Information System for Brand-Variety Performance and Decisions: Study and Application for Cotton in India

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Abstract

Information on brand-variety performance is critical for small farmers in India since every year they need to make crucial decisions on which brand-variety seeds to plant. The livelihoods from their small farms and returns on all the inputs used depend critically on this decision. Yet no systematic information is available to them on this, and year after year the farmers are forced to decide based on guesses, hearsay and opinions which are frequently imperfect or even biased. Even companies and governments need to know about the actual performance of brand-varieties in different areas so as to be able to recommend correctly. Markedly, on the other hand, official crop-cutting surveys for estimation and assessment of actual yields are a regular feature of all states, and they also record some information regarding the inputs used including the brand-variety. However, the information is never examined from this point of view. Cotton is a major cash crop in India but has substantial problems particularly from extensive pest damage and poor yields. Brand-variety performance varies substantially and poor decisions frequently lead to crop failures and farmer suicides. A study was done on the performance of cotton varieties through a survey across four major Indian states and 694 farmers, covering pest resistance, inputs, yields, quality, price, value of output, cost of cultivation, and profits. This brought out the features and variations, and on this foundation, a brand-variety performance information system is proposed which would draw upon information from the regular crop-cutting surveys, collate it, analyze it, and make findings available to the farmers. This would help provide correct information and advice to farmers over diverse agro-ecological settings. Through this, the farmers would be able to make better informed brand-variety decisions, which would help reduce crop failures and risks and improve farm performance and incomes.

Keywords *- Information systems, Knowledge management*

Introduction

Information on brand-variety performance is critical for small farmers in India. Cotton is a major cash crop in India and is grown under rainfed as well as irrigated conditions in many parts of the country. India is among the largest producers of cotton in the world (after China and USA) but the productivity is very low. A major reason is the pest problem which is among the worst of all crops. The main pest is boll worm and the highest quantity of pesticide among all crops is used on cotton to control this and other pests – often with little success. A spate of suicides by cotton farmers in the country is seen largely linked to this. Cotton cultivation had become uneconomic in many parts of the country due to the high cost of pesticides and the low yields. The introduction of pest resistant Bt cotton took place in India in this background in 2002 after much government hesitation. The crop has become the front runner in biotechnology introduction in the country but the farmers have to make tough variety decisions.

Cotton Production in India

India is unique in that all four major cultivated species of cotton: *Hirsutum, Arboreum, Herbaceum and Barbadense*, are grown commercially, Mayee and Rao (2002). The cotton produced is of 4 different qualities: Medium staple; Superior medium staple, Long staple and Extra long staple. The ushering in of Hybrid cotton era brought about a substantial increase in cotton production. Development of Hybrids such as Hybrid 4, JKHY 1, NHH 44 and DCH 32 brought about a white revolution in cotton. Similarly, the development and release of varieties such as LRA 5166, MCU 5, Suvin and hybrids like DCH 32, H 6 and Savitha brought about a qualitative change in Indian cottons.

With cultivation on around 9 million hectares, India's cotton acreage is the largest in the world and India is the third largest cotton producer after China and USA. The analysis given in the table below indicates that the cotton production nearly doubled in the green revolution period from 5.78 million bales in 1967/68 to 10.09 million bales in 2001/02 (one bale=170kg). The annual growth rate is 2.51 percent over these years, and most of the growth appears to have come from yield growth, which shows a growth rate of 2.13 percent. However, in the last 10 years the production growth rate shows deceleration to –0.38 percent and much of this is due to decline in

the yields, which show a growth rate of –2.34 percent, indicating the pest problem with the existing technology. However, the area growth rate has accelerated to 2.02 percent in this period indicating that the crop is finding favour with the farmers. The figures and growth rates for/ upto the recent year of 2004/05 indicates a revival in the yields and production of cotton which may be related to the introduction of Bt cotton varieties.

