PURCHASING BEHAVIOUR OF FARMERS TOWARDS HERBICIDES FOR SOYBEAN CROP

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ABSTRACT

Understanding farmers' purchasing behaviour is of great economic and strategic relevance for agri-business firms. The farmers' characteristics influenced their buying process and the influence was more evident in the case of frequently purchased agri-inputs. The purpose of this paper is to know purchasing behaviour of farmers towards herbicides for soybean crop in chhotaudepur district. Responses of 100 soybean growers were analyzed with the help of Principle Component Analysis of factor analysis. The study revealed that the most important components of farmers' attitudes towards purchasing herbicides for soybean crop in Chhotaudepur district were (i) Positive effects of herbicide on weeds along with crop (ii) Past experience and recommendation of experts (iii) Concern for cost and credit (iv) Condition and stages of crops and weeds. With the help of these four factors, this analysis could explain about 63.06 per cent variance in the study.

Keywords*: purchasing behaviour, attitude, factor analysis*

INTRODUCTION

India is the second most populous country after China in the world where more than 50 per cent of the population are dependent on agriculture for their livelihood. To sustain the growing population's food and nutrition needs, India needs to adopt sustainable measures in the agriculture sector. Agricultural production had been increased significantly in the past years due to the usage of hybrid seeds, fertilizer, crop protection chemicals, etc. but lower productivity is still becoming a major concern. These include the risk of land degradation, fall in per capita cultivable land and increasing water scarcity. Indian agriculture needs to undergo technological transformation and adopt modern methods which reduce the dependency on monsoons and ensure more productive use of the available resources. These factors highlight the importance of agrochemicals for enhancing food and nutrition security for the nation. Moreover, low per hectare yield as compared to the global average and increasing pest attacks further strengthen the need for crop protection (FICCI, 2020).

Agrochemicals are designed to protect crops from insects, diseases and weeds. Pest attacks significantly reduce the quantity and quality of food production. Approximately 25 per cent of the global crop output is lost due to attacks by pests, weeds and diseases and thus agrochemicals have an increasing role to play in enhancing crop productivity. The use of agrochemicals can increase crop productivity by 25-50 per cent, by mitigating crop loss caused due to pest attacks. In India, estimated annual production losses due to pests are as high as USD 42.66 million (Sushil, 2016).

Agrochemicals are broadly classified as insecticides, herbicides, fungicides, etc. based on the type of pest they control. Insecticides dominate the Indian crop protection market and form almost 53 per cent of the domestic agrochemicals market. Herbicides are, however, emerging as the fastest growing segment amongst agrochemicals. Usage of herbicides has been increasing due to shortages of farm labour and concerns about the affordability of labour costs. These reasons are the primary driver for the growing popularity of agrochemical and herbicides is expected to emerge as a key growth segment.

Attitude is a psychological variable that contains positive or negative evaluations about people or an environment. Understanding the customers' needs and the processes of making purchase decisions are among the most significant challenges faced by agribusiness firms. Indian farmers are characterized by small and fragmented land holdings, dependence on rain for irrigation, use of traditional agricultural practices, involvement in subsistence farming, and lack of resources, education, and media access (Ministry of Agriculture, 2014). The agri-input market in a developing economy like India is getting more and more competitive, international firms need to understand their customers' buying behaviour best to maintain and increase their market share.

The farmers' characteristics influenced their buying process and the influence was more evident in the case of frequently purchased agri-inputs. The farmers' education and farming experience are the two most important influential characteristics affecting their buying process of inputs. All the dimensions of the farmers' buying process, namely, buying decision time, number of information sources used, number of suppliers evaluated and number of conversations with suppliers are positively correlated to most of the agri-inputs (Kumar and Kapoor, 2017).

OBJECTIVE

To study purchasing behaviour of farmers towards herbicides for soybean crop in chhotaudepur district.

METHODOLOGY

Area of the study

Chhotaudepur district was selected for the study. It is a tribal and one of the important soybean growing districts in Gujarat. The district consists of six talukas of Chhotaudepur, Pavi jetpur, Kawant, Naswadi, Sankheda and Bodeli taluka. The district headquarters is located at Chhotaudepur. The geographical area of the district is 3,43,606 hectares among 2,08,866 hectares are the cultivable land. Around 61 per cent of soil is medium black soil. Cotton is a major field crop during Kharif Season.

