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Risks in Rainfed Agriculture and Farmers' Adaptation Practices: A Case of Cotton Farmers of Maharashtra

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ABSTRACT

The present study aims to profile the risks faced by the rainfed farmers and the management strategies adopted by them based on a field survey of 244 cotton farmers of Maharashtra. The farmers in the region face risk mainly due to late onset of monsoon and less rainfall, pest and disease incidence, availability and poor quality of inputs and variability in prices. They also undertake various strategies to minimise the risk, either *ex ante* or *ex post,* and the extent of adoption of these strategies varies among the small and large farmer categories. The correlates of adoption of selected risk management strategies are traced using Logit and Tobit regression. While the size of operational holding, area under irrigation, and education of the farmers affect mixed farming positively, diversification is positively affected by the area under cotton, number of plots and accessibility to non-farm income. Total area under irrigation, value of assets and the regional advantage helps in micro-irrigation. Interestingly, farmers who avail non-institutional source have higher probability of adoption of crop insurance. Migration, the key *ex post* strategy is positively influenced by the number of male members and negatively by the dependent family members, size of operational holding and education.

Keywords: Rainfed farming, Risk incidence, Adaptation strategies, Small holders, Farm distress.

JEL: D81, Q12, Q18, Q54.

I

INTRODUCTION

Indian agriculture faces risk and uncertainties, which is pervasive, and affect the livelihood of large number of farmers depending on it (Ramaswamy *et al.*, 2003). Consequently, the impacts of agricultural risks transcends on economic consideration of the individual, and affects the social well-being. Risk incidence has given impetus to development of a number of risk management strategies and tools, to be applied both *ex ante* and *ex post*, at individual as well as community level (Risbey *et al.*, 1999; Adger *et al*., 2003). While the strategies adopted *ex-ante* helps in minimising the loss in income from farm, the *ex-post* strategies helps in maintaining the consumption (Morduch, 1995).

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Farmers in different regions of India also have evolved their own mechanisms for risk adaptation. Changing the sowing time, sequence of cropping and agro forestry have been adopted by farmers to cope with changing climatic conditions. Many farmers in the drought affected regions grow crops that require less water (Kelkar *et al.*, 2008). In general, the adoption of crop diversification has been higher in the risk prone areas of semi-arid tropics of the country, and areas where irrigation supply is less assured (Walker and Jodha, 1986). In addition, farmers in the risk prone areas also grow several varieties of the same crop to stabilise output (Kshirsagar *et al.*, 1997). Crop insurance is another strategy that helps to transfer the risk, and thereby smoothen the income shock.

The issue of risk is accentuated in rainfed systems, on account of its implications on livelihood security of a large proportion of farmers dependent on it (Rao, 2004). About 56 per cent of the total cultivated area in India falls under rainfed agriculture and it contribute 40 per cent to the country's food production (Venkateswarlu and Prasad, 2012). In spite of attaining full irrigation potential, about half of the country's cultivated area would continue to be under rainfed farming, and even at the best possible growth scenario of irrigated agriculture, about 40 per cent of the long term additional food grain requirement needs to be met out from the rainfed regions (Government of India, 2006). Therefore, the developmental needs of the rainfed regions would be of foremost importance in future too.

Cotton is one of the major commercial crop cultivated in rainfed regions of India. The risks in cotton cultivation have profound influence on the rural livelihood and are reported to be associated with farm distress in those regions. The crop has also undergone significant technological change in the form of Bt cotton and consequent shifts in seed systems. In this context, by using field level data collected from cotton farmers of Maharashtra, the present study assesses the major risks faced by the and identifies the important factors that affect the adoption of various risk management strategies.

