Bt cotton cultivation in India

A report to understand the awareness, perception and acceptability of Bt cotton seeds among cotton growing farmers

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1 Introduction

The crop production technology where Genetic engineering is applied to industrial agriculture, with crops generally bred to be herbicide-resistant or insect-resistant is commonly referred to as genetically modified (GM) crop.

"Genetic Engineering" is the technique by which heritable material, which does not usually occur nor will occur naturally in the organism or cell concerned, generated outside the organism or the cell, is inserted into the said cell or organism. It refers to the formation of new combinations of genetic material by incorporation of a cell into a host cell, where they occur naturally (self-cloning) as well as modification of an organism or in a cell by deletion and removal of parts of the heritable material.

Bt Cotton is a genetically engineered form of natural cotton. The main advantage of utilizing biotechnology in agriculture are the possibilities of increase in productivity through the use of newer varieties that possess properties such as resistance to pests, diseases, and other stressful conditions like drought, salinity, or water logging.

The above benefits can be imparting to the normal crop through the transfer of a gene from Bacillus Thuringiensis (Bt) into target plants e.g. cotton by modern biotech methods.

1.1 Bt Cotton in India

Bt Cotton, the first GM crop, had been introduced in India after six years of experimentation and trials. The Genetic Engineering Approval Committee (GEAC), in its 32nd meeting, held on March 26, 2002, made the landmark decision of approving cultivation of Bt cotton in India

It has been more than 4 years since Genetic Engineering Approval Committee (GEAC), in its 32nd meeting on March 26, 2002, approved Bt cotton crop cultivation. There have been mixed responses towards productivity and crop success. This has been largely because of lack of understanding of what Bt cotton crop can do and what it can’t. Also, mismatch in the understanding towards proper cultivation practices in Bt cotton fields has also led to the disappointment to the farmers in some areas of the cotton growing belt.

1.2 Need for research

Several studies pertaining to Bt cotton have been done since its inception in India. There is a need to evaluate parameters like awareness, perception, reaction towards & acceptability of Bt Cotton crop on a periodical basis. Also, it is essential to identify whether farmers are aware of the proper information about Bt cotton so that they can exploit the benefits provided by it. Since Bt technology can be applied to other food products as well, the need was sensed to evaluate the acceptability of these food products in rural India. Secondly, there has been a mixed response towards increase in the cotton production and crop success with the usage of Bt cotton seed in India. The farmers' hue and cry against Bt-cotton crop failure in some parts of India has heightened the controversy and the crop has gained negative publicity.

With the above objectives in mind All India Crop Biotechnology Association (AICBA) commissioned this study to IMRB International to avail its research based consultancy. The following pages present the study objectives, information areas, methodology and findings from the extensive research exercise.

2 Objectives of the study

The study was commissioned with the following objective in mind:

1. To broadly understand the profile and farming practices of cotton growing farmers in the selected state clusters and to identify the factors causing financial distress among the cotton growing farmers
2. To estimate the awareness of Bt Cotton category of seeds and various certified and non-certified Bt cotton brands
3. To understand the purchase behaviour and the importance of various purchase criteria for cotton seeds among farmers
4. To gauge the perception of and satisfaction with ordinary, hybrid and Bt cotton seeds on the identified purchase criteria
5. To compare the cost economics for certified Bt cotton seeds with ordinary and hybrid seed categories
6. To determine the likelihood to purchase/ continue using Bt cotton seeds and Genetically Modified fruits and vegetables by cotton farmers in the future
7. To determine the media consumption habits of cotton growing farmers in the selected state clusters

In the conclusion, we have also provided the insights into the overall state-on-ground of Bt cotton seeds in India.

The above objectives have been addressed by answering the following issues:-

1. To broadly understand the profile and farming practices of cotton growing farmers in the selected state clusters and to identify the factors causing financial distress among the cotton growing farmers
    a. Crop cycles per year
    b. Land utilization for cotton
    c. Distribution of farmers between 'Rain fed' and 'Irrigated' area

d. Reasons for financial distress among cotton growing farmers

2. To estimate the awareness of Bt Cotton category of seeds and various certified and non-certified Bt cotton brands
    a. Awareness of Bt cotton seeds
    b. Awareness of certification among Bt cotton brands
    c. Sources of awareness about certification among Bt cotton brands
    d. Sources of awareness about availability of various Bt brands
    e. Brand Awareness
        i. Top of Mind (TOM) & Spontaneous recall for top 3 Seed companies for certified Bt cotton
        ii. Aided recall for top 3 Seed companies providing certified Bt cotton brands
        iii. Aided recall for top 3 non-certified Bt cotton brands across clusters

3. To understand the purchase behaviour of various purchase criteria for cotton seeds among farmers
    a. Sources of Purchases during current crop cycle
    b. Purchase process at the seed shop
    c. Source of finances used for sourcing total expenditure
    d. Percentage distribution of the total expenditure from various sources
    e. Interest rates charged by various entities financing expenditure
    f. Number of Bt cotton seed brands used during current crop cycle
    g. Usage of the brands from top 3 Seed companies providing certified Bt cotton brands

4. To gauge the perception of and importance and satisfaction with ordinary, hybrid and Bt cotton seeds on the identified purchase criteria
    a. Correspondence maps & top 2 boxes for various factors
    b. Importance of the factors
    c. Overall satisfaction levels – top 2 boxes with various seed categories
    d. 'Satisfaction – Importance' matrix for various factors:-

5. To compare the cost economics for certified Bt cotton seeds with ordinary and hybrid seed categories
    a. Number of sprays of pesticide already used or planning to use in the current crop cycle for:

b. Cost per acre on inputs (seed, pesticide and fertilizer) & labour for the following seed category cultivated on a maximum area:-
c. Individual break up for seed, pesticide, fertilizer and labour for:-
d. Productivity expectation per acre for the entire crop cycle for the following cotton seed categories (cultivated in the maximum area):-

6. To determine the likelihood to purchase/ continue using Bt cotton seeds and Genetically Modified fruits and vegetables by cotton farmers in the future
    a. Intention to purchase – Bt cotton and Bt fruits/vegetables
    b. Likelihood to recommend – Bt cotton and Bt fruits/vegetables

7. To determine the media consumption habits of cotton growing farmers in the selected state clusters
    a. Newspaper reading habits
    b. Most popular television channels
    c. Most popular radio stations

3 Research Methodology

3.1 DATA COLLECTION METHODOLOGY

To explore the research objectives outlined earlier, two pronged research methodology was suggested. The two modules for the research were as follows:-

3.1.1 Module 1 : Quantitative survey with farmers

In India, out of the 3 zones i.e. Central / Western, Southern and Northern, cotton crop is largely cultivated in the Central / Western and Southern zones. The biggest cotton growing clusters were identified across these two zones covering 6 states. Within the clusters, the representation of rich as well as poor farmers was ensured. All the respondents were key decision-makers for seed purchase.

A minimum quota of interviews was set for both Bt cotton as well as non-Bt cotton growing farmers. At a state level, major cotton growing districts were identified. Within a district, 5-8 cotton growing clusters (villages) were selected.

The sample size for survey among farmers was distributed keeping the following considerations in mind:-

- Coverage of biggest cotton growing areas across Western / Central and Southern Zone
- Area under cotton crop cultivation by the farmer
- Category of cotton seed cultivated by the farmer
- Significant random coverage of respondent at the sub-cluster (district) level to ensure randomness within each sub-cluster.

A total sample size of 911 respondents was distributed across six states in the following manner:-

Area under cotton/ No.of farmers met	**Western / Central Zone**			**Southern Zone**		
	Maharastra	**Gujarat**	**Madhya Pradesh**	**Andhra Pradesh**	**Tamil Nadu**	**Karnataka**
1 – 2 acres	49	55	56	54	46	34
2.1 – 5 acres	81	71	62	81	23	33
5.1 – 10 acres	37	43	45	38	15	23
More than 10 acres	15	19	17	8	6	0
Total	**182**	**188**	**180**	**181**	**90**	**90**

Table 1 : Sample Size distribution by area under cotton cultivation

Five geographical clusters were formed after merging the data from respondents in Tamil Nadu and Karnataka states.

The sample size distribution across six states by the ordinary non-hybrid seeds, hybrid non-Bt seeds and Bt cotton seed users was as follows:-

Type of farmer/ No. of farmers met	Western / Central Zone			Southern Zone		
	Maharastra	Gujarat	Madhya Pradesh	Andhra Pradesh	Tamil Nadu	Karnataka
Ordinary non-hybrid user	4	0	32	33	15	30
Hybrid non Bt cotton user	104	88	56	37	37	16
Bt cotton users	129	110	104	143	42	49
Total	**182**	**188**	**180**	**181**	**90**	**90**

Table 2 : Sample Size distribution by Ordinary, Hybrid and Bt cotton seed categories

Selection of sub-clusters within each state

Within each state, major cotton growing sub-clusters (at district level) were identified in the following manner:-

- District level contribution in the cotton production of the state.
- Geographical spread within the state
- Production of cotton at the state level
- Importance of the state with respect to addressing the problem like financial distress and the number of cases of such financially distress families in the state
- Minimum of 180 respondents per cluster so as to achieve the required confidence of 95% (+/- 7%) for reporting the data at the cluster level
- The sample size in each state (as shown in Table 2) was equally distributed across sub-clusters (with a variation of 5% percent).

At the state level, the following sub-clusters (district) were covered:-

Maharastra	Gujarat	Madhya Pradesh
Buldhana	Baroda	Dhar
Yeotmal	Rajkot	Khargone
Jalgaon	Bhavnagar	Khandwa
Akola	Jamnagar	Harda
Wardha	Khera	
Nagpur		
Tamil Nadu	**Karnataka**	**Andhra Pradesh**
Salem	Bijapur	Warangal
Coimbatore	Gadag	Guntur
		Kurnool
		Adilabad

Table 3 : Sample Size distribution : Sub-clusters (districts) at the state level

Overall, 23 districts were covered across 6 states.

3.1.2 Module 2 : In-depth interviews with Farmers and other stakeholders

In-depth Interviews were included in the research design with the following considerations in mind:-

- To obtain a category understanding of Bt Cotton
- To obtain insights into the issues pertaining to the financial distress of farmers
- To design a quantitative questionnaire so that the insights get captured correctly

Largely, interviews were conducted with cotton growing farmers across 3 states. However, 5 interviews were conducted with other stakeholders such as seed shops, scientists and professors.

The sample size distribution of depth interview with farmers was as follows:-

Zones Covered	States Covered	Sample Size
Western / Central Zone	Maharastra	14
	Gujarat	5
Southern Zone	Andhra Pradesh	5
	TOTAL	24

Table 4 : Depth Interviews with farmers

In addition, five interviews, two with seed shops and three with Scientists and Professors were also conducted.

3.2 DATA ANALYSIS METHODOLOGY

3.2.1 Methods of Segmentation

As mentioned under section 'Data Collection Methodology' earlier, the data so collected has been segmented according to the following headings:

State clusters – The various state clusters are as follows:

Central zone which includes Maharastra, Gujarat and Madhya Pradesh

Southern zone which includes Andhra Pradesh, Tamil Nadu and Karnataka

The data from Tamil Nadu and Karnataka has been merged and reported under one head.

Farmer classification – Farmers have been classified and reported as follows:

- Those using as Bt Cotton
- Those not using Bt Cotton. These farmers have been further classified into ordinary cotton seed users and hybrid non-Bt Cotton users

If a farmer has cultivated Bt cotton in an area more than or equal to the area under non-Bt hybrid and ordinary non-hybrid seed, he would fall under 'Bt cotton' farmer category and vice-versa.

3.2.1.1 Key terms used in the report

Rainfed area:- Areas under cotton crop cultivation where farmers are dependent solely at the mercy of rain for irrigation come under rainfed areas.

Irrigated area:- Areas under cotton crop cultivation where irrigation facilities are available e.g. farmland having well, bore-well, irrigation through canal system. Farmers of irrigated area can irrigate their lands whenever need for the same arises.

Western / Central Zone:- For segmentation purposes, the cotton belt across India is divided into 3 zones:- Central, Southern & North zones. Three states i.e. Maharastra, Gujarat & Madhya Pradesh comprise of central zone. Central zone contributes maximum to cotton crop cultivation across India.

Southern Zone:- Southern Zone comprises of Andhra Pradesh, Karnataka and Tamil Nadu states. This zone comes second as far as cotton production in India is concerned.

Bt certified:- This refers to the category of Bt-cotton seed hybrids that have been approved in India for various zones as on 16th June 2006 (list of hybrids and its seed companies have been taken from fact sheet of ISAAA – International Service for the Acquisition of Agri-Biotech Applications provided by the client).

Bt non-certified:- This refers to the category of Bt-cotton seed hybrids that are not certified by the central and state agencies for safer use in India. These seeds are sold illegally in the market. The list of commonly present non-certified Bt seeds across the two zones covered in this study has been provided by the client's associate companies. Some hybrids that have been approved by state bodies without the approval of GEAC (Genetic Engineering Approval Committee) have also been considered under this category. In other words, any Bt hybrid not falling under the fact sheet of ISAAA of the approved hybrid in India as on 16th June 2006 has been considered under Bt non-certified seed category.

Category of seed cultivated in the maximum area:- Certain insights e.g. cost economics, productivity estimates for the current crop cycle and number of sprays of pesticides etc have been captured specifically for the category of seed cultivated in the maximum area to compare the cost-benefits of one category with another one. It means the category of seed, out of 4 categories i.e. Ordinary non-hybrid, non-Bt hybrid, Bt certified and Bt not-certified, cultivated under the maximum area during current cotton crop cycle.

Top of Mind (TOM) recall:- This refers to the recall of the single brand / company (of a particular category) that comes to respondents' mind first, as soon as the specified category is mentioned.

Spontaneous recall:- This parameter measures the awareness levels about brands / companies (of a particular category) that comes after TOM recall, if he / she is asked to recall brands / companies further.

Unaided recall: - Together Top of Mind (TOM) recall and spontaneous recall form unaided recall. This parameter refers to the cumulative awareness levels of the brands / companies when the respondent is not exposed to some stimulus / reference material.

Aided recall: - This included unaided recall. It refers to the recall of the brands / companies (of a particular category) when the respondent is exposed to some stimulus material (like show cards,

posters etc) along with the unaided recall.

3.2.2 Key analysis techniques used

Correspondence Mapping: This technique is used to map the category perception with respect to the various attitudinal statements so that the correlation between the two can be easily comprehendible. The nearness of various statements with each category and the quadrant in which these categories and statements lie (in a two dimensional plane) tells about degree and type (whether positive or negative) of correlation the statement has with respective categories.

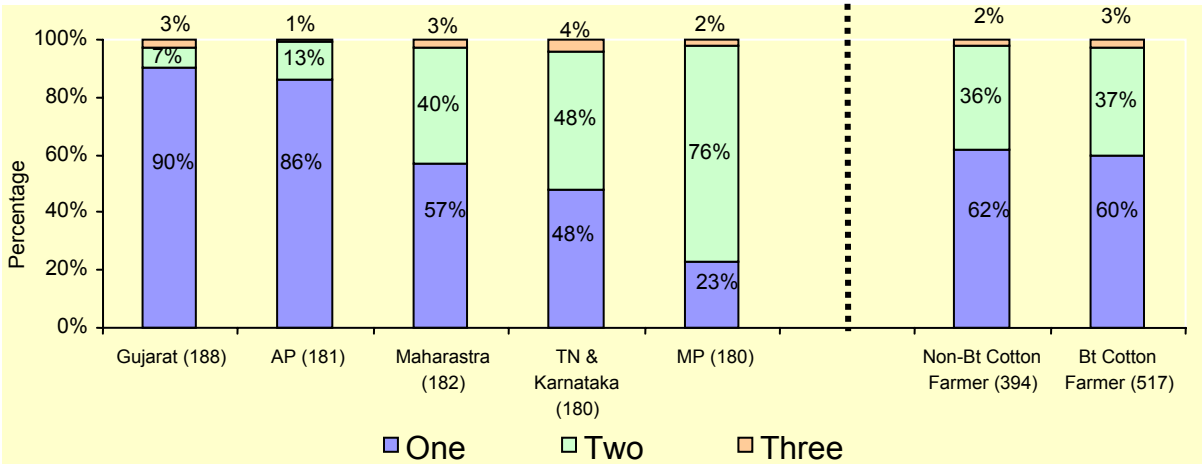
Regression Analysis: This is a method for determining the association between a dependent variable and one or more independent variables. This statistical technique is used for assessing the factor contributing the most to the overall satisfaction with the usage of a particular seed category.