Sampling Procedure

Chhotaudepur district is purposively selected for the study to examine purchasing behaviour of farmers while buying herbicides. The area is known for the potential area of herbicides for the cultivation of soybean. From the district, two talukas, viz., Bodeli and Chhotaudepur were selected which have the highest cropping area of Soybean. From these two talukas, five villages each were randomly selected and, in each village, ten soybean farmers were selected randomly. Thus, a total of 100 sample respondent farmers were selected. Response of farmers was collected through the structured schedule.

Nature and source of data

To evaluate the objectives of the study, the data were collected from both primary and secondary sources. The Primary data were collected from farmers to know different factors influencing purchasing behaviour of herbicides. The secondary data regarding cropping patterns, land utilization, general information of the district and area under cultivation was collected from the district agriculture office.

For data analysis 18 Likert scale statements were prepared to measure the attitudes of farmers towards buying herbicides. The likert scale can be used to measure someone's attitude by measuring the extent to which they agree or disagree with a particular question or statement. Factor analysis is adopted as an analysis method to reduce variables to a smaller, more manageable number of more identifiable groups of variables.

Factor analysis refers to a variety of statistical techniques whose common objective is to represent a set of variables in terms of a smaller number of hypothetical variables (Stone *et al*, 1994). Mathematically, factor analysis is similar to multiple regression analysis, in which each variable is expressed as a linear combination of underlying factors. The covariation among the variables is described in terms of a small number of common factors plus a unique factor for each variable. If the variables are standardized, the factor model may be represented as:

$$Xi = A_{i1}F_1 + A_{i2}F_2 + A_{i3}F_3 + \ldots\ldots\ldots\ldots + A_{im}F_m + V_iU_i$$

Where,

Xi = i^{th} standardized variable

A_{ij} = standardized multiple regression coefficients of variable i on common factor j

F = common factor

V_i = standardized regression coefficient of variable I on unique factor i

U_i = the unique factor for variable i

m = number of common factors

The unique factors are uncorrelated with each other and with the common factors. The common factors themselves can be expressed as linear combinations of the observed variables.

$$Fi = Wi_1X_1 + Wi_2X_2 + Wi_3X_3 + \ldots\ldots\ldots\ldots + Wi_kX_k$$

Where

Fi = estimate of i^{th} factor

Wi = weight or factor score coefficient

k = number of variables

RESULTS AND DISCUSSION

Socio-economic conditions of respondents

Socio-economic parameters like age, household size, education, experience, crop output, size of holdings, etc. have a significant impact on purchasing behaviour. The socio-economic profile of farmers is recorded in Table 1.

Table 1: Socio Economic conditions of respondents

(n=100)

Sr. No.	Socio economic conditions of respondents	%
1	**Age**	
a	<=25 years	03
b	26-45 years	38
c	46-65 years	48
d	>=65 years	11
2	**Qualification**	
a	Below SSC	30
b	SSC	36
c	HSC	30
d	Graduate	4
3	**Land holding size**	
a	Below 1 ha	31
b	1 - 2.5 ha	27
c	2.5 -5 ha	24
d	More than 5 ha	18
4	**Area under soybean crop**	
a	Below 1 ha	38
b	1 - 2.5 ha	21
c	2.5 -5 ha	25
d	More than 5 ha	16
5	**Annual income**	
a	Below ₹ 1 lakh	18
b	₹ 1 lakh - 5 lakhs	48
c	₹ 5 lakhs - 10 lakhs	26
d	More than ₹ 10 lakhs	08
6	**Major source of income**	
a	Agriculture	75
b	Agriculture + Livestock	10
c	Other	15
7	**Source of purchase of herbicide**	
a	Distributor	24
b	Dealer	76
8	**Terms of Purchase of herbicides**	
a	Cash only	30
b	Credit only	18
c	Both	52
9	**Choice of alternatives if credit sales are not available**	
a	Switch over to dealer who provides credit	73
b	Credit from others	27

In the study area, the Majority of the farmer were between 46-65 years. 66 per cent of farmers were studied SSC or below. All the categories of farmers grew soybean. Small farmer prefers it because of less cost and large farmers prefer it because of effortless farming compare to other crops. Almost 75 per cent of farmers depend on agriculture as the major source of income. The average annual income of farmers was 1-5 lakhs. 76 per cent of farmers bought from dealers, so dealers are a major influencer for farmers. Soybean farmers preferred to buy herbicide on a credit basis. Large farmers easily got credit for their chosen product whereas small farmers switch to the dealer who can give it on credit. Small farmers switch to other brands due to lack of credit.