II

DATA AND METHODOLOGY

The study uses primary data collected from cotton farmers of Maharashtra, following multistage sampling technique, during July-September, 2015. Two cotton growing districts, viz., Jalgaon and Yawatmal are selected based on the maximum area under cultivation. Two tehsils from each district and 6 villages from each tehsil are selected randomly. From each village, a minimum of 10 randomly selected farmers are interviewed. The total sample size is 244. The required data is collected using a questionnaire developed by the authors and validated by the experts. Farmers' risk attitudes were quantified using principal component analysis (PCA). Using PCA, principal component scores are constructed for each farmer using data on 10 statements on risk attitude recorded on a Likert scale. The major risk management

strategies considered for in-depth analysis are mixed farming, varietal diversification, crop insurance, micro-irrigation and migration. The correlates and factors affecting adoption of these strategies are identified by using logit model (Gujarati, 2003). In these models, dichotomous dependent variables are used, with dummy variable 0 indicating non-adoption and 1 representing adoption. Simpson Index of diversification is also constructed to study crop varietal diversification. Since the index ranges between 0 and 1, and a large number of observations has been distributed near the extreme points, a censored Tobit model is used for estimation (Tobin, 1958).

III

RESULTS AND DISCUSSION

Sample Characteristics

The analysis indicates that on an average, 39 per cent households are small farmers having an operational holding of less than 2 ha. The severity of some risks faced and the adaptive capability of the small farmers vary with those of the other farm categories, since their resource base is poor. About 18 per cent of the total farmers belonged to lower social strata (scheduled castes and scheduled tribe, SC/ST). Table 1 provides important characteristics of sample households classified across small and large farm categories, with corresponding relevant statistical analysis (t test/ chi square test). The average age of the farmers is just below 50 years, with average year of formal education close to 8.4 years. The mean family size is about 5.5, and it differed significantly between small and large holders. Also about 17 per cent of the household members are either below the age of 14 or above the age of 70, and therefore are dependents on the family.

TABLE 1. SELECTED FARM AND FARMER RELATED VARIABLES, ACROSS FARM CATEGORIES

Variable	Small	Large	Overall	Test value (t test)
(1)	(2)	(3)	(4)	(5)
Age (years)	48.5	51.0	49.5	1.46
Family size (No.)	5.2	5.9	5.46	1.76*
Dependent family members (per cent)	16.3	17.8	16.9	0.59
Formal education (per cent)	8.3	8.6	8.4	0.51
Value of non real-estate assets (Rs.)	19556	119302	58850	2.43**
No of livestock (ACU)	2.3	4.9	3.3	5.02***
Size of operational holding (acre)	3.0	11.8	6.5	16.21***
Size of irrigated operation holding (acre)	1.18	5.45	2.9	7.73***
Irrigated land (share)	40.6	44.3	42.0	0.62
Area under cotton (acre)	2.78	7.65	4.7	12.33***
Mean non-farm income (Rs./year)	3742	19329	8372	4.20***
Mean no. of parcels of land under cotton (No.)	1.68	2.67	2.1	5.88***

Source: Field survey.

Notes: ***, ** and * indicates significance at 1, 5 and 10 per cent levels, respectively.

Holding of Agriculturally Important Assets

There is statistical difference in the ownership of agriculturally important assets between the small and large holders, not only with respect to operational holdings and area under irrigation, but also in possession of livestock. On an average more than three-fourth of the farmers possess livestock. While 87 per cent of large farmers own livestock, only 66 per cent among small holders are able to do so. The average livestock holding, expressed in adult cattle unit (ACU) is also significantly higher for large farmers. The most important livestock is bullocks of indigenous breed, used for agricultural purpose. Though there is higher demand for rearing small ruminants like sheep and goat, the social stigma associated with rearing these animals prevents many from starting these enterprises. The possession of agriculturally important (except real estate, land and buildings) assets like machinery and farm implements is valued at about Rs. 58,000 (2015 prices). The large holders, on an average, have 10 times higher assets value compared to the small holders. The average non-farm income, mainly from local service sector, petty trade, etc. accounted for about Rs. 8372 (15 per cent of the household income), and its value was for large holders at about Rs. 0.19 lakhs per year is significantly higher than that for the small holders.