4 Cotton farming practices and farmer distress

Prior to understanding the awareness, perception and purchase behaviour of the cotton growing farmers for cotton seeds, it is essential to understand the farming practices of these cotton farmers. This section highlights the farmer profiling related issues like number of crop cycles per year (cultivated in the cotton growing region across various clusters), Land utilization per year for growing cotton and cotton growing land distribution under 'rain-fed' and 'irrigated' areas.

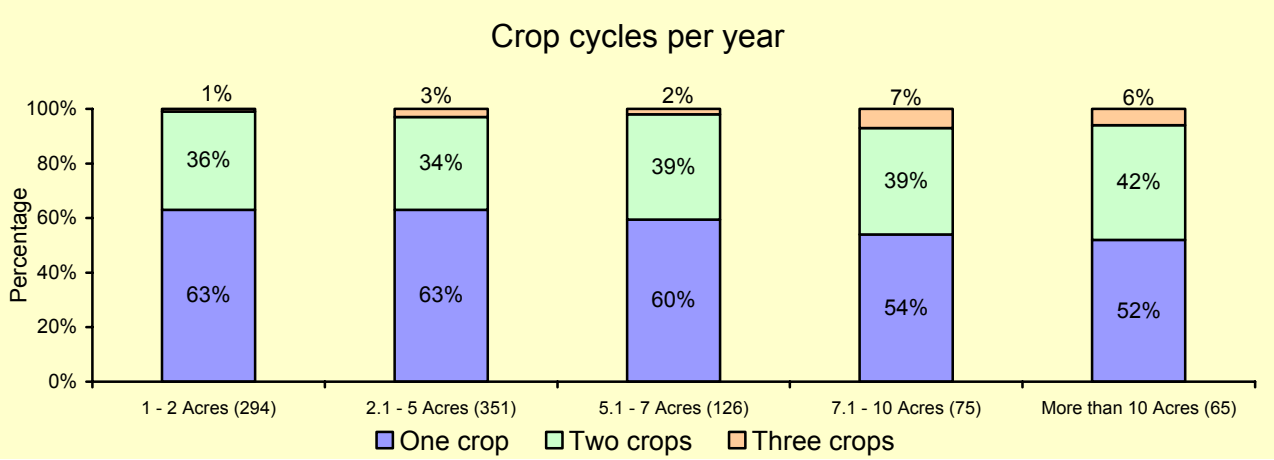
The reasons for financial distress among cotton growing farmers were also validated in the quantitative phase. Insights related to the same have been mentioned in the section below.

4.1 Crop cycles per year



The figure above shows 90% of the cotton growing farmers in Gujarat have single crop cycle against 57% of the cotton farmers in Maharastra. It also indicates the longer tenure of cotton crop for most of the farmers in Gujarat, since as high as 90% of them have a single crop cycle. This phenomenon, along with other factors like 'more irrigated area' (described later in this section) explains better productivity of cotton crop in Gujarat (described in the 'Cost economy' section) when compared with other states. In Madhya Pradesh cluster, 76% of cotton growing farmers have 2 crop cycles per year, which in the highest percentage for 2 crop cycles across clusters.

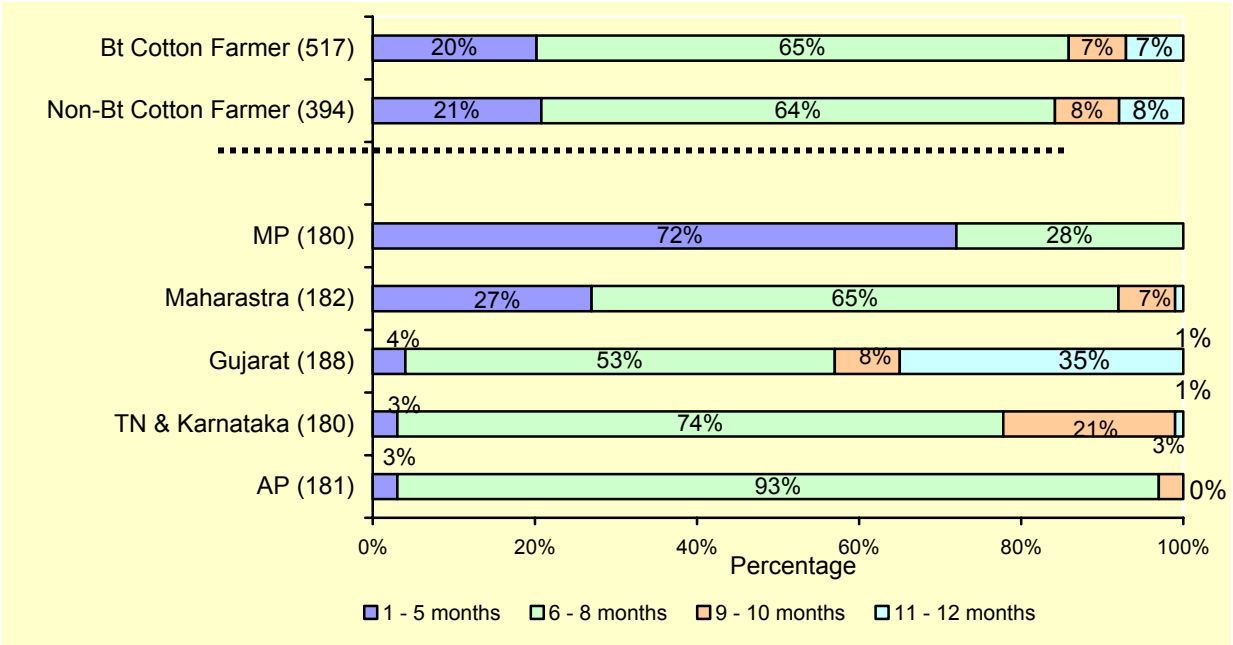
Looking at the crop cycle distribution across Non-Bt and Bt cotton farmers (as classified in Section 4.2.1), largely distribution of number of crop cycles per year is similar. However, Bt cotton growing farmers have slight edge over non-Bt cotton farmers with it comes to two and three crop cycles per years with 37% and 3% of the farmers respectively cultivating it.



Looking the number of crop cycles per year by area under cotton crop cultivation in current crop cycle, 42% of the bigger farmers (10 acre plus cotton cultivation) have 2 crop cycles per year.

4.2 Land utilization for cotton

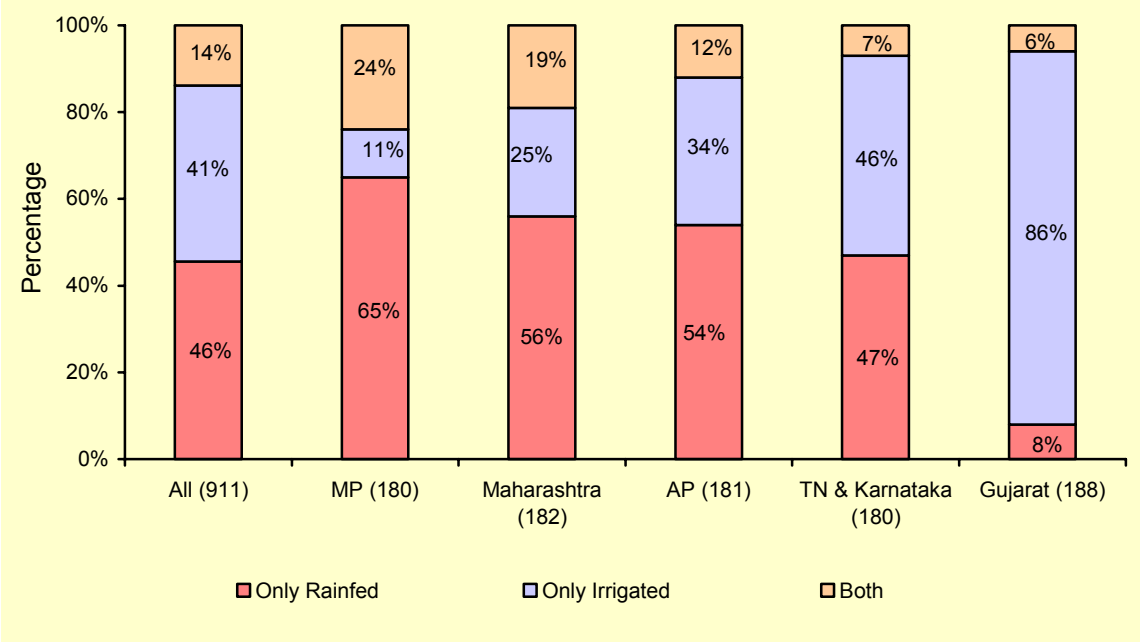
Another important aspect towards understanding the farming practices is understanding the extent of land utilization per year for growing cotton in the cotton growing belt across clusters.



The figure above show that in Gujarat, 35% of the farmers utilize their land (including lease one) for growing cotton for 11 - 12 months a year. 72% of the farmers in Madhya Pradesh utilize their land for cotton cultivation for 1 – 5 months a year. This largely substantiates the prevalence of 2 cotton crop cycles per year phenomena in this state. In Maharastra, 73% farmers cultivate cotton crop for 6 – 8 months or more in a typical year.

4.3 Distribution of farmers among 'Rain fed' and 'Irrigated' area

Understanding the profile of cotton farmers who were surveyed in the cotton growing belt across the clusters (as shown in Table 1, 2 and 3 of Section 4.1.1) would not be complete without looking at the distribution of the sample size between 'rain fed' and 'irrigated' area (as defined in Section 4.2.1).

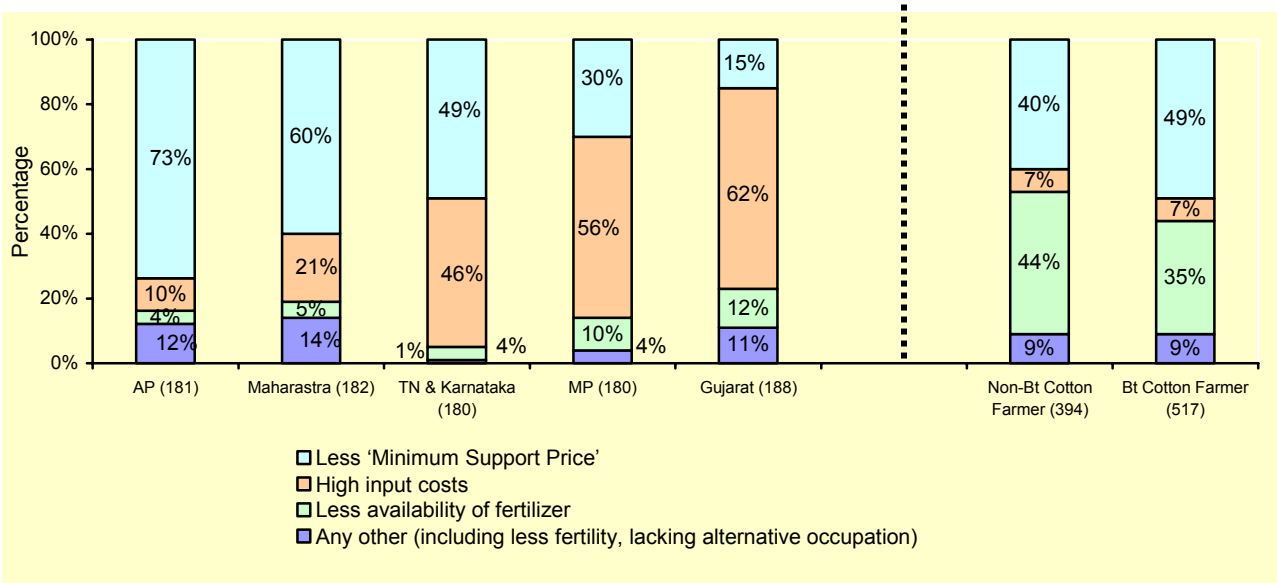


The figure above shows as high as 86% of cotton growing farmers in Gujarat cultivate cotton in only 'irrigated' area. This explains the high yield per acre in the Gujarat cluster.

65% and 56% of the cotton farmers from MP and Maharastra clusters respectively cultivate cotton only in the rain fed area. This could be one of the key reasons for lower productivity (yield) in these states.

4.4 Reasons for financial distress among cotton growing farmers

Recently, farmers' raised hue and cry in the backdrop of cotton crop failure in some parts of the cotton growing belts. The reason for crop failure was cited to be the usage of Bt Cotton seeds which led to increase in input cost, which in turn, led to financial distress. There was a need to address the issue of financial distress and identifying major underlying reasons behind it in the cotton growing belt across the clusters. The findings are as follows:



73% of cotton producing farmers from Andhra Pradesh and 60% of cotton producing farmers from Maharastra believe less 'minimum support price' fixed by the Government to be the most important reason for financial distress among cotton growing farmers.

62% of cotton producing farmers in Gujarat followed by 56% of cotton producing farmers in Madhya Pradesh believe higher input cost as the most important reason for the financial distress.

Interestingly, in Maharastra, that accounted for 14.75% of cotton crop production in India in 2005-06 (Source: Cotton Advisory Board), only 21% of the farmers believe higher input cost to be the most important reason for acute financial distress. Some secondary reports and newspaper articles mentioned the 'Vidharbha' region of Maharastra as the epicenter of suicides in cotton growing belt of India and the primary reason was cited as financial distress caused by high cost of inputs. It can be concluded from the above chart that higher cost of inputs such as seeds, fertilizers and pesticides is not the primary reason responsible for financial distress among cotton growing farmers. On the contrary, farmers have cited "Less Minimum Support Price" as the primary reason for financial distress.

According to one of the farmers from Sevagram, Wardha (in Maharastra)
"There was a suicidal case in 'Waipadh - Dorli' village, around 20-25 Kms from Sevagram and the reason highlighted was 'Bt cotton crop failure'. But the actual reason was something else. Largely suicides happen because of:-

1. Lesser savings, largely due to improper financial planning
2. Depression / tension due to family/personal conflicts
3. Loan from Bank gets waived off after committing suicide and the farmer considers it as an easier exit option
4. Family gets ex-gratia payment of Rs 1 Lacs."

Other reasons for financial distress / suicides that were significantly highlighted during in-depth Interviews with farmers are:-

- Inability to pay back bank loans of the previous year that debars eligibility for the crop loan for next year. Even those who pay back or don't default are not given the credit to the extent required (for more information on this area, refer to 'Sources of Finance' under the Purchase Behavior section). The reason largely lies in the failure of cooperative system in the rural areas that has led to cash crunch situation among these cooperative banks. When farmers do not get full credit on their finance requirements from these cooperative banks, they resort to other available options like approaching money lenders.
- Sole dependence on agriculture is another prominent reason reflected during qualitative phase. The situation gets worse when crop fails for more than 1 year.