Table 1: Cotton: Performance			
Year	Area (m ha)	Yield (kg/ha)	Production (million bales: 170 kg each)
1967/68	8.00	123	5.78
1981/82	8.06	166	7.88
1990/91	73.9	269	11.70
1991/92	7.66	216	9.71
2001/02	9.10	189	10.09
2004/05	8.97	404	21.30
Annual Growth Rates			
1967/68-2001/02	0.373	2.134	2.513
1981/82-2001/02	1.092	1.599	2.704
1991/92-2001/02	2.020	-2.341	-0.381
1990-91-2004-05	0.77	1.70	2.47
Source: India, Ministry of Agriculture			

In view of the controversy on Bt cotton, the importance of cotton, the severe pest problem, and the solution Bt Cotton offers an indepth examination of assessment of cotton varieties, particularly Bt vs non-Bt, was undertaken.

Data and Sample Profile

A multi-state study was conducted through the Centre for Management in Agriculture, IIM, Ahmedabad, funded by the Ministry of Agriculture, Government of India. The study covered a stratified random sample of 694 cotton farmers spread over four major cotton states namely Andhra Pradesh, Gujarat, Maharashtra, and Tamil Nadu. The sample covered nearly equal numbers of Bt cotton and Non-Bt cotton farmers, across small, medium and large landholding, with and without irrigation for cotton. The survey was conducted in 2004-05.

Varieties Grown, Pest Incidence and Resistance

As indicate above, there is a huge diversity in types and varieties of cotton grown in the country. Within the sample as well, a large number of different varieties have been indicated. In Bt cotton, in the state of Gujarat, the varieties are identified by the name of the company and include Rasi, Mahyco and other non-confirmed. In Maharashtra, these include MECH 184, MECH 12, MECH 162, Rashi 2, the first three being Mahyco-Monsanto varieties, and the last one from Rasi Seeds. In Andhra Pradesh, the MECH, Rashi and non-confirmed varieties are seen. The non Bt varieties vary substantially by state and include Shankar and Vikram in Gujarat, Ankur and Bunny in Maharashtra and Bunny, Brahma and Satya in Andhra Pradesh.

Table 2 : Varieties Reported

State	Cotton Type	Varieties
Gujarat	BT	RCH, Mahyco, Other Non-confirmed
	Non-BT	Sankar, Vikram, Navbharat Deshi, Other deshi
Maharashtra	BT	MECH 184, MECH 12, MECH 162, Rasi 2, 2 MECH, MECH + Rasi
	Non-BT	Ankur, Bunny, Ajit, Others
Andhra Pradesh	BT	Rasi, MECH, Other Non-confirmed
	Non-BT	Bunny, Super Bunny, Brahma, Satya, Attara, JK, Tagore, Bindu, Others
Tamil Nadu	BT	Rasi-2 BT
	Non-BT	Rasi-2 Non-BT

The reason for the adoption of Bt cotton varieties is its pest resistance. The table below shows the considerable difference found in pest incidence.

Table 3: Pest/Insect Attack on Bt and non-Bt Cotton: Response of Growers of Bt: Maharashtra										
	BT					***Non-BT***				
Pest/Insect	Per-cent repo-rting	Infestation reported				Per-cent repo-rting	Infestation reported			
		None	Light	Mode-rate	Heavy		None	Light	Mode-rate	Heavy
A. Boll Worm										
1. American Boll Worm	96.47	74.39	21.95	3.66	0.00	11.76	30.00	50.00	20.00	0.00
2. Pink Boll Worm	87.06	75.68	20.27	4.05	0.00	61.18	3.85	36.54	30.77	28.85
3. Spotted Boll Worm	90.59	72.73	20.78	6.49	0.00	56.47	2.08	41.67	39.58	16.67
4. Others	18.82	50.00	6.25	18.75	25.00	56.47	4.17	41.67	35.42	18.75
B. Sucking Pests										
1. Thrips	96.47	4.88	56.10	35.37	3.66	11.76	30.00	0.00	20.00	50.00
2. Leafhopper	95.29	3.70	58.02	30.86	7.41	58.82	0.00	18.00	56.00	26.00
3. Whitefly	95.29	6.17	58.02	33.33	2.47	57.65	0.00	20.41	55.10	24.49
4. Others	3.53	33.33	0.00	66.67	0.00	60.00	1.96	19.61	47.06	31.37
C. Foilage Feeding Pests										
1. Leaf Roller	94.12	27.50	45.00	26.25	1.25	42.35	2.78	38.89	50.00	8.33
2. Caterpillar	89.41	27.63	40.79	28.95	2.63	40.00	2.94	29.41	61.76	5.88
3. Others	7.06	50.00	33.33	16.67	0.00	5.88	20.00	40.00	40.00	0.00
D. Soil Pests										
1. Termite	88.24	34.67	17.33	36.00	12.00	40.00	2.94	14.71	55.88	26.47