Institutional Arrangement in Land and Credit

The distribution of land assets across farm categories is provided in Table 2. Farmers enter into contractual arrangement for land leasing. Many landowners lease out the agricultural land entirely or in parts, either due to mounting cost of cultivation, inability to manage agricultural operations or due to absentee landlordism. About 43 per cent farmers lease in land for agricultural purposes, at prevailing market price, and about 13 per cent enter into share cropping (which is a risk-management mechanism). However, the prevalence of share cropping is on the decline, as share cropping dis-incentivises the cultivator from improving the efficiency of production. About 91 per cent of farmers avail credit either from institutional or non-institutional sources, and 36 per cent from both the sources. Even though 88 per cent farmers avail credit from institutional sources, mostly co-operatives, the credit from non-institutional sources is also at a high level of 39 per cent.

TABLE 2. INSTITUTIONAL ARRANGEMENT IN LAND AND CREDIT MARKETS FOR COTTON FARMERS, ACROSS FARM SIZE CATEGORIES

Variables (1)	Small (2)	Large (3)	Overall (4)	Chi-square test value (5)
Tenancy/leasing in (per cent)	40.10	46.10	42.8	0.66
Share cropping (per cent)	14.30	10.90	12.9	0.53
Status of institutional credit (per cent families)	89.30	87.90	88.7	0.10
Status of non-institutional credit (per cent families)	38.60	40.60	39.4	0.10

Source: Field survey.

Risk Incidence on Farmers

The farmers in the region are affected by a bundle of risks emerging from various sources (Table 3). Risks due to varying rainfall, untimely rainfall and delay in onset of monsoon affect crops the most. More than 90 per cent farmers perceive late onset of monsoon to be the major risk (average score of 4.67), and low rainfall or drought as the second most important risk (average score of 4.56). The National Commission on Agriculture (Government of India, 1976) has also noted that the variations in rainfall accounts for more than 50 per cent of the variations in crop output. The variability in temperature, though, is a serious weather risk, is not as pronounced as in the case of the variation in rainfall. Among the other weather induced risks, hailstorms damage the crop in the region significantly as perceived by 68 per cent farmers (average score 3.90). Weather induced risks are, however, specific to the regions and may often vary within a few kilometers.

TABLE 3. PROFILE OF RISKS FACED BY FARMERS IN COTTON CULTIVATION IN MAHARASHTRA

Sources of risk	Farmers reporting (per cent)	Mean score (on a scale of 1-5, maximum value 5)
(1)	(2)	(3)
Late onset of monsoon	90.90	4.67
Low rainfall / drought	91.30	4.56
High rainfall/ flood	47.40	3.02
Untimely rainfall	81.70	4.36
High variability in temperature	69.10	3.92
Hailstorm	68.10	3.90
Diseases	86.00	4.34
Pests	87.40	4.43
Grazing by blue bull/other animals	74.90	4.04
Risk due to inputs	58.53	3.40
Price risk	90.60	4.59
Others	22.70	3.09

Source: Field survey.

Farmers consider the risks out of pests and diseases only next to the risks from variation in rainfall. The average score obtained in case of the incidence of pests is more than that in case of diseases. Cotton is known as a crop that attracts a large number of pests, and consumes the largest quantity of pesticides. The introduction of the Bt cotton has helped to reduce the usage of pesticide, at least in the initial phases of the technology introduction, but the risk due to pest attack is still very high, owing to emergence of sucking pest complex. Another important source of risk is the problem of non-insect pests including blue bulls, stray animals, rodents etc. Lack of efficient management opportunities for such non-insect pests makes it a key risk. Finally, risks due to issues in access to inputs, quality of inputs, affordability of inputs etc. also pose threat to farming in the region. Input risks include the risks due to all major inputs, viz., fertilisers and pesticides, seeds, irrigation, credit, and information.

The price risk constitutes an important component of farm income risk. It is estimated that the risks associated with the prices accounts for more than 60 per cent of the variation of the farm income risk in case of cotton. The farmers in general face high level of price volatility in cotton, as expressed by more than 90 per cent of farmers. This coupled with non-operation of MSP system, discrimination in price realisation and lack of public procurement is reported to trouble them considerably. On many occasions, the Cotton Corporation of India (CCI) starts its operation very late, by which time farmers would have sold the produce in the market to the private traders at available price. Even if, the CCI is operational, farmers may not get the declared price, on account of various quality issues. Further, individual farmers face idiosyncratic risks, which are specific to farm and farmer households. Some of these pertain to the health issues of the farmers, lack of access to non-farm employment opportunities, inaccessibility to public distribution system and employment guarantee programmes.