"Failure of Bt crop is a ruse for financial distress. Farmers are not proactive especially in the adverse weather conditions. When crop fail, proactive farmer takes advantage of 2nd crop. Major problem is finance."

- One of the farmers from the cotton growing belt of Dakor district in Gujarat

"..I know a person who committed suicide by Vish paijan (consumption of poison) in *'Jorman – Padershatil'* village of Yavatmal. The reason for suicide was inability to pay last years' Rs 15000. On the top of that he took Rs 20000 this year. Crop failed due to flood this year. He has a family with 3 children. He could not incur family expense let aside the bank repayment."

- One of the farmers from the cotton growing belt of Yavatmal district in Maharastra

"...unavailability of credit 'on time' is leading to lesser crop productivity, which in turn is leading to suicidal cases across the region."

- One of the farmers from 'Vadgiri' village of Yavatmal district in Maharastra

"…. this village is less prone to suicide as here farmers have two occupations - farming and cattle farming (milk selling)."

- One of the farmers from 'Vadgiri' village of Yavatmal district in Maharastra

5 Awareness related insights

Determining the awareness levels of Bt cotton seeds category as a whole and certain other issues like awareness of certification levels and distinction of certified seed with non-certified seeds was one of the key objectives of this study. Also, because awareness precedes the purchase process, it is paramount that cotton growing farmers should be aware of the correct information to extract better mileage out of it.

In this regard, this section starts with the awareness of Bt cotton as a category, and further drills down to the issues like awareness of certification, unaided (Top of Mind and Spontaneous) and aided awareness for various certified and non-certified brands across cotton growing farmer clusters.

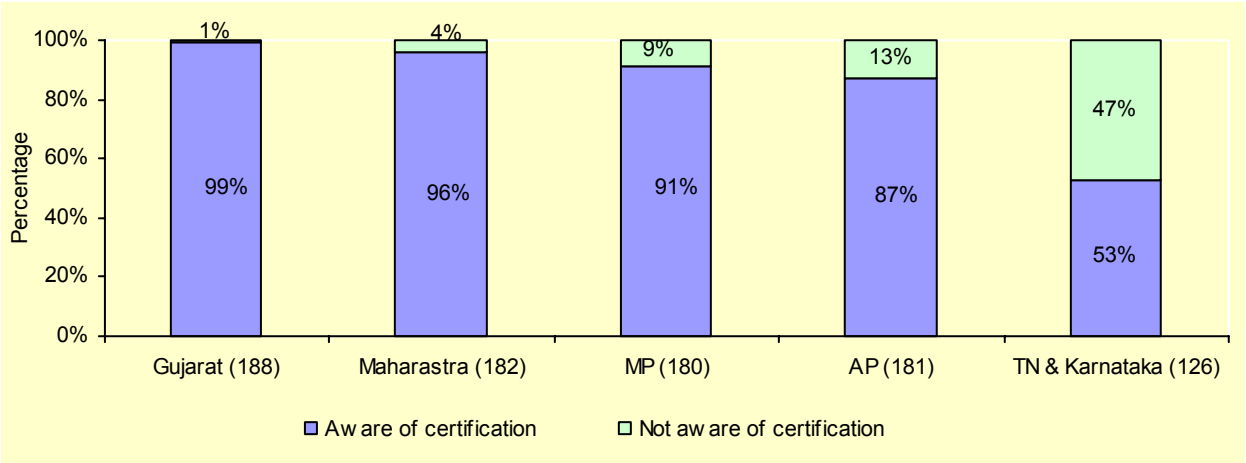
5.1 Awareness of Bt cotton seeds

	Maharastra	Gujarat	MP	AP	TN & Karnataka
Base	**182**	**188**	**180**	**181**	**180**
Aware of Bt cotton seeds	100%	100%	100%	100%	70%
Not aware of Bt cotton seeds	0%	0%	0%	0%	30%

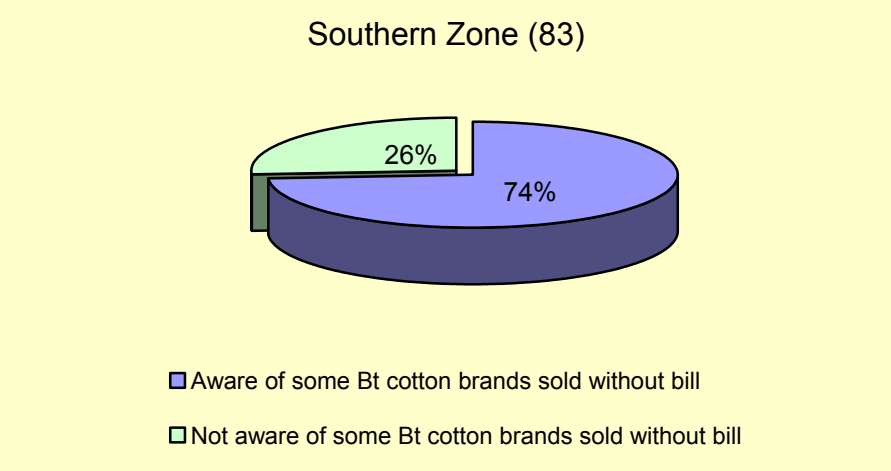
Awareness levels for 'Bt cotton' category as a whole was found to be very high across all the clusters. The four clusters having cent percent awareness levels were Maharastra, Gujarat, Madhya Pradesh and Andhra Pradesh. In TN-Karnataka cluster, awareness level of Bt cotton category was an issue with around 30% of the farmers not even aware about the Bt cotton category. In Tamil Nadu, awareness levels were relatively higher in Salem cluster than in Coimbatore cluster.

5.2 Awareness of certification among Bt cotton brands

Since the spurious seed brands are easily available under Bt cotton seed category across the clusters, it becomes very important that farmers should be aware of Bt cotton certification or Government approval so that they can easily distinguish between certified seed brands and non-certified brands. It is also essential that cotton farmers should know that benefits claimed by Bt cotton can only be accrued if they are purchasing certified cotton seeds.



The figure above shows that Gujarat and Maharastra lead as far as awareness levels of certification of Bt cotton seeds is concerned. Awareness levels of certification of Bt cotton seeds (among those who are aware of Bt cotton) are comparatively lower in Tamil Nadu & Karnataka cluster at 53%. Hence, there is a need to provide special focus towards certification related marketing initiatives in TN-Karnataka cluster so that awareness about certification in this cluster can be brought on par with Central zone clusters.



Among those farmers who are not aware of certification of Bt cotton brands, in Southern Zone, 74% of the farmers are aware that some Bt cotton brands are sold without bill. However, these farmers are not directly aware that some brands are certified whereas others are not. In the western zone, since the base of the cotton farmers not aware of certification is very less (less than 30 respondents out of 550 respondents), data for the same has not been given. However, most of these farmers are aware of the fact that some brand are sold without bill.

To sum up, it can be said that awareness building of certification of Bt cotton seeds is not an issue in the central zone but it is required in the southern zone especially in the TN-Karnataka cluster.

5.3 Sources of awareness of Bt cotton brands

Sources of awareness can be measured at two levels. Firstly, there are sources that have made the farmers across various clusters aware of the existence of Bt cotton brands and their benefits. A step ahead is the sources that made them aware about the certification related issues. During the study we found that while some sources for these two levels of awareness were common, awareness from 'seed shops' was found to be significantly present for making farmers aware about the existence of Bt cotton brands and not about the certification levels of these brands. Tables below provide insights into these issues.

5.3.1 Sources of awareness about existence / availability of Bt cotton seeds

	All	Maharastra	Gujarat	MP	AP	TN & Karnataka
Base :	**911**	**182**	**188**	**180**	**181**	**180**
Word of Mouth from other farmers	94%	96%	91%	97%	96%	90%
Newspapers / Magazines	38%	84%	36%	9%	51%	9%
Owner / employee of the seed shop	82%	74%	96%	71%	73%	92%
Television	31%	55%	46%	9%	37%	8%
Wall Paintings / Hoardings / Posters	24%	49%	28%	27%	17%	1%
Point of purchase material e.g. danglers, posters etc	17%	41%	12%	19%	2%	11%
Sales/Mktg personnel of various seed companies	31%	38%	31%	15%	19%	52%
Radio	9%	16%	5%	5%	1%	17%
Melas / haaths or similar initiatives by vaious universities / bodies	4%	12%	4%	3%	0%	2%
Sarpanch / Agri Development Officer / NGOs / University personnel	13%	4%	11%	5%	5%	37%

For brand awareness also, word of mouth from other farmers is the most prevalent source of awareness. In Maharastra, 84% of the farmers become aware of various brands from Newspapers / magazines.

In Gujarat & TN-Karnataka clusters, 96% and 92% of the farmers respectively are aware of various brands from the owner / employee of the seed shop.

5.3.2 Sources of awareness of certification

	All	Maharastra	Gujarat	MP	AP	TN & Karnataka
Base :	**748**	**174**	**187**	**163**	**157**	**67**
Word of Mouth from other farmers	93%	97%	93%	95%	97%	70%
Owner / employee of the seed shop	80%	70%	96%	77%	75%	82%
Newspapers / Magazines	45%	81%	43%	11%	55%	12%
Television	37%	61%	49%	12%	35%	4%
Sales / Marketing personnel of various seed companies	32%	47%	33%	17%	20%	57%
Wall Paintings / Hoardings / Posters	27%	39%	31%	29%	18%	1%
Point of purchase material e.g. danglers, posters etc	17%	35%	11%	24%	3%	7%
Radio	10%	24%	3%	10%	0%	13%
Melas / haaths etc by vaious universities / bodies	5%	14%	4%	6%	0%	0%
Sarpanch / Agri Development Officer / NGOs / University personnel	11%	11%	9%	7%	6%	39%

Word of Mouth from other farmers is the most common source of awareness across all the clusters. 97% and 93% of the cotton farmers in Maharastra and Gujarat respectively have become aware of certification from word of mouth.

In Maharastra and Andhra Pradesh, Newspaper / Magazine is also one of the important sources of awareness for Bt cotton certification.

5.4 Awareness of Bt cotton brands

After the awareness of category, certification aspects and sources, the study explored the un-aided recall and aided recall (to define, refer to Section 4.2.1) for various seed companies. Most of the seed companies providing certified Bt cotton seeds are known by the seed companies names although some exceptions exist.

The segmentation consideration for classifying various seed companies and their brands during the questionnaire preparation phase were as follows:-

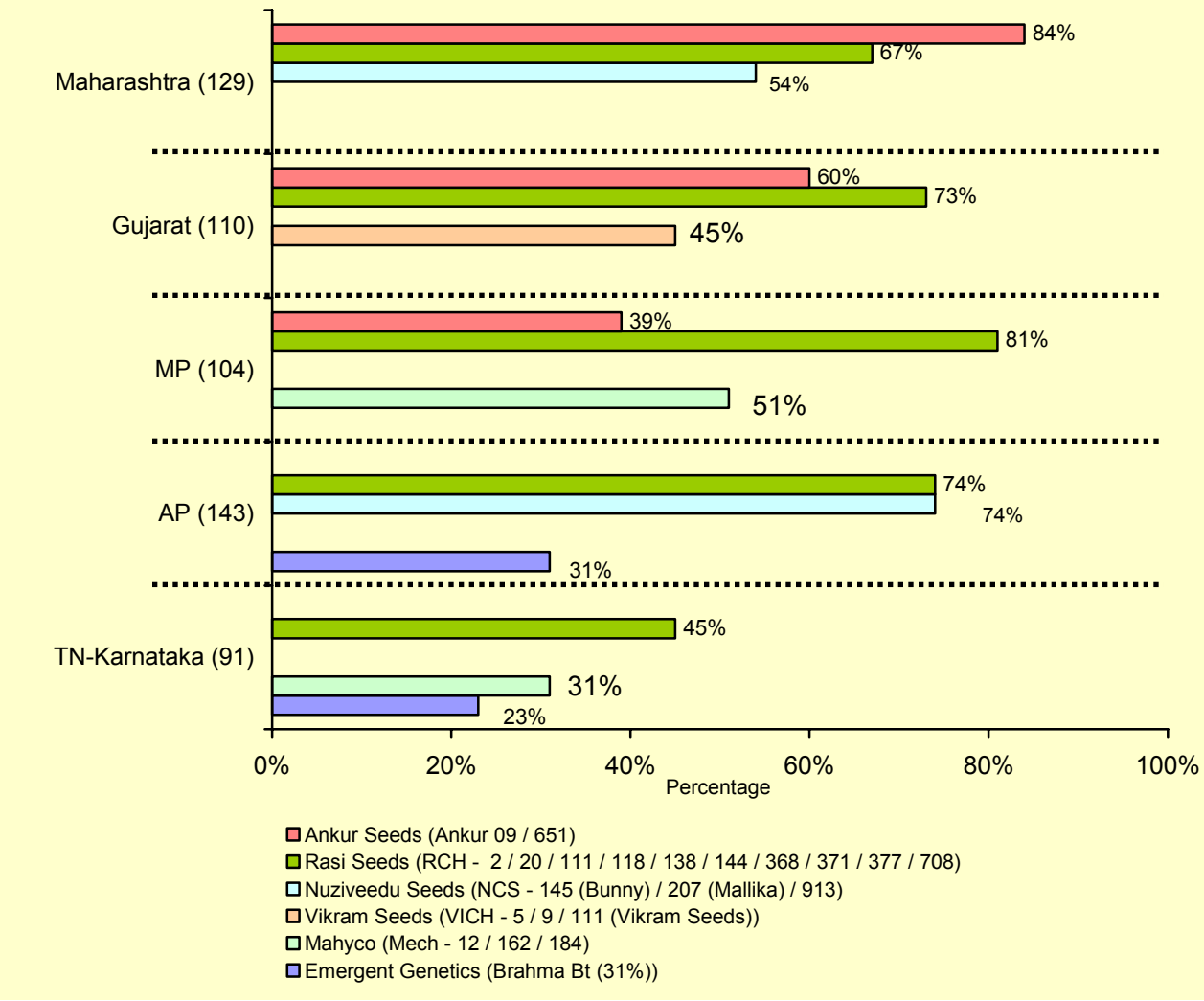
- NCS – 145 and NCS – 207 brands of Nuziveedu Seed Company are fairly popular by the names of 'Bunny' and 'Mallika' respectively. However, NCS brand (with all variants) from Nuziveedu Seed Company has been taken as a single brand for brand recall.

- Brands from 14 seed companies have been classified under 19 heads. The reason for the same is that the brands of some seed companies are known by two different names altogether e.g. Mahyco seed company's brands were found to be known with 2 different brands i.e. Mech and MRC. During qualitative phase, generally, it was observed that farmers are not aware of the 'number' in the brand name except in some most popular brand like 'Ankur-651'.