Analysis of Performance, Cost and Impact

The impact of Bt cotton on selected aspects of the economics of cotton is analyzed statistically here. This is examined first through a regression analysis relating yield with a Bt dummy variable, which is 1 for Bt cotton and 0 for Non-Bt cotton. Combined data is used. Results would be identical to those obtained by Analysis of Variance, Green and Carroll (1978). The results given below indicate that Bt cotton has a statistically significant impact on the yield, significant at the 99 percent level. The estimates indicate that Bt cotton yields are 30.71 percent higher. The impact on the value of output is also highly significant and estimates show that this is boosted by 33.35 percent. However, the total cost also rises, and this rise is estimated to be 6.69 percent. The pesticide cost is reduced by 23.98 percent, but the seed cost rises by 168.77 percent. This explains the opposition to seed prices. The difference in the output price between Bt and Non-Bt cotton is positive but not statistically significant. The increase in profit is found to be highly significant and the increase is estimated to be 87.58 percent. The results reveal a strong economic advantage of Bt cotton over non-Bt cotton.

Table 4: Regression Results: Impact of Bt Cotton				
		Independent Variables		N=515
Dependent Variable		Constant	Bt	Percent Impact of Bt
Yield	Coefficient	2212.25	679.45	30.71
	t-stat	47.05	10.37	
	Signifi.	***	***	
Value of Output	Coefficient	41861	13960	33.35
	t-stat	45.2	10.81	
	Signifi.	***	***	
Total Cost	Coefficient	28066	1878.56	6.69
	t-Stat	71.5	3.43	
	Signifi.	***	***	
Pesticide Cost	Coefficient	7387.95	-1771.47	-23.98
	t-Stat	33.01	-5.68	
	Signifi.	***	***	
Seed Cost	Coefficient	1296.12	2187.41	168.77
	t-Stat	28.71	34.76	
	Signifi.	***	***	
Price	Coefficient	19.04	0.28679	1.51
	t-Stat	140.45	1.52	
	Signifi.	***	NS	
Profit	Coefficient	13795	12081	87.58
	t-Stat	16.1	10.11	
	Signifi.	***	***	
Note: *** = significant at 99 percent, ** = significant at 95 percent, * = significant at 90 percent, NS = not significant				

Even though Bt appears to have a dominant effect, it perhaps also pulls in/ is associated with other inputs in boosting profitability. The performance can be also be analyzed as a function of all inputs. The model below relates the performance related dependent variables to various factors including Bt, pesticide, seed, fertilizer, irrigation and state of location. These results would be affected to some extent by the multicollinearity across the explanatory variables. The results given in the table below confirms that Bt is highly significant statistically as a determinant of the yield, value of output and profitability.