Purchasing behaviour of farmers towards herbicides for soybean crop in Chhotaudepur district using factor analysis

Table 2: KMO and Bartlett's Test (n=100)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.723
Bartlett's Test of Sphericity	Approx. Chi-Square	826.645
	Df	153
	Sig.	.000

The first step in this test is to see whether or not the data generated from the fieldwork is suitable for factor analysis. The Kaiser-Meyer-Olkin (KMO) Measure of sampling adequacy is an index that examines the suitability of factor analysis. Values between 0.5 and 1.0 indicate that factor analysis is appropriate in the given case. Bartlett's test of Sphericity is used to examine the hypothesis that the variables are not correlated in the population. In other words, each variable correlates with itself but does not correlate with other variables (Malhotra, 2003). The hypothesis is examined using the Chi-square test. The KMO value in this analysis is 0.723, indicating that the sample size is adequate and factor analysis is suitable for the given data. The significance value for Bartlett's test is 0.00, suggesting rejection of the hypothesis. This means that the variables are correlated, hence factor analysis is an appropriate test in this situation (Raghuvanshi, 2016).

The amount of variance is shared by a variable with all the other variables being considered and explained by communality. This is also the proportion of variance explained by the common factors. The variables having low communality don't combine with other variables. Rescaling is performed by the SPSS software using a set of accumulations for normalization of data collected from a large population to minimize the effect of extreme responses. The output for communalities is shown in Table 3.

Table 3: Communalities (n=100)

Particulars	Initial	Extraction
Different Packaging Size	1.000	.576
Credit availability	1.000	.639
Timely availability	1.000	.576
Result is better than its competitor	1.000	.694
Long term and positive effect on crop	1.000	.718
Should increase productivity	1.000	.735
After field demonstration	1.000	.764
Type of weed	1.000	.594
Intensity of weed	1.000	.501
Stage of crop growth	1.000	.625
Weather conditions matter	1.000	.643
Low price	1.000	.653
Annual income of farmer	1.000	.614
Past experience	1.000	.572
Progressive farmers' influence	1.000	.788
Brand image of company	1.000	.679
Distributor and dealers' recommendation	1.000	.567
Sales after service	1.000	.515

Variables having low communality (< 0.5) do not combine with other variables and those variables make high number of factors in the output of the analysis. There are no such variables having communality score is less than 0.5. This is the reason that only four different factors are seen, even in the most optimized situation.

Extraction method : Principal Component Analysis

Factor loading represents the degree of correlation between the particular variable and the factor. It also represents the importance of the factor and rotation is made to bring relationships not previously seen. Varimax rotation method is used to minimize the number of factors. An Eigen value is the sum of square factor loading for a particular factor. A common criterion for selecting factors to be extracted from the analysis is based on the strength of Eigen values. If the Eigen Value is greater and equal to 1, the factor is considered as being significant. The percentage of variance explained is the summary measure indicating how much of the total original variance of all the variables is explained by the factor. Total four factors extracted from the data using the principal component analysis (PCA) approach explain about 63 per cent variance in the attitude of farmers towards buying herbicides. The Eigen values for all factors are more than one; therefore, we have included them in the number of factors extracted.

Table 4 : Total variance explained (n=100)

Sr. No.	Initial Eigen Values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumultive %	Total	% of Variance	Cumulative %
1	3.869	21.492	21.492	3.869	21.492	21.492	3.307	18.373	18.373
2	3.161	17.562	39.054	3.161	17.562	39.054	3.032	16.843	35.216
3	2.442	13.567	52.621	2.442	13.567	52.621	2.708	15.046	50.262
4	1.880	10.446	63.067	1.880	10.446	63.067	2.305	12.804	63.067
5	1.242	6.898	69.965						
6	.773	4.293	74.258						
7	.719	3.994	78.252						
8	.718	3.987	82.239						
9	.586	3.256	85.496						
10	.446	2.479	87.975						
11	.417	2.315	90.290						
12	.343	1.906	92.196						
13	.327	1.816	94.012						
14	.281	1.559	95.570						
15	.255	1.418	96.989						
16	.205	1.139	98.127						
17	.186	1.034	99.161						
18	.151	.839	100.000						