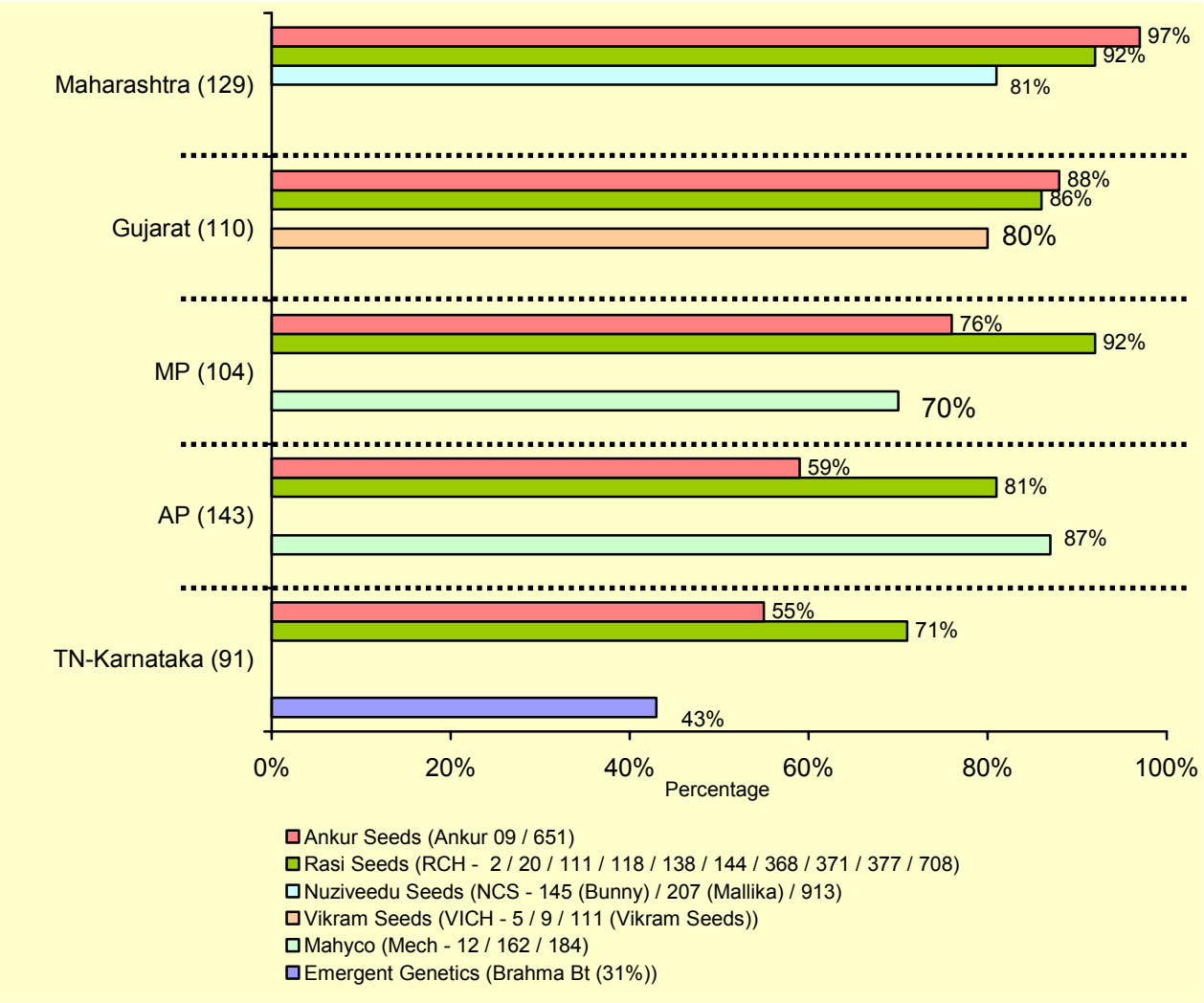
- During qualitative phase, farmers were also found to be aware of BG-I and BG-II classification for the brands like Ajeet Seeds and Krishidhan. The same has been taken into consideration while segmenting certified Bt cotton brands.

5.4.1 'Unaided' recall - certified Bt cotton seeds

The chart below shows top-3 certified Bt cotton seed companies across clusters as far as unaided recall is concerned. Ankur Seed Company is 1st and 2nd most unaided recalled company in Maharastra (84%) and Gujarat (60%) respectively. Among AP cotton growing farmers, 'TOM + Spontaneous' recall is highest for Rasi Seeds and Nuziveedu Seeds at 74% each. Rasi seeds are among the top 3 'unaided recall' companies across all the 5 clusters when it comes to the Bt cotton category recall among cotton growing farmers.



5.4.2 Aided recall - certified Bt cotton seeds



Aided recall includes unaided recall along with the respondents recalling the brands when exposed to some stimulus / show card.

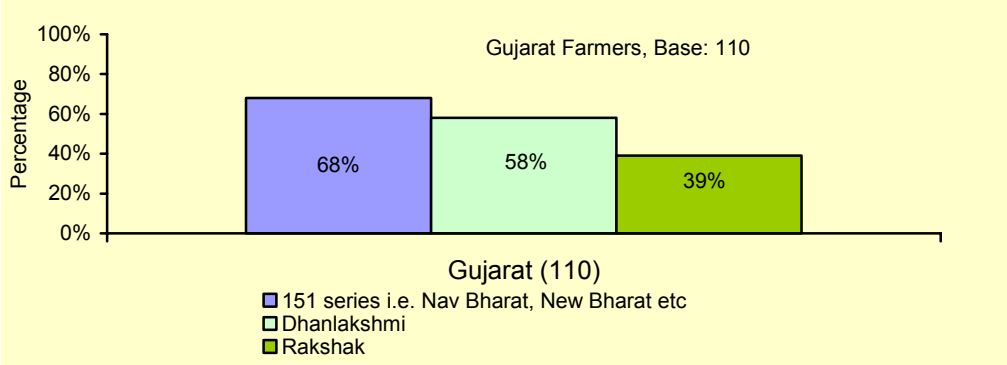
The chart above highlights that when it comes to 'aided recall', Ankur seeds again is the leading company with the presence in the top-3 seed companies across all the custers. It has the highest aided recall in the two big clusters – Gujarat and Maharastra.

Rasi Seeds has the highest aided recall in Madhya Pradesh at 92% and Nuziveedu Seeds has the highest aided recall in Andhra Pradesh at 87%

5.4.3 Unaided recall - non-certified Bt cotton seeds

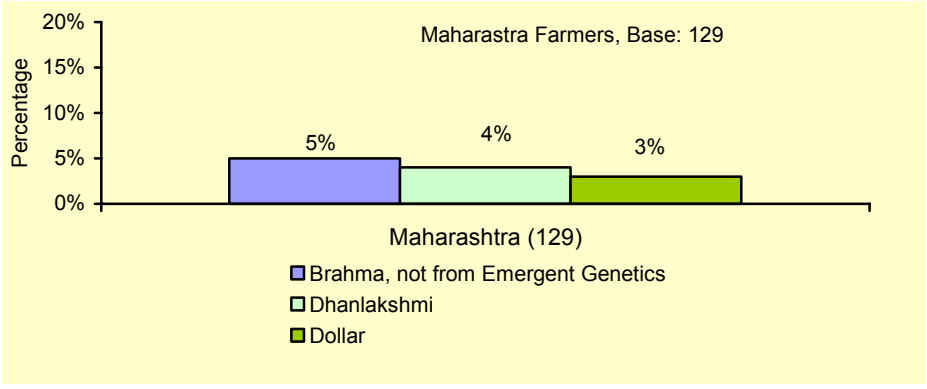
A large number of Non-certified Bt cotton brands were found present across various clusters. Most of these were local / regional centric brands. The following charts present the top non-certified brands aware of in each state cluster.

Gujarat



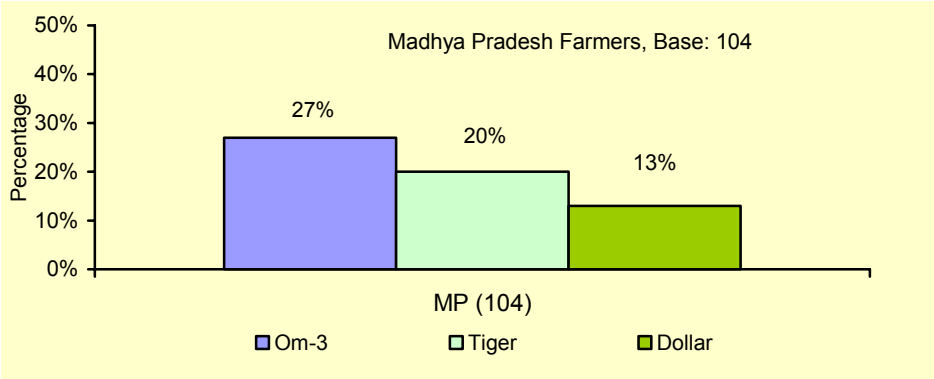
In Gujarat cluster, among non-certified Bt cotton brand, 151 series i.e. Nav Bharat has the maximum unaided recall of 68% followed by Dhanlakshmi at 58% and 'Rakshak' brand at 39%.

Maharastra



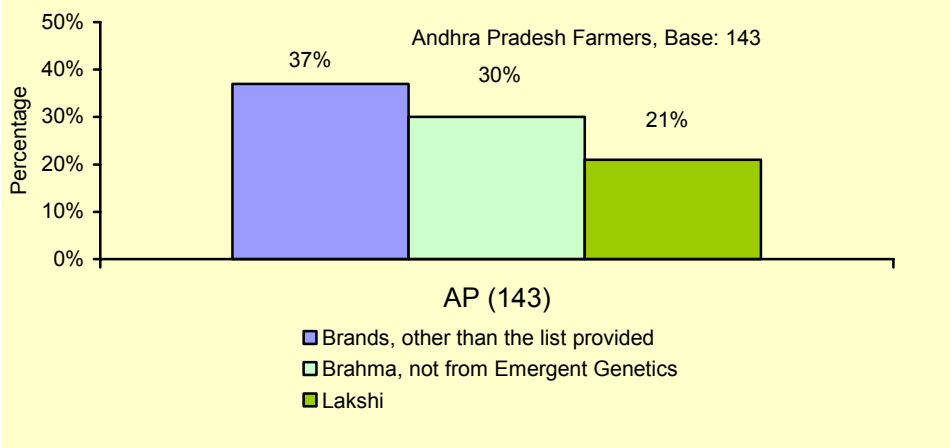
In Maharastra, unaided recall from the provided list of 40 non-certified brand is considerably less. Non-certified 'Brahma' brand has the highest unaided recall at 5%, followed by Dhanlakshmi and Dollar at 4% and 3% unaided recall respectively.

Madhya Pradesh



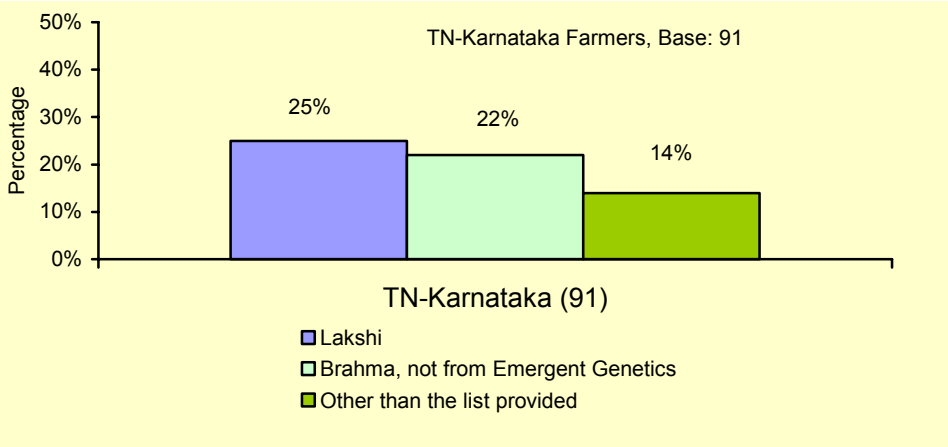
In MP, Om-3 brand has the highest unaided recall among the brands in the non-certified list, at 27%. Tiger is another popular non-certified brand with the unaided brand recall at 20%, followed by Dollar at 13%.

Andhra Pradesh



In AP cluster, among non-certified Bt cotton brand, some other brands not present in the list of 40 major non-certified brands provided by the client are fairly popular if seen as a whole. Cumulatively, brands other than provided in the list have 37% unaided recall. Non-certified 'Brahma' brand is a popular brand with 30% unaided recall, followed by 'Lakshi' with 21% of the AP cotton growing farmers recalling it at the unaided level.

TN - Karnataka



In TN-Karnataka cluster, 'Lakshi' brand is the most popular brand among non-certified Bt cotton brands at 25% unaided brand recall. Non certified 'Brahma' brand is the second most popular brand at 22% unaided recall.

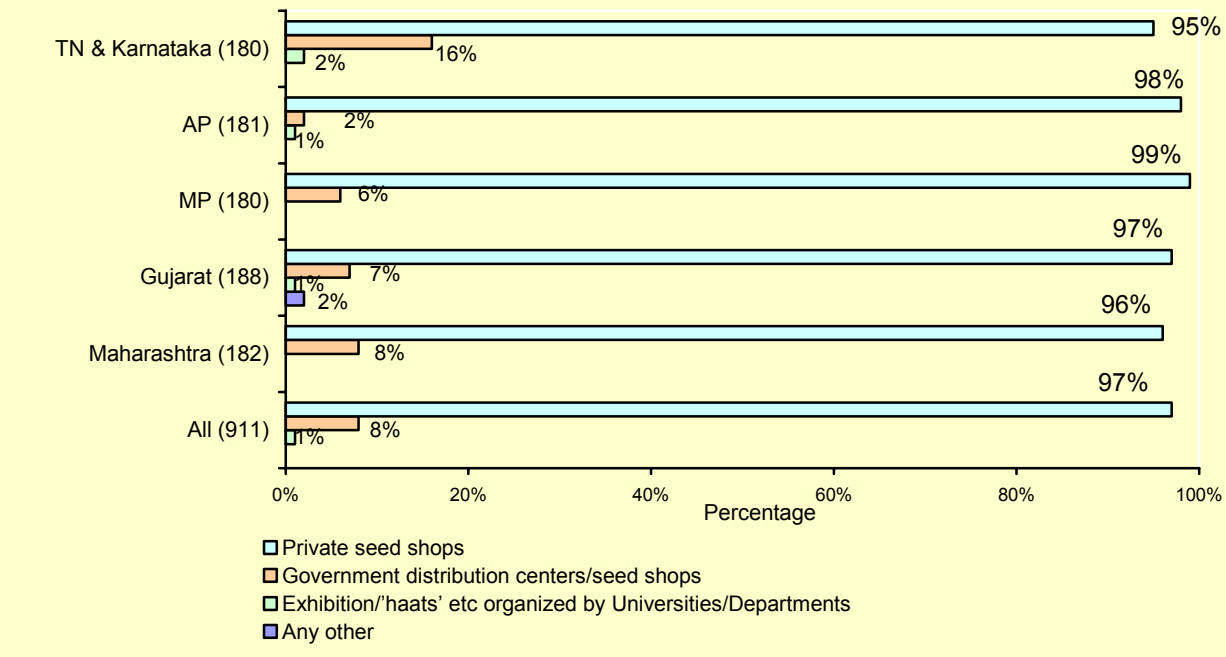
6 Purchase Behaviour of Cotton Farmers

This section includes the purchase behaviour and usage related insights covering the following:-

Purchase related insights:- Sources of purchase, purchase process, sources of finances used, percentage distribution of total expenditure from these sources
Usage related insights:- Usage of top 3 certified Bt seed companies across the clusters.