Table 5: Regression Results: Impact of Bt Cotton and Other Determinants									
		Independent Variables (N=515)							
Dependent Variable		Constant	Bt	Pesticide Cost	Seed Cost	Fertilizer Cost	Irrigation Status	Maha Dummy	AP Dummy
Yield	Coefficient	1912.78	428.03	0.0318	0.1469	-0.0819	475.07	-333.41	-37.70
	t-stat	16.36	3.78	2.27	3.44	-4.43	6.22	-2.94	-0.3
	Signifi.	***	***	**	***	***	***	**	NS
Value of Output	Coefficient	35854	7568.29	0.6136	3.3843	-1.2864	8440.21	-2875.29	-6810.50
	t-stat	15.08	3.28	2.16	3.9	-3.42	5.43	-1.25	-2.67
	Signifi.	***	***	**	***	***	***	NS	***
Total Cost	Coefficient	15637	392.30	1.2683	1.6172	1.2548	1117.76	-9105.81	-6689.49
	t-stat	20.7	0.54	14.03	5.86	10.49	2.26	-12.43	-8.25
	Signifi.	***	NS	***	***	***	**	***	***
Profit	Coefficient	20217	7175.99	-0.6547	1.7671	-2.5412	7322.45	6230.52	-121.014
	t-stat	9.85	3.61	-2.67	2.36	-7.82	5.46	3.13	-0.05
	Signifi.	***	***	***	**	***	***	***	NS
Note: *** = significant at 99 percent, ** = significant at 95 percent, * = significant at 90 percent, NS = not significant									

Advantages and Disadvantages

The Table below summarizes the findings on the advantages/ disadvantages of Bt versus Non-Bt cotton reported by Bt cotton growers. The results indicate that by and large the farmers find no difference in the availability of seeds, fertilizer need, machine need, irrigation need or market preference. A large number report disadvantage in the seed cost. Advantage or strong advantage is seen by a large majority of farmers in matters of pest incidence, pesticide need, cotton quality, staple length, yield and profitability.

Table 6: Advantages or disadvantages of Bt cotton-G *vis-à-vis* non-Bt Cotton reported by Bt Cotton Growers: Percentage (Maharashtra, Andhra Pradesh and Tamil Nadu)

		Strong Advantage	Advantage	No Difference	Disadvantage	Strong Disadvantage
1	Availability of seeds	0.0	4.4	62.1	32.7	0.7
2	Seed cost/price	0.0	2.5	6.9	26.7	30.6
3	Quality of available Seeds	2.0	51.5	44.9	1.6	0.0
4	Pest Incidence/problem	30.0	48.5	15.7	5.9	0.0
5	Pesticide need/cost	33.4	49.1	14.7	2.4	0.4
6	Fertilizer need/cost	1.0	14.3	72.9	11.8	0.0
7	Labour need/cost	0.8	20.5	73.5	5.2	0.0
8	Machine need/cost	0.8	2.7	95.7	0.4	0.4
9	Irrigation need/cost	2.0	13.5	72.1	12.4	0.0
10	Harvesting cost	1.5	28.5	58.1	11.5	0.4
11	Cotton quality	12.6	68.9	17.7	0.8	0.0
12	Market preference	3.8	24.3	69.5	2.0	0.4
13	Staple length	6.6	64.7	24.3	4.4	0.0
14	Fibre colour	12.9	56.7	27.7	2.4	0.4
15	Cotton price	5.2	10.6	81.8	2.4	0.0
16	Easy marketing	1.2	9.9	86.5	2.4	0.0
17	By-product output	0.8	3.2	96.0	0.0	0.0
18	Yield	17.9	78.5	3.1	0.4	0.0
19	Profit	18.9	66.9	12.6	1.5	0.0
20	Livestock feeding	0.8	3.6	95.6	0.0	0.0
21	Water saving	2.8	11.2	80.2	5.7	0.0
22	Suitable for early sowing	4.9	22.3	72.8	0.0	0.0
23	Suitable for late sowing	0.8	3.3	90.6	5.3	0.0

Conceptual Approach for Designing an Information System

The modern conceptual method for designing a market/ technology information system is based on the approach for designing good management information systems. In the old approach, information was a by-product of the operation and was transmitted routinely, generating benefits by chance. In the modern approach, the starting-point of design is key tasks and decisions that need to take place given the objectives and strategy. Then, a tailor-made information system is developed, squarely addressing the information needs of the key tasks and decisions. As a result,

the system is clearly focused and directly contributes to more effective decisions and performance.

