopters	Non-Adopters
Age (Yrs)	39.59[*]	44.90[*]
Education (Yrs)	8.59[***]	4.73[***]
Farm Experience (Yrs)	18.38[*]	23.63[*]
Farm Size (Ac.)	69.48[**]	21.18[**]

[*], [**] and [***] denotes significance at 10, 5 and 1% levels, respectively.

The scope of the above analysis may be limited in nature as it only examines the relationship between two variables at a time. More information can be explored by investigating the multivariate relationships.

The probit estimates for education and farm size were positive and significant at 5 and 10% levels, respectively implying that formal education and farm size positively contributed towards adoption of hybrid varieties. The results for the logit and LPM were similar to probit analysis. The coefficients of logit and probit models were very close. The count R^2 was also the same i.e. equal to 0.704 (Table IV).

Table IV. Regression results for factors affecting adoption of hybrid Maize varieties

Variables	LP Model	Logit Model	Probit Model	Marginal Probability
Constant	-0.3116[*]	-0.2991	-0.3554	-----
Age	-0.0191	-0.0322	-0.0270	-0.0105
Edu	0.0743[**]	0.0857[**]	0.0826[**]	0.0321
Farm exp	0.0102	0.0191	0.0137	0.0053
Farm size	0.0045[**]	0.0122[*]	0.0115[*]	0.0045

[*], [**] denotes significance at 10 and 5% levels, respectively.

The marginal probabilities were small in magnitude (Table IV), however, the marginal impacts of education were relatively high as compared with other factors. The age of the farmer was found hindering adoption, but it was insignificant.

SUMMARY AND SUGGESTIONS

From the results of present study, it was observed that the hybrid maize varieties were relatively more common in the cotton-wheat zone-II. Formal education and the size of the operational holding were the important determinants of the adoption of hybrid maize varieties. These can be compensated by improving the managerial skills of the farmer through improved and enriched extension services.

A large potential for increasing maize production exists in the mixed cropping zone. This can be successfully realized through various policy measures such as reduction in the cost of hybrid seed. Provision of credit for purchased inputs and technical guidance may enhance the diffusion of hybrid maize varieties in this area. Further in depth investigation into the other factors constraining diffusion of these varieties in the mixed zone is also suggested. Possible effects of expansion of maize cultivation on wheat production and consumption also need to be looked into a relatively broader context.

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