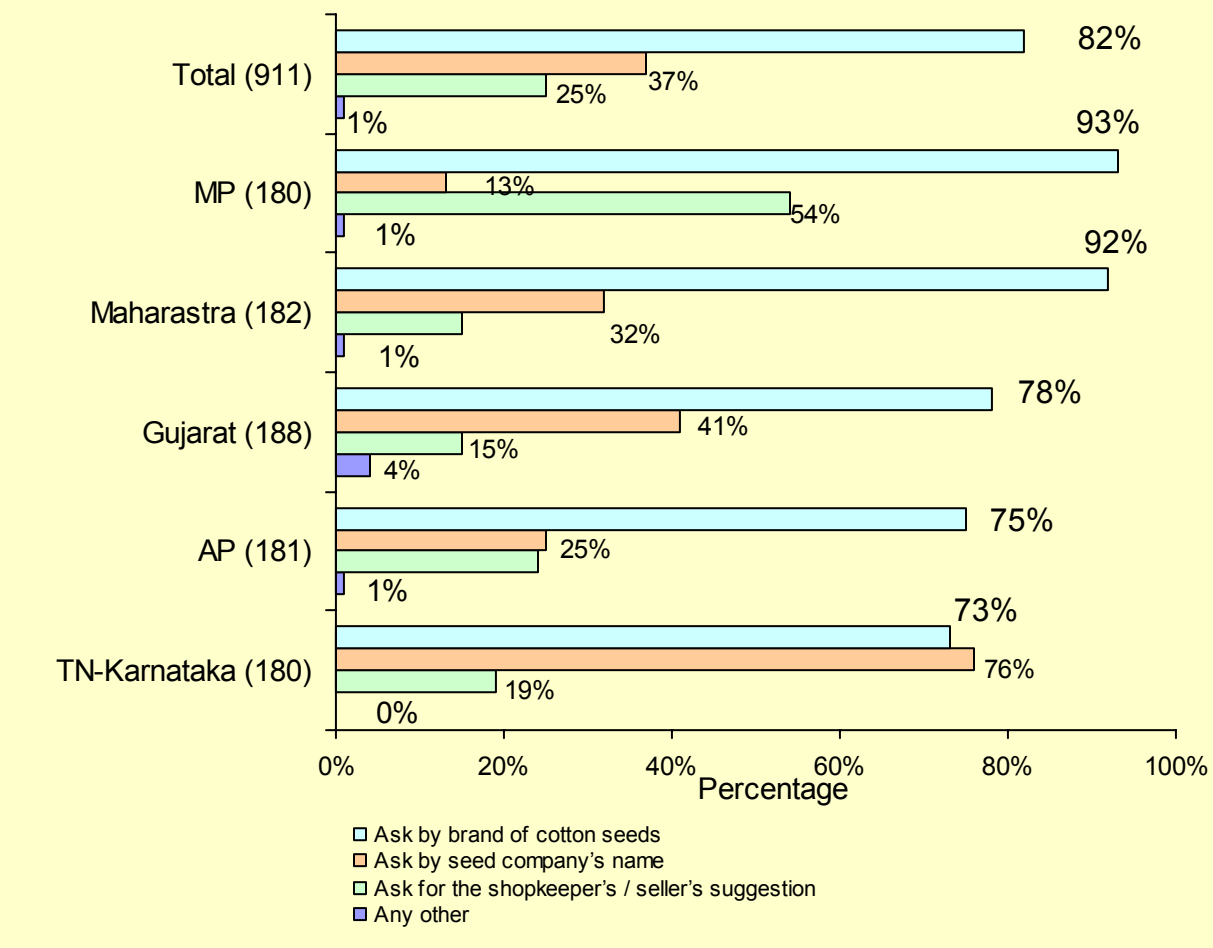
6.1 Purchase related insights

6.1.1 Sources of Purchases during current crop cycle



The graph above shows that across the states, farmers largely purchase cotton seeds from private seed shops. These shopowners have good rapport with the farmers. A distant second source of purchase is Government distribution centers / seed shops. It may be noted that the farmers in Tamil Nadu/ Karnataka cluster have a very high prevalence of buying from Government distribution centers/ seed shops.

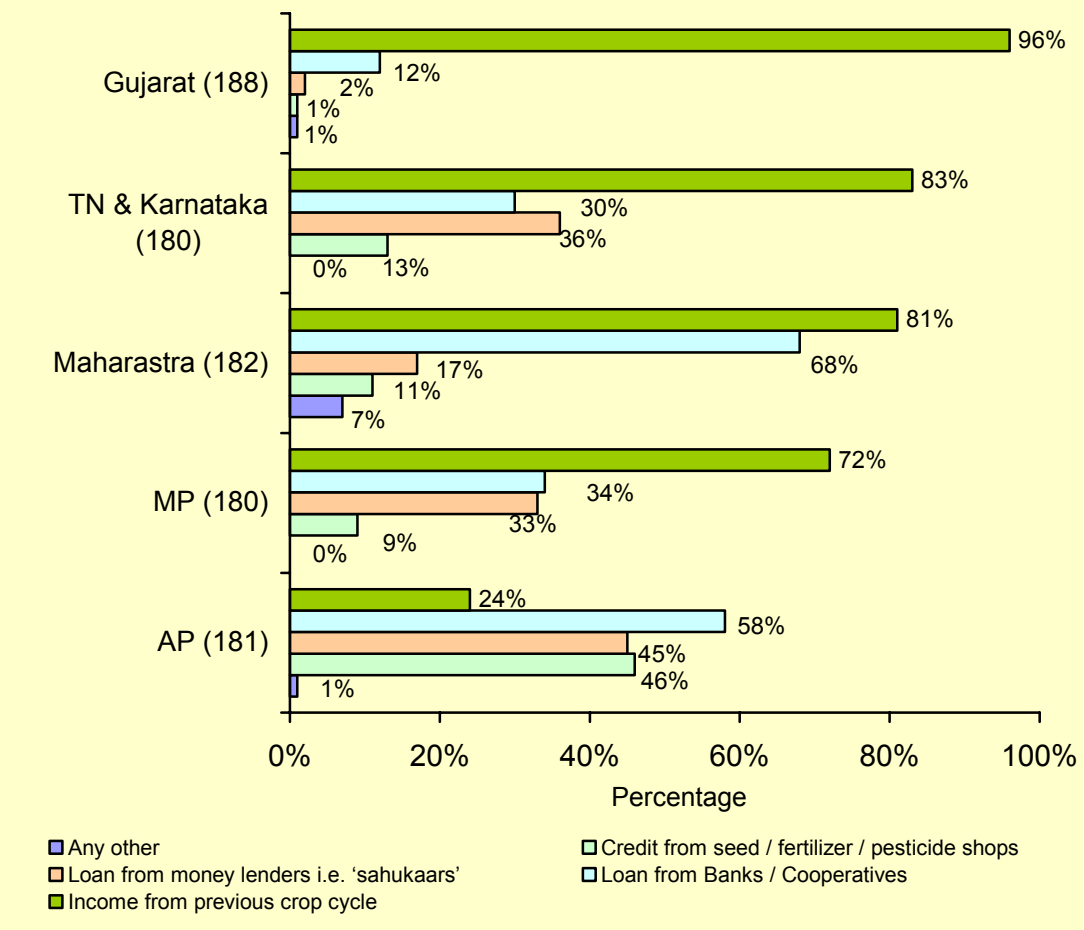
6.1.2 Purchase process at the seed shop



By and large, farmers demand seeds by their brand name. Only in TN-Karnataka cluster, more percentage of farmers, i.e. 76%, express their intention to purchase by seed company's name than by expressing it by the brand name.

6.1.3 Source of finances used for sourcing total expenditure

It is important to understand source of finances for sourcing total expenditure incurrent during cotton crop cycle in the light of interest charged by various sources. This shall help us better understand the financial distress situation among cotton farmers across the clusters.

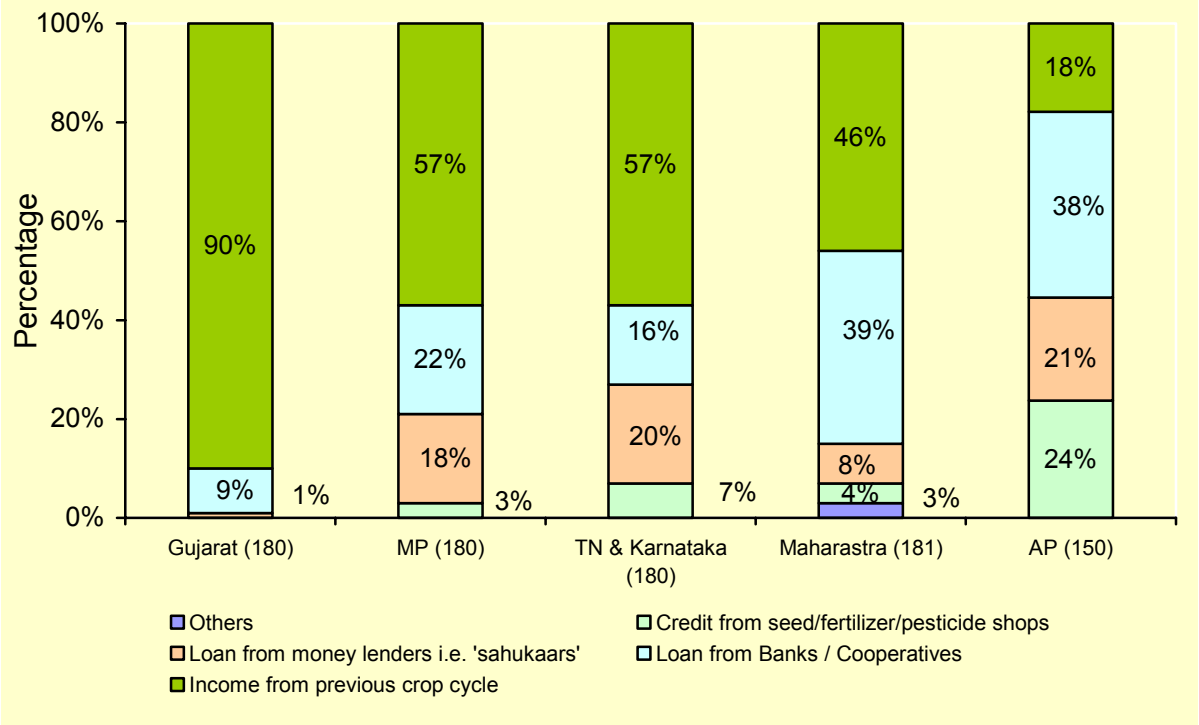


Only in Andhra Pradesh cluster, percentage of farmers sourcing expenditure from the savings of previous year's crop cycle is lesser than the percentage of farmers dependent upon loan providing agencies.

In the Central and Southern zones:-

- Mean yearly rate of interest charged by the banks / cooperatives is 11% and 13% respectively in the two zones.
- Yearly rate of interest charged by money lenders is around 45% and 30% respectively in the two zones. Such a high interest rate is trapping the farmers in the vicious circle of debts. This, in turn, is leading to higher number of suicides.

6.1.4 Percentage distribution of the total expenditure from various sources

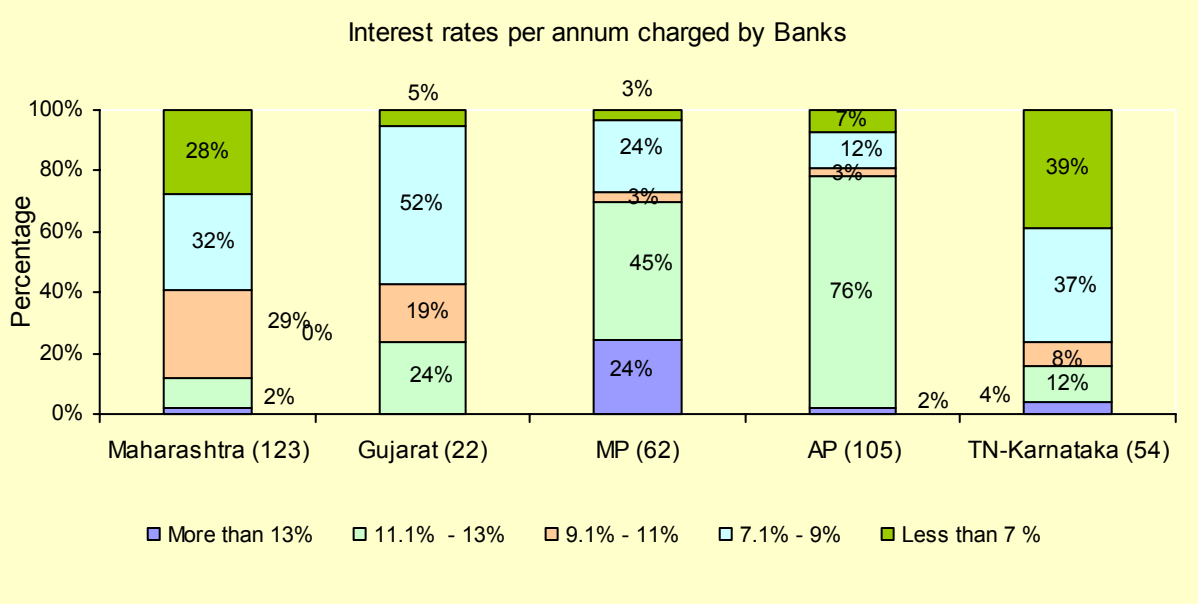


As shown in the graph above, cotton farmers from Gujarat source 90% of the expenditure incurred during entire crop cycle from the income from previous crop cycle. This reveals their 'far-sightedness' and better planning for expenditure.

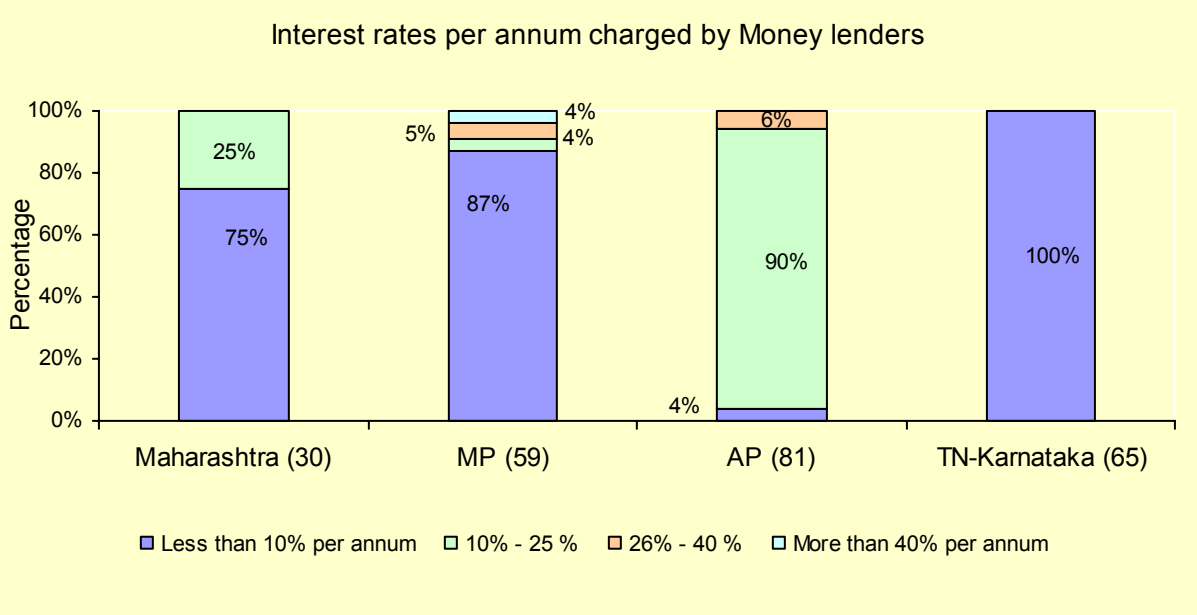
Income from previous crop cycle contributes only 57% each out of the total expenditure during entire crop cycle for the cotton growing farmers from Madhya Pradesh and TN-Karnataka.

In Andhra Pradesh, maximum contribution for the farmer's crop cycle expenditure i.e. 38% comes from banks / cooperatives.

6.1.5 Interest rates charged by various entities financing expenditure



Interest rates charged by banks are relatively lower with a mean value of 12% across clusters. However, there are some cooperative banks charging interest rates more than 13% per annum, especially in Madhya Pradesh where over 24% of the farmers taking loan from banks are paying more than 13% interest rates per annum..