Information System Based on Crop-Cutting Survey Data

Even though examinations such as the study described above are possible from time to time, a regular information system is required. Information on brand-variety performance is critical for small farmers since every year they need to make crucial decisions on what brand-variety seeds to purchase and plant. There is a huge variation in the performance of varieties, new brand-varieties are regularly introduced, and the farmers' livelihoods from the small farm and all the inputs used depend critically on this decision. Poor brand-variety decisions frequently lead to crop failures in cotton and also farmer suicides. Yet no systematic information is available, and year after year the farmers have to decide based on guesses, hearsay and opinions which are frequently imperfect or biased. The companies and government also need to know about the actual performance of brands-varieties in different areas so as to be able to recommend correctly. Official crop-cutting surveys for actual yield assessment are, however, a regular feature of all states and also collect some information on inputs including brand-variety.

The scientific method for estimation of crop yields which does not depend on the judgment of farmers of farmers or field staff is the crop-cutting survey method. This is now widely adopted in India and many other countries. It involves taking a number of standard sized crop cuts (often a few meters square) in the crop fields at harvest time over a randomized set of locations in the reference region (Gandhi 1990). The crop output from these cuts is measured and recorded and is used to estimate the yield in the region. Official crop-cutting surveys for actual yield assessment are now a regular feature of all states in India and also collect selected information on inputs used including the brand-variety of seed used. This information is hardly processed and utilized.

This information resource was studied in the state of Gujarat. For cotton in the state of Gujarat, crop cutting surveys are carried out in pairs in selected villages. Two samples are taken from each village. The location of the crop cut is determined through a three stage randomization within a district. At the first stage villages are chosen randomly. If the crop is not being cultivated in a particular selected village, it is substituted by another village by a random process.

Within each selected village the second stage of random selection is done by randomly selecting the area survey numbers where the crop cuts which will be subject to the experiment and again survey plots which are not cultivating the crop are substituted with randomly selected ones that are cultivating the crop. The third stage of randomization occurs when the plot of 5 meters X 10 meters is selected within the survey area to carry out the crop cutting experiment/ assessment. This randomization process assures objectivity and representativeness.

The crop cutting survey information is collected in two statements in two rounds by the government appointed village level worker (VLW). The first round is done before the harvest time in which data such as the sowing time, the various inputs used, variety used, and some other features are recorded. The second round and statement are done by the VLW at harvest time and in this the yield obtained from the 5 meter X 10 meter crop cut is reported.

The two reports are compiled first at the Taluka (sub-district), then at the district, and then the state capital levels and fed into a FOXPRO based database computer system after the reports have been thoroughly checked. The Taluka summaries are then generated with the results for each selected survey number and each crop cutting experiment covered. These summaries are checked and then the compiled District level summaries are generated with mainly the yield average figures and standard errors. Any anomalies are identified and resolved in this multi-stage checking process. The original forms recorded by the VLWs are maintained as hard copies and provide a lot of useful information which is hardly used. Only the Taluka and District compilations are maintained as summaries derived from the FOXPRO system.

Table 7 gives selected information obtained from a sample set of forms recorded by the VLWs in the crop cutting survey. It can be seen from it that the information on the variety names and brands as well other input information as well as the estimated yields are available. Table 8 gives the information reported on a sample Taluka report generated by the FOXPRO system. Table 9 gives the information reported on a sample district report generated by the FOXPRO system. It can be seen from these tables that it would be possible to compile, analyze and generate brand-variety performance information and reports which would be extremely useful to the farmers for their decision-making.