Extraction method: Principal component analysis

Rotated factors

The factor matrix contains the coefficients of variables in terms of factors. These coefficients, known as factor loadings, represent the correlations between factors and variables. A coefficient with a large absolute value indicates that the factor and the variable are closely related. The coefficients of the factor matrix are used to interpret the factors. Rotation redistributes the variance explained by the individual factors hence it may result in the identification of different factors. The most commonly used method of rotation is the Varimax rotation. This is an orthogonal method that minimizes the number of variables with high loadings on a single variable, thereby enhancing the interpretability of the factor (Malhotra, 2003). Factors having greater than 0.5 is only considered to combine with variables. The rotated component matrix with factor loadings is shown in Table 5.

Table 5. Rotated Component Matrix

Particulars	Component			
	1	2	3	4
Different Packaging Size			.652	
Credit availability			.766	
Timely availability			.729	
Result is better than its competitor	.810			
Long term and positive effect on crop	.841			
Should increase productivity	.853			
After field demonstration	.829			
Type of weed				.755
Intensity of weed				.683
Stage of crop growth				.693
Weather conditions matter				.787
Low price			.691	
Annual income of farmer			.698	
Past experience		.669		
Progressive farmers' influence		.804		
Brand image of company		.792		
Distributor and dealers' recommendation		.670		
Sales after service		.695		

Extraction method: Principal component analysis.
Rotation method: Varimax with kaiser normalization[a]
a. Rotation converged in 5 iterations.

It can be easily noticed from Table 5 that the first factor was loaded on four attitudinal variables, including Result is better than its competitor (.810), Long term and positive effect on the crop (.841), Should increase productivity (.853) and After field demonstration (.829). These variables may together club under one factor as "Positive effects of herbicide on weeds along with crop". This first factor represents 18.37 per cent of the variance in the attitudinal make-up of farmers towards purchasing herbicides for soybean crop. In this factor, farmers expected a good result of herbicide on weed as well as a positive effect in increasing yield. In soybean crop, the farmers use it in early stage to reduce the growth of the plant that helps him in boosting production later.

The second factor was loaded on five variables namely: Past experience (.669), Progressive farmers' influence (.804), Brand image of the company (.792), Distributor and dealers' recommendation (.670), and Sales after service (.695). Based on the common attributes of these five variables, this factor may be labelled as "Past experience and recommendation of experts". This factor explained about 16.84 per cent variance in the attitude of farmers towards purchasing herbicides for soybean crop. In this factor, farmers purchased based on past experience and other progressive farmers, dealers' recommendation along with services offered by dealers and companies' representatives.

The third factor encompassed five variables namely: Different packaging size (.652), Credit availability (.766),

Timely availability (.729), Low price (.691) and Annual income of farmers (.698). Based on common properties of the five attributes, this factor may be named as "Concern for cost and credit". This third factor explained about 15.05 per cent variance in the attitude of farmers towards purchasing herbicides for soybean crop. In this situation, farmers gave preference to a cheap and available product that is offered with credit. They wasn't concern about the quality of the product. Big farmers can get credit easily while small farmers switch dealers and products for the sake of credit.

The fourth factor was loaded on four variables identified as Type of weed (.755), Intensity of weed (.683), Stage of crop growth (.693) and Weather conditions matter (.787). This factor was named "Condition and stages of crops and weeds". This factor explained about 12.80 per cent variance. In this factor, Farmers make purchases based on the condition of crops, weeds and weather. On rainy days, farmers avoid using herbicides and in case needed, they make an instant purchase.

CONCLUSION

Attitude is a wide area of study and not exactly measurable; however, predictions can be made to reach some conclusions. The attitude of farmers depends on age, household size, education, experience, crop output, size of holdings, etc. The farmers' buying process, although very important both for agri-business firms and for researchers in consumer behaviour. In this context, the findings of this study become important. The most important components of farmers' attitudes towards purchasing herbicides in soybean crop in Chhotaudepur district are (i) Positive effects of herbicide on weeds along with crop (ii) Past experience and recommendation of experts (iii) Concern for cost and credit (iv) Condition and stages of crops and weeds. With the help of these four factors, this analysis could explain about 63.06 per cent variance in the study. The remaining 36.94 per cent variance is attributed to other elements not explained by this analysis.

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