4% of the farmers in Madhya Pradesh pay 'more than 40% per annum' of the interest rates to the money lenders.

In Maharastra, even though money lending from money lenders has been banned, 25% of the farmers who take loan from money lenders pay the interest charges to the tune of 10% - 25% per annum.

Looking this data in light of….

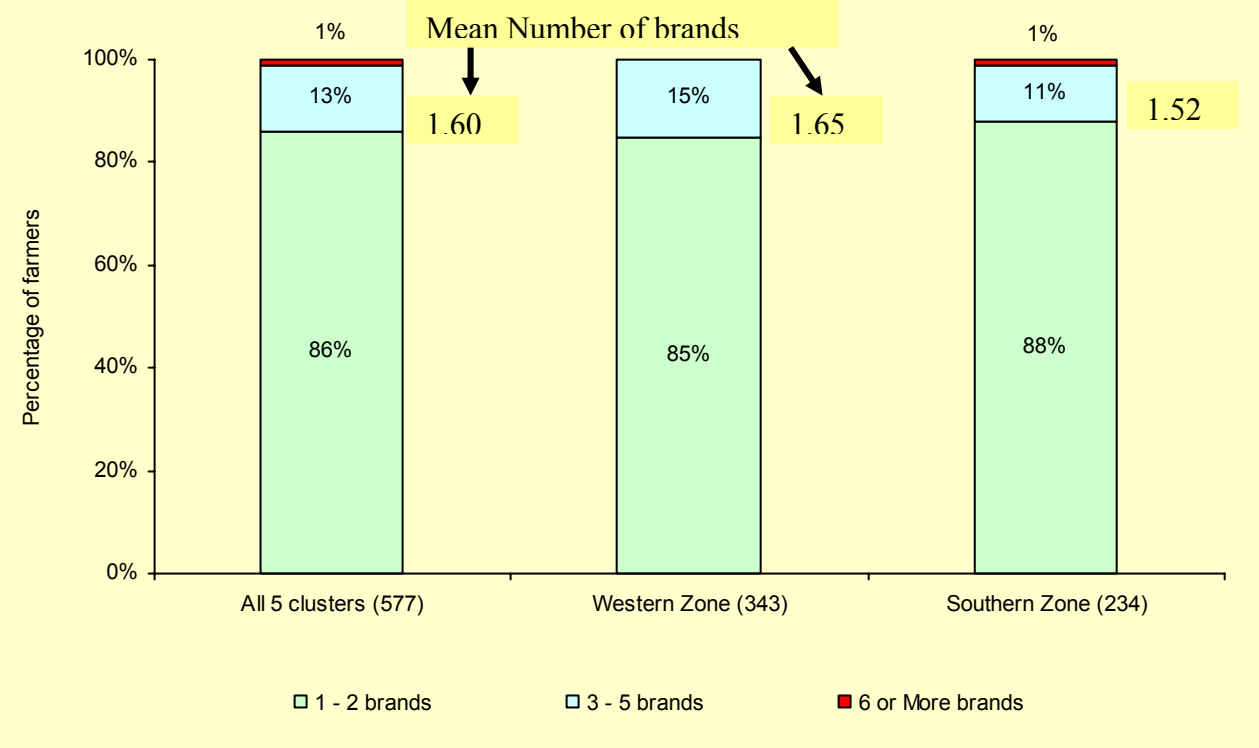
- the data from Section 7.1.3 that 17% and 34% of the farmers from Maharastra and Madhya Pradesh source finance from money lenders
- the data from Section 7.1.4 that this financing from money lender contributes about 46% and 57% of their total expenditure in Maharastra and Madhya Pradesh respectively

…it can be concluded that this is the most important reason for the financial distress of the farmers in these state clusters. Money lending from these lenders increases the actual input costs of these farmers significantly who are not able to understand this difference at the time of lending money. During the qualitative phase, it was revealed that sourcing money from these money lenders is never the first choice across the clusters. They have to take assistance from these money lenders because of the following reasons:-

- Sourcing from banks is inadequate.
- Credit from banks is not available at the right time (purchase of seed, fertilizer, pesticide, etc).

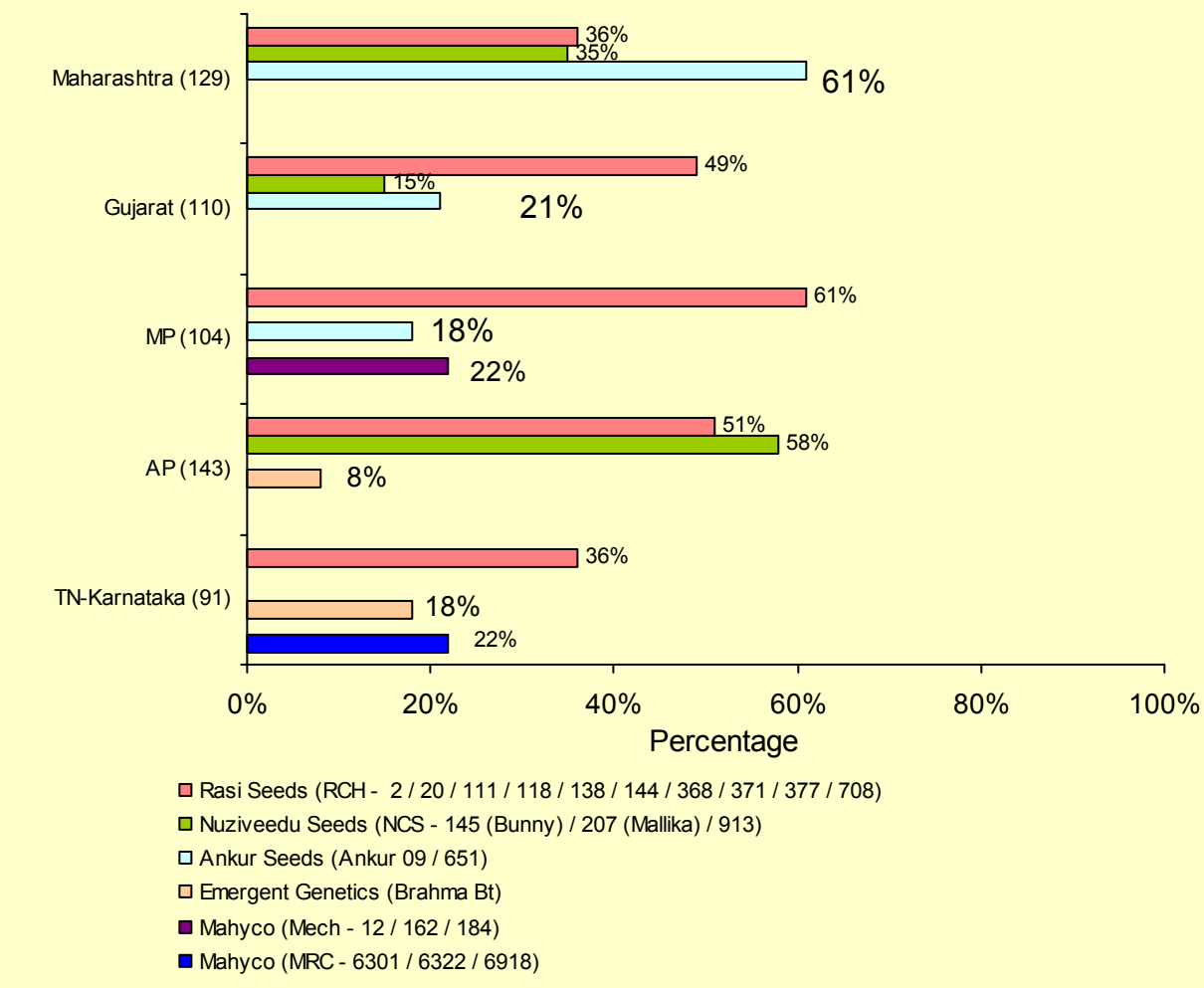
6.2 Bt Cotton seed usage related insights

6.2.1 Number of Bt cotton seed brands used during current crop cycle



When it comes to choosing Bt cotton brand, most of the farmers from both the zones choose 1 – 2 brands for Bt cotton crop. In the 'Karnataka' state of TN-Karnataka cluster, 100% of the farmers covered under survey chose 1 – 2 brands Bt cotton brands. This is largely because farmers do not have confidence and reliability of Bt cotton crop success as the category of seed is relatively new. Farmers crop hybrid non-Bt category of seeds along with Bt cotton crop variety to distribute the risk of crop failure.

6.2.2 Top 3 Seed companies providing certified Bt cotton brands



'Rasi seeds' is the only seed company among top 3 used certified Bt cotton seeds companies across 5 clusters.

'Ankur seeds' is the most popular seed company as far as usage is concerned in Maharastra with 61% of the farmers who are using certified Bt cotton claimed to be using it.

'Nuziveedu seeds' is another dominant player with the presence in three clusters among top-3 seed company category. Nuziveedu seeds are fairly popular among farmers of Andhra Pradesh and Maharastra by the name of 'Bunny' and 'Mallika'.

Other popular seed company brand names are: - Mahyco's Mech and MRC brand variants that are popular in Madhya Pradesh and TN-Karnataka cluster.

7 Perception, importance of factors and satisfaction

7.1 Category Imagery

Gauging the perception levels of the cotton growing farmers for various seed categories with respect to the attributes considered for purchasing cotton seeds was another important objective of this study. Before determining the perception levels, the attributes on which farmers consider purchasing the cotton seeds were identified through depth interviews with farmers in 2 states and secondary research. A list of 16 attributes was prepared before launching the qualitative phase.

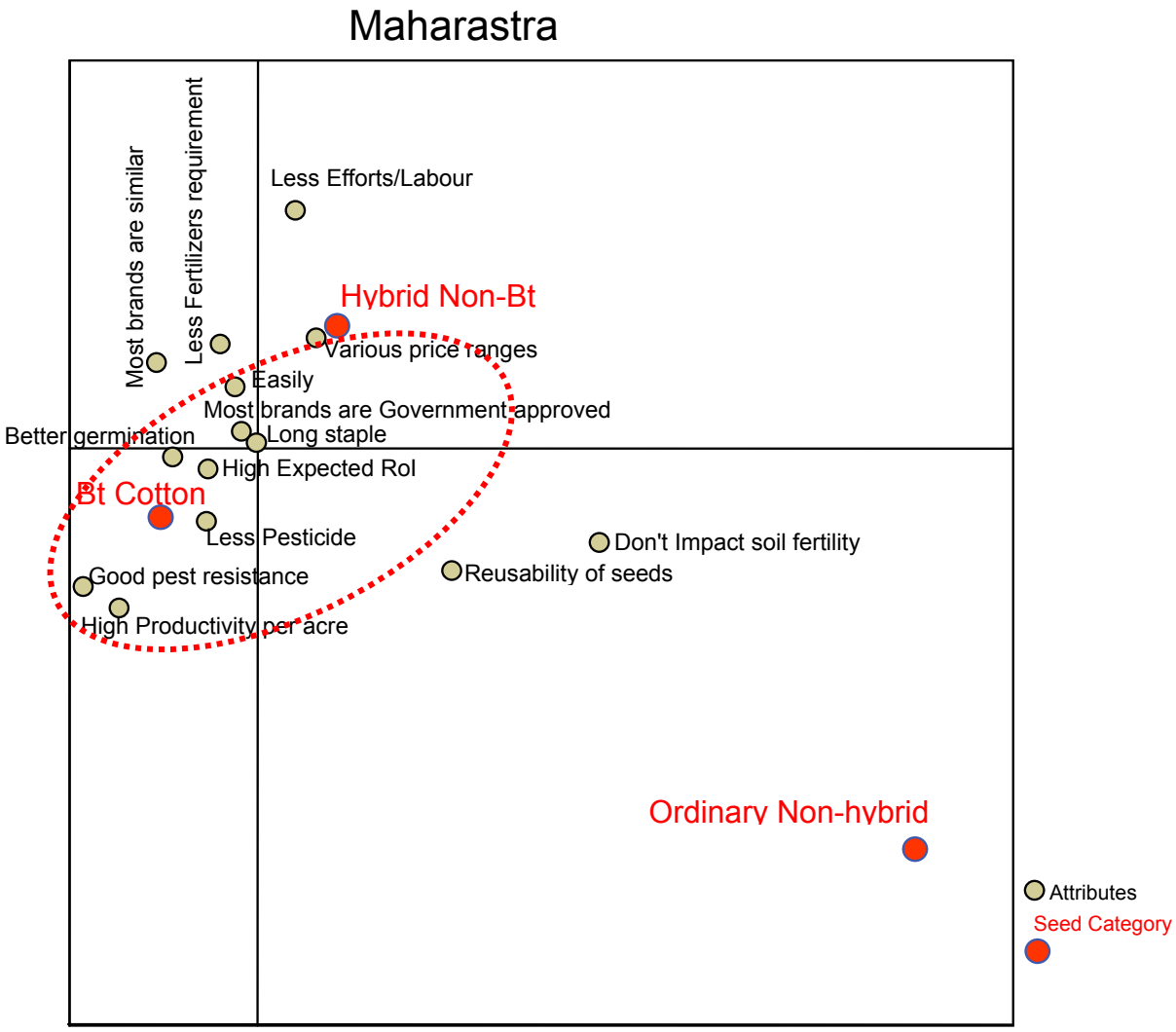
The perception levels across various clusters have been mapped below.

7.1.1 Maharastra

Attributes	Maharastra (182)		
	Ordinary Seeds	Hybrid Non-Bt Seeds	Bt cotton Seeds
Productivity per acre is high	3%	42%	77%
Long staple length	0%	36%	75%
Most brands are Government approved	0%	51%	73%
Better germination	2%	52%	72%
Good pest resistance	2%	37%	70%
Easily available	3%	59%	70%
Less Pesticide requirement	3%	47%	69%
Most brands are similar	1%	54%	69%
Less prone to failure	1%	41%	68%
Various price ranges	4%	66%	68%
Expected RoI is high	3%	48%	65%
Less Fertilizers requirement	2%	49%	57%
Doesn't Impact soil fertility	10%	60%	55%
Successful in rain-fed areas	7%	45%	51%
Less Efforts/Labour	2%	55%	50%
Reusability	6%	42%	49%

In Maharastra, cotton farmers have a positive disposition towards Bt cotton on the highlighted attributes. It is only on one factor i.e. 'this category of seeds doesn't impact soil fertility', hybrid non-Bt scores marginally higher than Bt cotton seeds category. Other two attributes where hybrid non-Bt category scored better by the cotton farmers were 'This category is easily available' and 'This category is available in various price ranges' at 66% and 59% respectively.

In a correspondence map, the relative proximity of the point representing a seed category (red dot in this case) to the point representing an attribute (green dot in this case) indicates the degree of association of a seed category to an attribute.



In the Maharastra cluster, this correspondence map shows that farmers associate 'High Expected Return on Investment' with Bt cotton. Other attributes like 'Less Pesticide requirements', 'Good pest resistance' and High Productivity per acre are also closely associated with Bt cotton brand.