Table 7: Sample Crop-Cutting Survey Data, State Gujarat, District Rajkot													
Location			**Sowing**		**Manure**	**Fertilizer**		**Seeds**	**Pesticides**	**Irrigation**		**Productivity**	
District	**Village**	**Survey Number**	**Date of Sowing**	**Sowing type (Early/ Normal / late)**	**Manure**	**Urea**	**DAP**	**Variety Name**		**Status**	**No. of Irrigations**	**Date of harvesting / First Picking**	**Estimated Production (kg/ha)**
Rajkot	Madarwada	125	6/24/2008	Normal	No	75	150	B.T.Kharad		Irrigated	2	10/5/2008	1000
Rajkot	Magarwada	245/1	6/24/2008	Normal	No	75	150	B.T.Kharad		Irrigated	2	10/5/2008	1000
Rajkot	Lodhida	115	6/14/2008	Normal	No	25	50	GangaCauvery B.T.	Monocrotophos Acephate Powder Thiodocarb	Irrigated	2	10/20/2008	1700
Rajkot	Lodhida	3	6/14/2008	Normal	No	10	50	Vikram 9 B.T.	Monocrotophos Acephate Powder	Irrigated	2	10/21/2008	1800
Rajkot	Faddang	303/2	6/22/2008	Normal	No	75	150	Suraj -5 B.T.		Irrigated	2	11/25/2008	2200
Rajkot	Faddang	89/7	6/22/2008	Normal	No	75	150	Suraj -5 B.T.		Irrigated	2	11/25/2008	2200
Rajkot	Padasan	75	6/15/2008	Normal	Yes	250	150	Tulsi-17 B.T.	Monocrotophos	Irrigated	3	10/25/2008	1500
Rajkot	Padasan	215	6/15/2008	Normal	Yes	150	100	Super 97 , B.T.	Monocrotophos	Irrigated	4	10/22/2008	1500
Rajkot	Hodathali	54/2	6/22/2008	Normal	No	75	150	B.T.		Irrigated	4	11/25/2008	2200
Rajkot	Hodathali	62/3	6/22/2008	Normal	No	75	150	B.T.Sha		Irrigated	4	11/25/2008	2200
Rajkot	Berdi	117	6/12/2008	Normal	30	No	100	B.T	Monocrotophos Profenofos Imidochlopride Aceta	Irrigated	3	October	2400
Rajkot	Berdi	64	6/12/2008	Normal	30	No	100	B.T	Monocrotophos Profenofos Imidochlopride Aceta	Irrigated	3	October	2700
Rajkot	Waghgad	41/5	7/30/2008	late	No	No	50	B.T	Monocrotophos Aceta	Un-irrigated		December	1000
Rajkot	Waghgad	37	8/1/2008	late	No	No	50	B.T	Monocrotophos Aceta	Un-irrigated		December	7000
Rajkot	Rampara	47	6/15/2008	Normal	No	50	100	Vikram -5 B.T.	Monocrotophos Indosulfan	Uni-rrigated		10/17/2008	2000
Rajkot	Rampara	3	6/15/2008	Normal	No	50	70	GangaCaveri B.T.	Monocrotophos Indosulfan Acifet Powder	Un-irrigated		10/17/2008	2000