Risk Adaptation by Farmers and Factors Influencing It

Farmers adapt to the risk situations by beholding different strategies, which can be broadly classified as the risk reduction strategies that the farmer adopts *ex ante* and risk coping strategies that the farmer adopts *ex post* the shock (Ramaswamy *et al*., 2003). Table 4 provides the status of major risk adaptation strategies followed by different farm categories. The major *ex-ante* adaptation strategies considered for detailed analysis are, enterprise diversification (mixed farming in which livestock enterprises are undertaken along with crops), crop varietal diversification, micro-irrigation (drip and sprinkler systems), and crop insurance (risk transfer mechanism), and the major *ex-post* adaptation strategy considered is migration.

TABLE 4. RISK ADAPTATION STRATEGIES ACROSS FARM CATEGORIES

Variables	Small	Large	Overall	Test value
(1)	(2)	(3)	(4)	(5)
Livestock ownership (per cent of families)	66.30	86.80	76.2	9.3***
No of varieties of cotton (No.)	1.96	2.92	2.34	6.94***
Mean value of Simpson index of diversification	0.31	0.47	0.37	4.21***
Micro-irrigation adoption (per cent)	54.30	54.90	54.5	0.01
Adoption of crop insurance (per cent families)	35.00	32.90	34.1	0.13
Share of migration (per cent farm families)	40.00	29.70	35.9	2.55*

Source: Field survey.
Notes: ***, ** and * indicates significance at 1, 5 and 10 per cent levels, respectively.

Mixed Farming (Enterprise Diversification)

Undertaking mixed farming practices is the most common adaptation strategy followed by farmers. Table 5 indicates that more than three fourth of the respondents practice livestock farming. Contrary to expectations, the small holders have relatively

lower share of participation in livestock enterprises (66 per cent) and has lower holding size as well (2.3 acu), compared to their counterparts (87 per cent and 4.9 acu, respectively). While, large holders generally maintain bullocks (major livestock in the region) for agricultural purposes, some of the small holders even lease in bullocks on a daily basis for undertaking agricultural operations rather than maintaining them during the entire year.

TABLE 5. LOGIT REGRESSION ESTIMATES OF OWNERSHIP OF LIVESTOCK

Variables	Coeff.	Std. Err	P-value
(1)	(2)	(3)	(4)
Constant	- 0.67	0.92	0.46
District (dummy variable)	- 0.17	0.39	0.66
Age of the farmer (years)	0.01	0.01	0.53
Family size (No.)	- 0.02	0.06	0.68
Caste (dummy variable)	- 0.06	0.45	0.89
Education (years)	0.08	0.05	0.07
Tenancy status (dummy variable)	- 0.28	0.36	0.44
Share cropping (dummy variable)	0.90	0.59	0.13
Value of assets (Rs. '000)	0.0003	3.41	0.31
Operational holding size (acre)	0.11	0.05	0.02
Share of irrigated land (per cent)	0.01	0.01	0.08
Total credit outstanding (Rs.)	8.32	1.05	0.42
Non-farm income (dummy variable)	- 0.42	0.59	0.48
Risk attitude (PCA Score)	- 0.16	0.13	0.21

The factors affecting practice of mixed farming is examined by using a logit regression model (Table 5). The major factors that positively influence mixed farming are size of operational holding, area under irrigation, and education of the farmers. Family size influenced negatively. Other variables included in the analysis are not statistically significant. Propensity for rearing livestock for income smoothening is on the decline in the surveyed areas, owing to the feed and fodder scarcity, lack of organised milk procumbent and marketing system in rural areas, and stigmatised views against small ruminant rearing. Newer practices of labour pooling for grazing and outsourcing grazing management are evolving in the surveyed villages, in response to labour scarcity and decline in grazing resources.

Crop Varietal Diversification

Varietal diversification is a common *ex-ante* adaptation strategy among farmers. On an average, a farmer cultivates 2.3 varieties, and this varies between large farmer (2.9) and small farmer (2.0). The varietal diversification status is examined by using Simpson index of diversification (SID). A higher SID points to higher level of diversification. The results suggest that the larger farmers are significantly more diversified compared to small farmers.