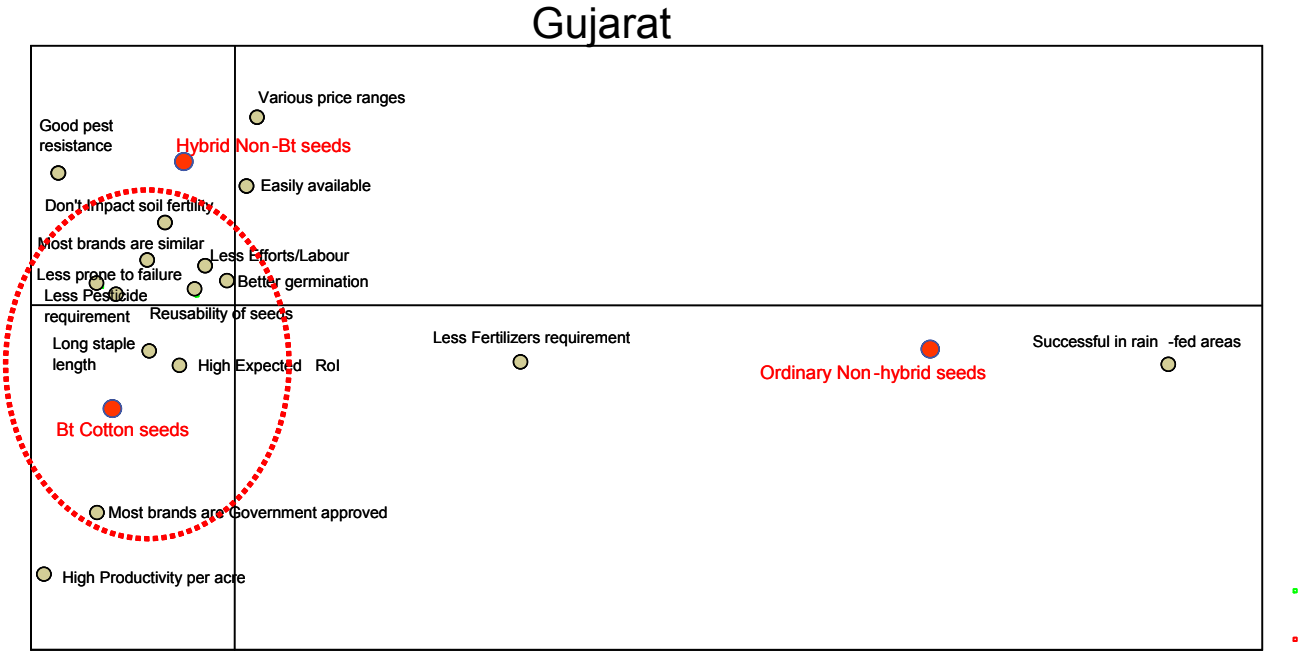
7.1.2 Gujarat

Attributes	Gujarat (188)		
	Ordinary Seeds	Hybrid Non-Bt Seeds	Bt cotton Seeds
Productivity per acre is high	4%	45%	89%
RoI is high	13%	54%	79%
Long staple length	10%	49%	71%
Less Pesticide requirement	7%	52%	70%
Easily available	18%	62%	70%
Less Efforts/Labour	14%	54%	69%
Most brands are Government approved	6%	38%	69%
Less prone to failure	6%	50%	68%
Reusability	12%	49%	64%
Most brands are similar	9%	50%	64%
Various price ranges	18%	62%	63%
Good pest resistance	3%	52%	62%
Better germination	13%	44%	56%
Doesn't Impact soil fertility	9%	45%	54%
Less Fertilizers requirement	21%	27%	34%
Successful in rain-fed areas	68%	31%	21%

Perception scores of the cotton farmers from Gujarat are relatively better than the scores from the farmers of Maharastra. Two possibilities can arise out of this comparison:-

- Either farmers from Maharastra are not associating themselves with any of the three categories OR
- Farmers from Maharastra associate largely with only one type of category.

Data presented in the table above can be pictorially represented with the help of correspondence map below.



As shown in the map above cotton farmers from Gujarat closely associate themselves with Bt cotton on some of the most important attributes. These attributes in the order of closeness of association are:-

- High expected return on investment
- Long staple length
- Less pesticide requirement
- Less prone to failure etc

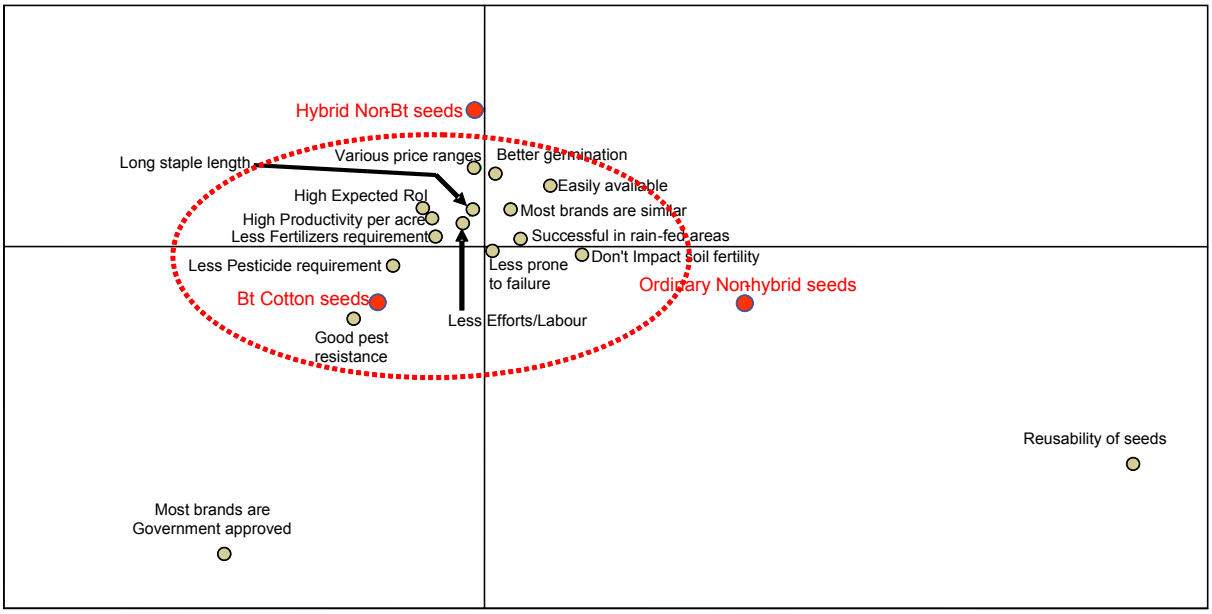
Interestingly, these farmers associate 'Successful in rain-fed areas' to 'Ordinary non-hybrid seeds'.

7.1.3 Madhya Pradesh

Attributes	Madhya Pradesh (180)		
	Ordinary Seeds	Hybrid Non-Bt Seeds	Bt cotton Seeds
Most brands are Government approved	3%	8%	94%
Productivity per acre is high	25%	49%	87%
RoI is high	24%	49%	86%
Less Pesticide requirement	18%	38%	84%
Good pest resistance	13%	31%	84%
Long staple length	29%	48%	78%
Less prone to failure	31%	42%	74%
Less Efforts/Labour	26%	43%	73%
Various price ranges	29%	52%	73%
Easily available	45%	57%	72%
Better germination	31%	52%	72%
Less Fertilizers requirement	21%	37%	69%
Doesn't Impact soil fertility	48%	46%	68%
Successful in rain-fed areas	33%	41%	66%
Most brands are similar	32%	43%	65%
Re-usability	61%	9%	1%

Farmer in Madhya Pradesh also strongly associate the encircled attributes under Bt cotton column with it. Higher score presents the percentage of farmers associating various attributes with a particular category. Comparing the absolute scores of Maharastra, Gujarat and Madhya Pradesh cluster, a clear trend of strong association with Bt cotton seed category across various attributes can be seen.

Madhya Pradesh



Correspondence map for Madhya Pradesh, as shown above, reveals strong association of 'Good Pest Resistance' and 'Less Pesticide requirement' with Bt cotton seed category. Interestingly, association of Bt cotton category with 'Most Brands are Government Approved' attribute is relatively lesser. Still that association is stronger than other two categories.

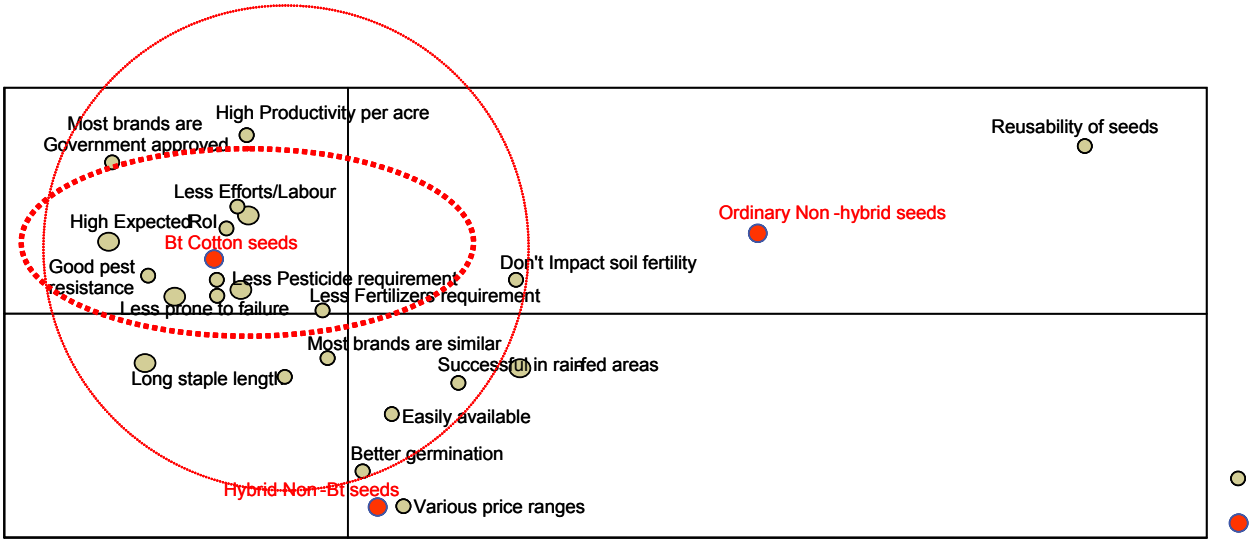
Hybrid seed is associated with 'Available in various price ranges' attribute where as among all categories, 'Reusability of seeds' is closer to Ordinary non-hybrid seed category.

7.1.4 Andhra Pradesh

Attributes	Andhra Pradesh(181)		
	Ordinary Seeds	Hybrid Non-Bt Seeds	Bt cotton Seeds
Easily available	34%	49%	94%
Less prone to failure	13%	31%	92%
Less Pesticide requirement	13%	30%	91%
Better germination	29%	50%	91%
Most brands are Government approved	6%	20%	91%
Good pest resistance	7%	27%	91%
Less Efforts/Labour	16%	27%	90%
Productivity per acre is high	17%	23%	90%
Most brands are similar	24%	39%	88%
RoI is high	14%	26%	87%
Less Fertilizers requirement	22%	33%	83%
Long staple length	18%	35%	83%
Successful in rain-fed areas	36%	43%	77%
Various price ranges	29%	47%	76%
Doesn't Impact soil fertility	37%	32%	63%
Reusability	71%	27%	15%

Andhra Pradesh farmers have even more stronger association with Bt cotton seed category than with Madhya Pradesh cluster farmers on certain important attributes.

Reusability of seeds is the only attribute that is strongly associated with ordinary non-hybrid cotton seeds.



Correspondence map above show the strong association of Andhra Pradesh cotton farmers with the following attributes in the order of closeness:-

- Less Pesticide requirement
- Less prone to failure
- Higher return on investment
- Less efforts / labour requirement
- Good pest resistance
- Less fertilizer requirement etc

Also for Andhra Pradesh, reusability of seeds is the only attribute that is strongly associated with ordinary non-hybrid cotton seeds.

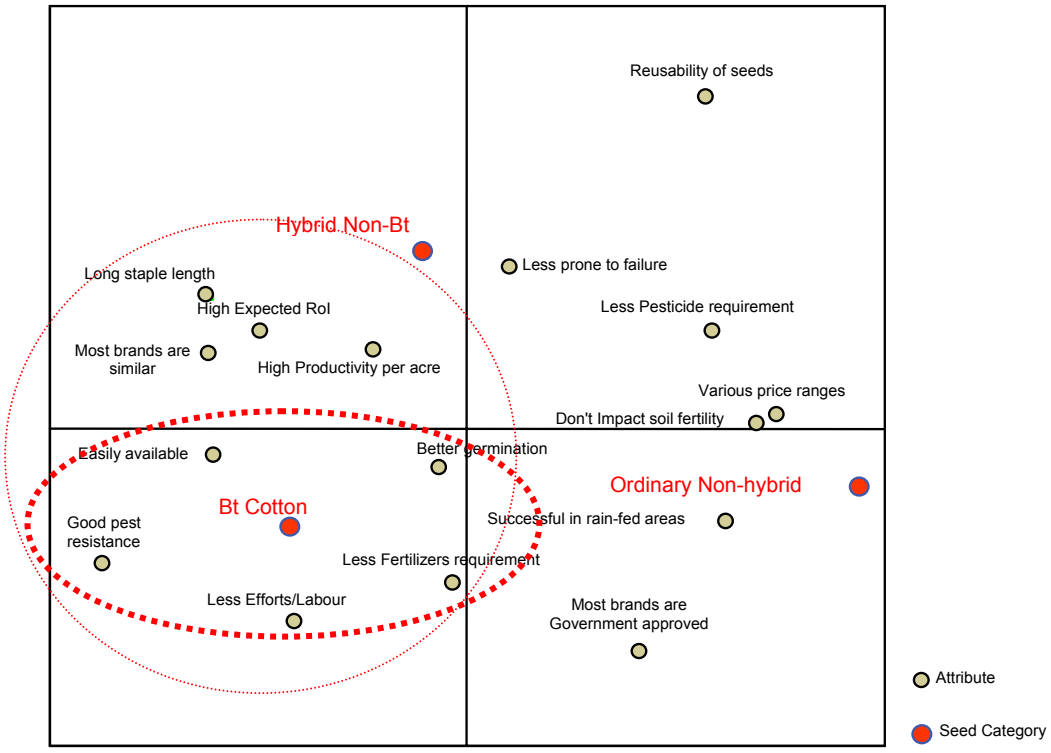
7.1.5 TN-Karnataka

Attributes	TN-Karnataka (180)		
	Ordinary Seeds	Hybrid Non-Bt Seeds	Bt cotton Seeds
Productivity per acre is high	24%	41%	56%
Long staple length	16%	39%	56%
RoI is high	18%	39%	56%
Good pest resistance	11%	28%	53%
Doesn't Impact soil fertility	49%	43%	53%
Most brands are similar	15%	35%	52%
Less Efforts/Labour	18%	28%	52%
Less Pesticide requirement	15%	32%	52%
Easily available	44%	44%	50%
Successful in rain-fed areas	41%	34%	47%
Better germination	23%	31%	47%
Less Fertilizers requirement	22%	26%	44%
Most brands are Government approved	29%	24%	41%
Various price ranges	38%	33%	39%
Less prone to failure	22%	31%	37%
Reusability	8%	10%	9%

Percentage scores in the case of TN-Karnataka cluster cotton farmer are relatively lower for the association of various attributes with Bt cotton seed category. This is because of the lesser awareness and in turn lesser usage of Bt cotton seeds among the farmers of this cluster.

Farmers from TN-Karnataka cluster associate hybrid non-Bt category the most with 'easy availability' and ordinary seed category the most with 'Doesn't impact soil fertility' attribute.