Table 8: Crop Estimation Survey, Crop Cotton, District Rajkot, Taluka Tankara, Year 2007-08										
Sr. No	**Village No.**	**Village Name**	**Exp. No.**	**Survey No.**	**Manure**	**Chemical Fertilizer**	**Variety Name**	**Use of Pesticide**	**Irrigation**	**Yield Kg.**
1	366	Mahendrapur	1	252/1	Y	Y	H	Y	Y	19.500
2	366	Mahendrapur	2	103	Y	Y	H	Y	Y	19.300
3	367	Bangavadi	1	139/1	Y	Y	H	Y	Y	17.500
4	367	Bangavadi	2	265/1	Y	Y	H	Y	Y	12.600
5	368	Vadhgadh	1	281/1	Y	Y	H	Y	Y	17.600
6	368	Vadhgadh	2	475	Y	Y	H	Y	Y	13.600
7	369	Kothariya	1	137/1	Y	Y	H	Y	Y	11.000
8	369	Kothariya	2	172/1	Y	Y	H	Y	Y	14.000
9	370	Saraya	1	18	Y	Y	H	Y	Y	13.000
10	370	Saraya	2	86/1	Y	Y	H	Y	Y	16.700
11	371	Virvav	1	521/1	N	Y	H	N	Y	8.900
12	371	Virvav	2	106	N	Y	H	N	Y	9.900
13	372	Kagdadi	1	265	Y	Y	H	Y	Y	14.000
14	372	Kagdadi	2	449/1	Y	Y	H	Y	Y	12.500

Table 9: Crop Estimation Survey, Gujarat State, Crop Cotton, District Rajkot, Year 2007-08				
	Taluka	**Total Exp.**	**Area Covered Hectares**	**Average Yield of dried crop (Kg./Hec)**
1	Maliya	0	0	0
2	Morbi	6	9503	3213.4
3	Tankara	14	22969	2850.6
4	Vankaner	20	34890	2449
5	Padhari	20	16564	2565.6
6	Rajkot	12	25000	2674.2
7	Lodhika	20	2790	2696
8	Kotada Sangani	20	9350	2255
9	Jasdan	30	41100	2765
10	Gondal	20	26625	1689
11	Jam Kandorna	20	10873	2371
12	Upleta	20	23616	3421
13	Dhoraji	20	13450	2366
14	Jetpur	20	23434	2872
	District	242	261064	2628.8

Information System Features

Information must be useful for decision-making and therefore it is important to identify the major decisions and where they need to be made. A centralized information system is proposed consistent with the leading role played by the government, the extensive involvement of the govt. staff in collection and handling of information, as well as the nature of the information. The information would be collected from the grass-roots level through the existing formats and systems in place, augmented to cover the kind of detail required, as described in the study above. It would be compiled at the Directorate of Economics & Statistics (DES), Ministry of Agriculture, at the state level. The DES would use the internet to streamline the collection of the information. It would then process the collected data using computers and specially developed programs. It will then disseminate the output information through reports to different groups such as farmers, extension staff, input industry, agribusiness and the government. These reports will be specially tailored to their decision-making and information needs, covering all the critical information.

Conclusion

Cotton is a major cash crop in India but has substantial problems particularly from extensive pest damage and poor yields. The performance varies substantially across brand-varieties and many offer solutions to these problems. Information on brand-variety performance is critical for small farmers in India since every year they need to make crucial decisions on what brand-variety seeds to purchase and plant. There is a huge variation in the performance of varieties, new brand-varieties are regularly introduced, and the farmers' livelihoods from the small farm and all the inputs used depend critically on this decision. Yet no systematic information is available, and year after year the farmers have to decide based on guesses, hearsay and opinions which are frequently imperfect or even biased. The companies and government also need to know about the actual performance of brands-varieties in different areas so as to be able to recommend correctly.

Official crop-cutting surveys for actual yield assessment are, however, a regular feature of all states and also collect some information on inputs including brand-variety. Yet, this information is hardly processed and utilized. Poor brand-variety decisions frequently lead to crop failures in

cotton and also farmer suicides. The study uses data from an extensive survey across four Indian states and 694 farmers. A statistical assessment is done for the performance of varieties including pest resistance, yields, quality, market acceptance, price/ value of output, cost of cultivation, and profits. On this basis, a brand-variety performance information system is proposed and designed which would augment the ongoing crop-cutting surveys, analyze the data, and make it available to the farmers so that they can make informed and better decisions on brand-variety. This would reduce crop failures and also help the government and the companies to provide correct advice to the farmers in diverse agro-ecological settings.

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