The potential correlates that affect the diversification is examined using a Tobit model (Table 6) which indicates that diversification is positively affected by area

under cotton and the number of plots (proxy for differences in land quality). Accessibility to non-farm income sources also favours diversification significantly. The income-risk trade-off calculations of the small holders favour adoption of income augmenting high yielding varieties, at an expected risk level. Given the variation in management requirements of different varieties, consideration of economies of scales also discourages diversification. Also, the practice of share cropping negatively and significantly affects diversification. In share cropping, the lesser and leesee shares the inputs and outputs in a pre-agreed quantity/ proportions, and therefore the risk of cultivation is partly passed on to the landlord as well. This may discourage further risk reduction through varietal diversification. Instead, a farmer tries to maximise the returns by cultivating better yielding varieties, for a reduced level of risk. Also, the higher caste groups diversify their varietal choice better. The dummy variables for districts exhibit significant difference, with Jalgaon depicting higher diversification, which may be due to an active seed distribution mechanism by private enterprises there.

TABLE 6. TOBIT REGRESSION ESTIMATES OF SIMPSON INDEX OF VARIETAL DIVERSIFICATION

Variables	Coeff.	Std. Err	P> (Z)
(1)	(2)	(3)	(4)
Constant	- 0.14	0.15	0.38
District (dummy)	0.28	0.06	0.00
Age of the farmer (years)	- 0.01	0.01	0.19
Caste (dummy)	0.19	0.07	0.01
Education (years)	0.01	0.01	0.45
Dependent family members (per cent)	0.01	0.01	0.49
Tenancy status (dummy)	0.03	0.05	0.60
Share cropping (dummy)	- 0.34	0.08	0.00
Value of asset (Rs. '000)	- 0.0005	1.95	0.02
Livestock (acu)	0.0006	0.002	0.75
Share of irrigated land (per cent)	0.00	0.00	0.76
Area under cotton (acre)	0.03	0.01	0.00
Parcels of land (No.)	0.06	0.02	0.01
Non-farm income (dummy)	0.15	0.09	0.11
Risk attitude (PCA Score)	0.01	0.02	0.78

Micro-Irrigation

Farmers undertake micro-irrigation through drip and sprinkler systems. Micro-irrigation, being capital intensive, is promoted through high level of subsidies, despite which its investment requirement for farmers is high. This, along with inadequate technical assistance, results in slow adoption of micro-irrigation. The study indicates that irrespective of land category, more than half of the respondents adopt micro-irrigation (Table 7). The push by the governments as well as the presence of a major micro-irrigation manufacturing company and its strong distribution system in the surveyed villages could be responsible for relatively higher share of micro-irrigation in the district.

TABLE 7. LOGIT REGRESSION ESTMATES OF DETERMINANTS OF MICRO-IRRIGATION

Variables	Coeff.	Std. Err	P> (Z)
(1)	(2)	(3)	(4)
Constant	- 2.64	1.18	0.03
District (dummy)	1.36	0.40	0.00
Age of the farmer (years)	0.02	0.01	0.20
Education (years)	0.02	0.05	0.67
Caste (dummy)	0.24	0.50	0.63
Tenancy (dummy)	- 0.72	0.42	0.08
Share cropping (dummy)	- 0.14	0.57	0.81
Value of assets (Rs. '000)	0.0003	0.0001	0.08
Livestock units (acu)	0.04	0.07	0.55
Operational holding size (acre)	- 0.02	0.04	0.57
Irrigated area share (per cent)	0.03	0.01	0.00
Status of institutional loan (dummy)	0.28	0.57	0.62
Non-farm income (dummy)	- 0.33	0.77	0.66
Family labour (No.)	- 0.07	0.10	0.48
Risk attitude (PCA Score)	0.01	0.14	0.97

To identify the factors that could affect the micro-irrigation, several variables are regressed on micro-irrigation adoption using logit framework (Table 7). None of the variables except total area under irrigation, value of assets and district dummies are positive and significant. Higher the proportion of area under irrigation, higher the chance that the farmer may go for micro-irrigation. Jalgaon district has higher presence of micro-irrigation, compared to Yawatmal, and it has a manufacturing unit of one of the leading micro-irrigation system manufacturers of India. The promotional efforts of the company have also resulted in large scale adoption. The land leasing practices deters adoption of micro-irrigation.

Crop Insurance

Crop insurance is an important risk transfer mechanism. In India, Comprehensive Crop Insurance Schemes based on area yield approach, and Weather Based Crop Insurance Schemes are prevalent, with and without participation of private sector. Many farmers, who avail credit from the institutional sources, have to subscribe to crop insurance compulsorily. However, only 34 per cent farmers have availed crop insurance, which is a major lacuna. An analysis of the potential reason for the low adoption indicates that the dissatisfaction of farmers with regard to the efficacy of crop insurance, given their prior experience with it, hinders its adoption. Farmers expect a return for the expenditure they made, the way some of the present day life insurance endowment schemes provide. A significant proportion of the farmers viewed crop insurance as an additional expenditure, which would not provide any return.

The adoption behaviour for crop-insurance is modeled using logit framework (Table 8). The results indicated that those farmers who avail non-institutional source have higher probability of adoption. By voluntarily adopting some insurance

products, the farmers availing non-institutional credit could be reducing chances of farm distress, in case the crop fail. While share of irrigated area enhanced the probability of adoption, education has the opposite effect. Most of the variables, were statistically insignificant, pointing to the lack of enthusiasm towards adoption of crop insurance. This apathy has been rooted in their past experiences of difficulties in getting compensation, procedural difficulties, insufficient amount of compensation etc., as has been reported by the farmers. This could be pointing towards the plausibility that any promotional effort of the crop insurance has to factor-in the deficiency of the extant systems *vis a vis* farmers' expectations.

TABLE 8. LOGIT REGRESSION ESTIMATES OF DETERMINANTS OF ADOPTION OF CROP INSURANCE

Crop insurance	Coeff.	Std. Err	P > (Z)
(1)	(2)	(3)	(4)
Constant	- 2.21	0.98	0.02
District (dummy)	- 1.19	0.36	0.00
Age of farmer (years)	- 0.01	0.01	0.29
Education of farmer (years)	- 0.08	0.04	0.04
Caste (dummy)	0.18	0.42	0.67
Tenancy (dummy)	- 0.13	0.34	0.69
Share cropping (dummy)	- 0.42	0.53	0.43
Value of assets (Rs. '000)	- 0.0004	0.0007	0.54
Livestock (acu)	- 0.0004	0.001	0.97
Operational holdings size (acre)	- 0.003	0.03	0.91
Share of irrigated land (per cent)	0.006	0.003	0.09
Status of institutional loan (dummy)	- 0.08	0.50	0.88
Status of non-institutional loan (dummy)	0.64	0.32	0.04
Non-farm income (dummy)	- 0.98	0.63	0.12
Risk attitude (PCA Score)	0.02	0.12	0.89

Migration

Migration of family members in search of jobs towards metros, cities or even other states is a common *ex post* risk adaptation strategy and, therefore, a coping mechanism. The study indicates that members of almost 36 per cent of farm households have undertaken short-term migration during crop failure. The proportion of migrants under small holder families (40 per cent) is statistically higher than large holder (30 per cent) (Table 4). Migration is undertaken by one or more male members of the family, whereas rest of the family stay back. The results of logit estimates of socio-economic correlates of migration are provided in Table 9. The results indicate that while the number of male members is statistically insignificant, the proportion of dependent family members exert a negative influence. Migration is an extreme step adopted by the farm family, but the higher proportion of dependent population deters family members from being away from family, probably due to the necessity to be with the family to look after them. Thus, even while migration is a risk management option, its practice is conditional upon family related variables, than farm related variables. Another group of variables that negatively influence migration are the size

of operational holding and education. Higher size of land holding and higher level of education of the farmers reduces the probability of undertaking migration. In Jalgaon, on agriculturally better district, probability of migration has been significantly low.

TABLE 9. LOGIT REGRESSION ESTIMATES OF DETERMINANTS OF MIGRATION

Variables	Coef.	Std. err	P > (Z)
(1)	(2)	(3)	(4)
Constant	4.44	1.09	0.00
District (dummy)	- 2.76	0.42	0.00
Age of farmer (years)	- 0.04	0.02	0.02
Adult male members (No.)	0.19	0.15	0.19
Dependent family members (per cent)	- 0.28	0.13	0.03
Caste (dummy)	- 0.45	0.46	0.33
Education of farmer (years)	- 0.10	0.05	0.05
Tenancy (dummy)	- 0.20	0.40	0.12
Share cropper (dummy)	0.72	0.62	0.25
Value of assets (Rs. '000)	0.0004	0.0006	0.54
Livestock (acu)	- 0.04	0.07	0.60
Operational holdings size (acre)	- 0.09	0.04	0.04
Share of irrigated land (per cent)	0.002	0.004	0.58
Total credit outstanding (Rs. '000)	- 0.0006	0.001	0.57
Non-farm income (dummy)	- 0.27	0.65	0.67

IV

CONCLUSION

Risk is a pervasive issue in rainfed cotton cultivating system of Maharashtra. The major factor behind the farm risk are weather risks in the form of high variability in rainfall distribution, its onset and withdrawal, and temperature; biotic factors in terms of pests and diseases; input risks in terms of its availability in quality and quantity; and variability in prices. It is quite noteworthy that farmers view price risk equally important as weather risks. Farmers undertake various strategies to minimise the risk, either *ex ante* or *ex post*. The study has identified mixed farming, varietal diversification of cotton, crop insurance and micro-irrigation as the major ex-ante strategies; and migration as the major ex-post strategy.

Livestock, in rainfed cotton system of Maharashtra, caters to the agricultural purpose than serving the income smoothening purpose. This is mainly because bullocks are used for cultivation, including ploughing and intercultural operations. Indigenous cow is maintained as a source for bullocks for agricultural purpose, than for milk purpose. Selling the stocks of cattle is not a tenable proposition, on account of higher costs of building up the stock for the next agricultural season. Varietal diversification is another widely adopted strategy. In both mixed farming and varietal diversification, large farmers fare statistically significantly better compared to the small farmers. Interestingly, relatively richer farmers go for diversification, compared to the smaller farmers. The lower diversification of small holders could probably be due to higher income-risk trade for small farmers, on account of their immediate

necessities. Being a share cropper reduces the probability of diversifying. Farmers also consider the quality of land while deciding the number of varieties. The small farmers need to be encouraged to undertake a diversified portfolio of crop varieties so as to spread the risk.

Micro-irrigation as a major strategy is promoted by the state and central government through the vehicle of subsidy. The surveyed areas had higher level of micro-irrigation systems compared to the national average. It is mainly the capital constraints and maintenance expenditure involved that prevents the rest from installing micro-irrigation systems. This warrants policy attention. The crop insurance scheme, though has policy focus, has not penetrated much. The fact that only one-third of the farmers adopt crop insurance attracts attention and warrants focused intervention. Insurance is largely viewed as an additional expenditure than as a useful precaution. There is an urgent need to educate farmers to undertake insurance and to improve the efficacy of the insurance system.

Migration, as an ex-post risk adaptation strategy depends on family compulsion, and therefore does not serve as a useful means for all the categories of farmers, even within the vulnerable sections. Proportionately small farmers undertake migration more often than large farmers, and it creates discomfort to migrant member and his family. While farmers undertake some adaptation strategy against weather risks, biotic risks and input risks, they are unable to undertake any strategy against price risk. Thus the price risk, turns out to be a significant variable to be dealt with. The only available adaptation strategy against price risk mentioned by the farmers is to store the produce in anticipation of higher prices in future. Given the urgent nature of financial requirement of the farmers, this could not be a tenable strategy. Timely market intervention by CCI emerges as significant factor in ensuring a decent market price.

Overall, it has emerged that the matrix of adaptation strategies is capital intensive, and its effect falls differently over small and large farmers. Therefore, development strategies taking into account the class difference assumes utmost importance in order to reduce the probability of risk and smoothen the risk impacts.

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