Tamil Nadu-Karnataka

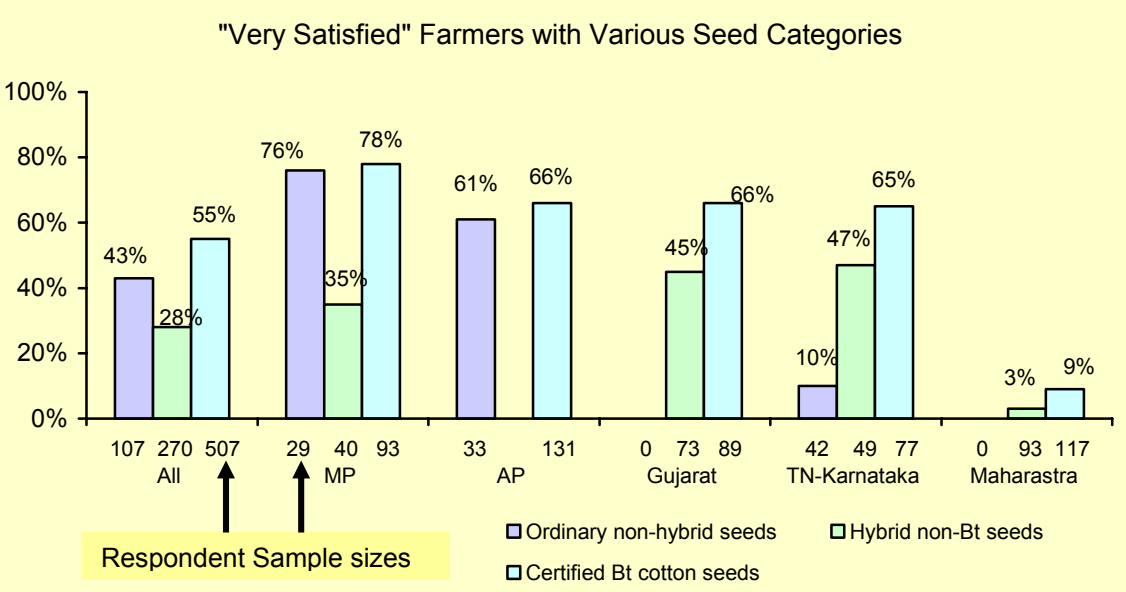


Correspondence map of TN-Karnataka cluster is much different from other 4 previously mentioned clusters. In this clusters, attributes are more scattered than largely confined in the previous categories.

Interestingly, factors like 'Less prone to failure', 'Long staple length' and 'High expected return on investment' attributes are relatively closer to hybrid non-Bt category than to Bt cotton seed category. This clearly shows that lesser awareness is leading to scattered perception. This was especially the case with some clusters like the cotton growing belt in Coimbatore sub-cluster where awareness levels towards Bt cotton were significantly lower.

7.2 *Importance of attributes and satisfaction*

7.2.1 Overall satisfaction levels with various seed categories



	Mean Score (Out of 5)		
Cluster Name	Ordinary	Hybd Non-Bt	Certified Bt
All 5	4.14	3.96	4.36
M.P.	4.72	4.33	4.78
A.P.	4.33	3.8	4.66
Gujarat	-	4.41	4.64
TN-Kar	3.79	4.33	4.60
Maharastra	-	3.29	3.33

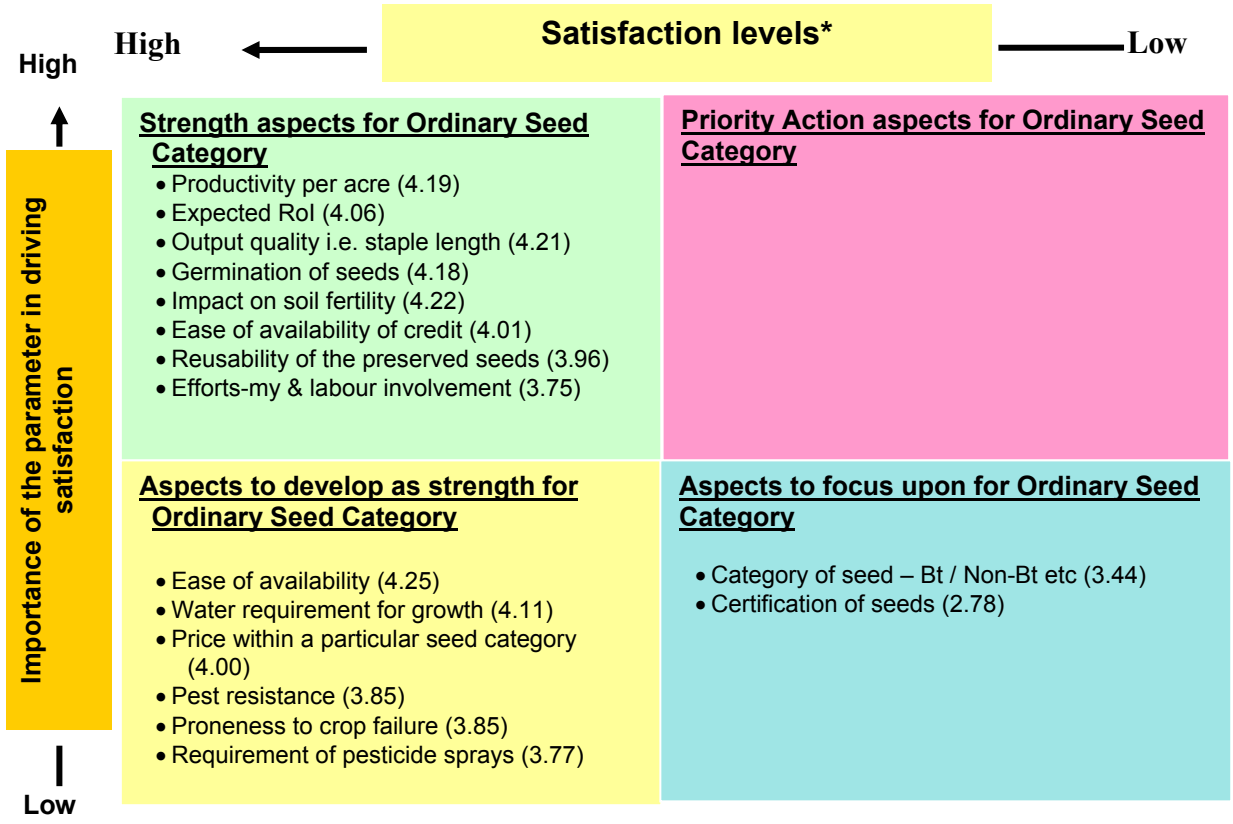
Table: 8.2.1

Looking at the graph above, 78% of the farmers from Madhya Pradesh who have used certified Bt cotton are very much satisfied with a mean satisfaction score of 4.78 out of 5.

Maharastra has the least percentage i.e. only 9% of the cotton farmers who have used certified Bt cotton this year and are very much satisfied. The reason for this was found during qualitative phase where it came out that some areas in the state had an attack of sucker pests (colloquial name 'laliya'). Farmers' lack of awareness about the fact that Bt cotton is resistant against Lepidoptera pest can also be the reason for lesser satisfaction.

7.2.2 Distribution of attributes, across 'Satisfaction – Importance' matrix

I. Ordinary Seed Category



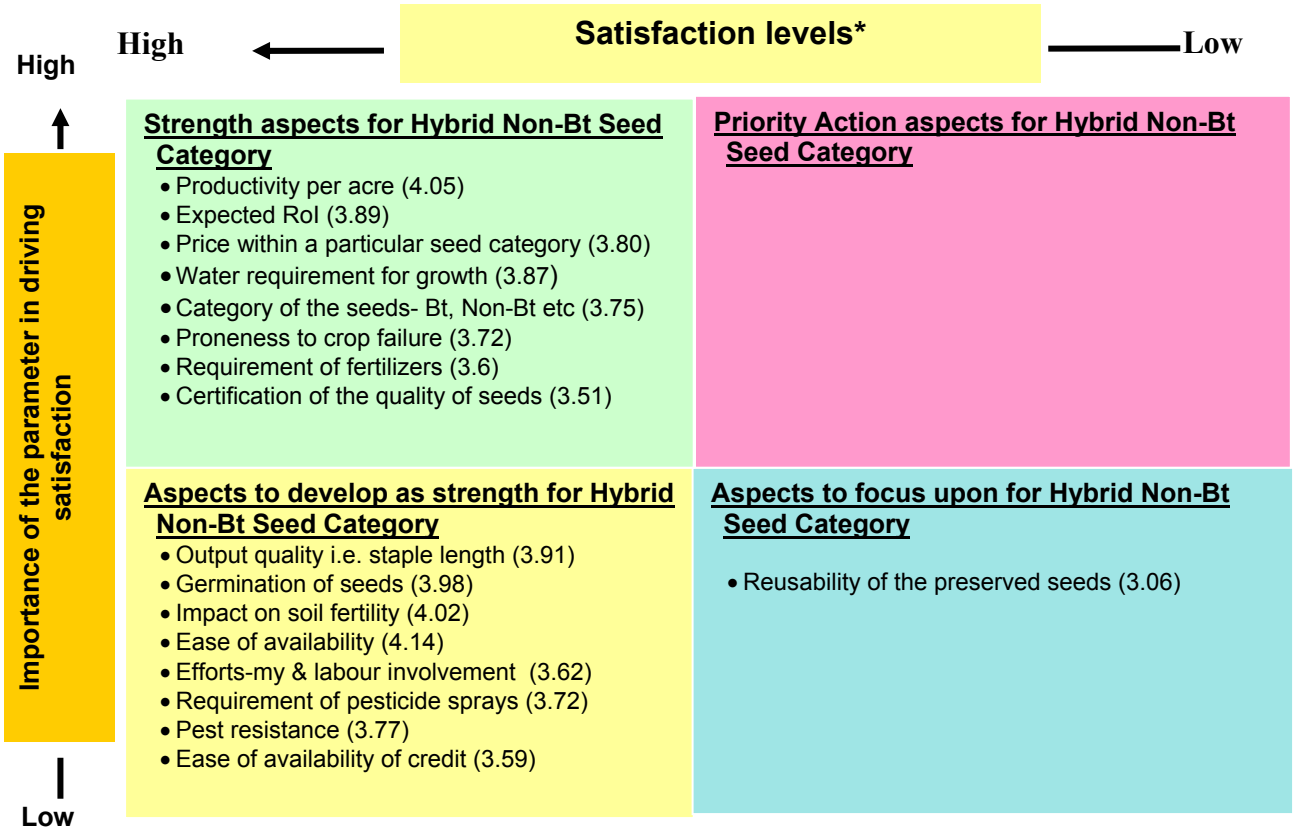
The matrix above segregates various attributes that play some role towards the decision making of the cotton farmers when they purchase ordinary cotton seed in their order of importance and also depicts satisfaction level of the farmers using ordinary category seeds.

The 'satisfaction-importance' matrix above shows distribution of attributes for hybrid cotton seed category users. Scores against each attribute shows mean value of satisfaction scores out of 5 for that particular attribute.

In the matrix above,

- If the mean satisfaction level score for a particular attribute is more than 3.5 out of 5, it is taken as high as far as satisfaction with that attribute is concerned.
- Importance of a particular attribute has been calculated by using 'regression' on all the attributes with the overall satisfaction. Beta score of each attribute has been compared to evaluate the importance as far as deriving overall satisfaction with a particular category is concerned. In case of ordinary cotton seed category for a particular attribute if the beta co-efficient is 0.08 or more, it has been taken as important factor in deriving satisfaction levels.

II. Hybrid Non-Bt Seed Category



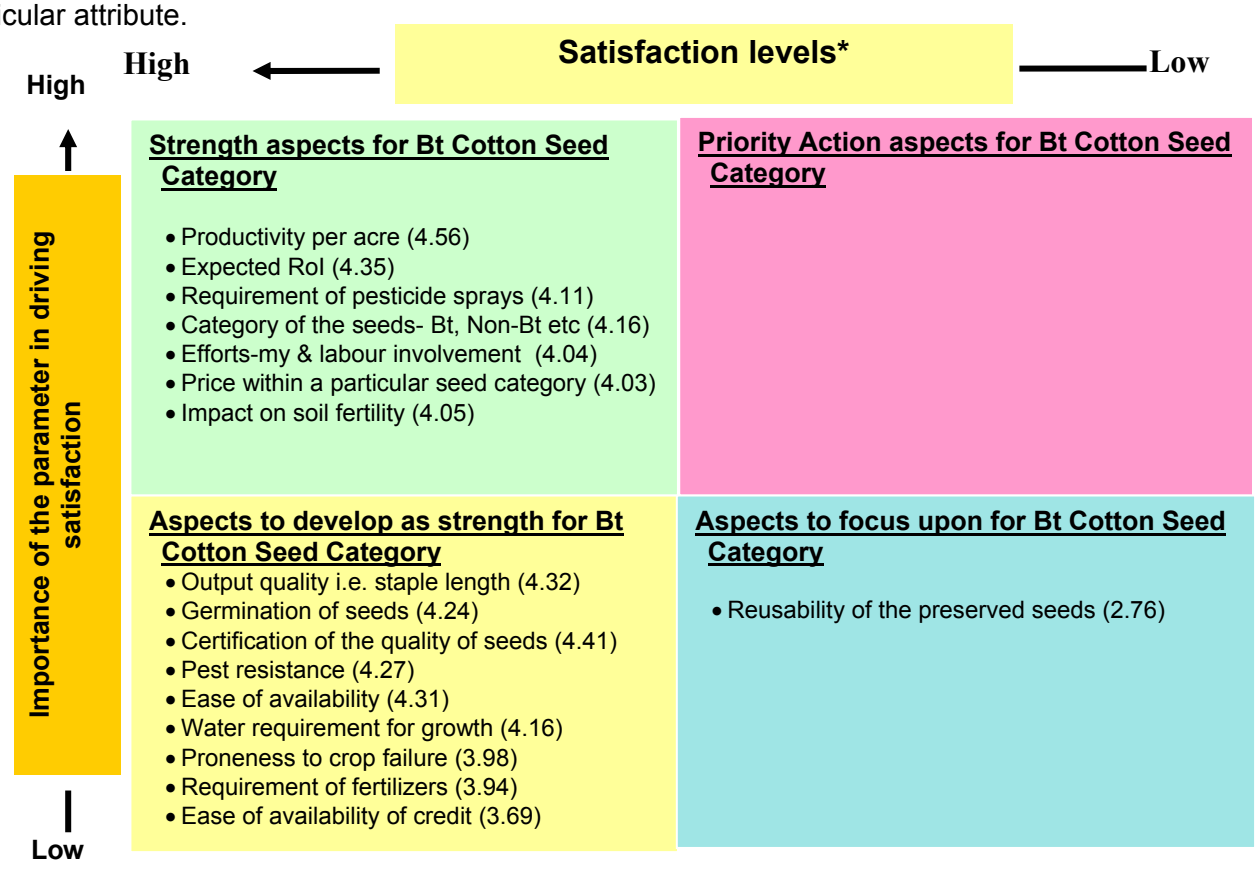
The 'satisfaction-importance' matrix above shows distribution of attributes for hybrid cotton seed category users. Scores against each attribute shows mean value of satisfaction scores out of 5 for that particular attribute.

In the matrix above,

- If the mean satisfaction level score for a particular attribute is '3.5 or more' out of 5, it is taken as high as far as satisfaction with that attribute is concerned.
- For a particular attribute if the beta co-efficient is 0.08 or more, it has been taken as important factor in deriving satisfaction levels

III. Bt cotton Seed Category

The 'satisfaction-importance' matrix above shows distribution of attributes for certified Bt cotton seed category users. Scores against each attribute shows mean value of satisfaction scores out of 5 for that particular attribute.



In the matrix above,

- If the mean satisfaction level score for a particular attribute is 'More than 4.1' out of 5, it is taken as high as far as satisfaction with that attribute is concerned.
- For a particular attribute if the beta co-efficient is 0.6 or more, it has been taken as important factor in deriving satisfaction levels.

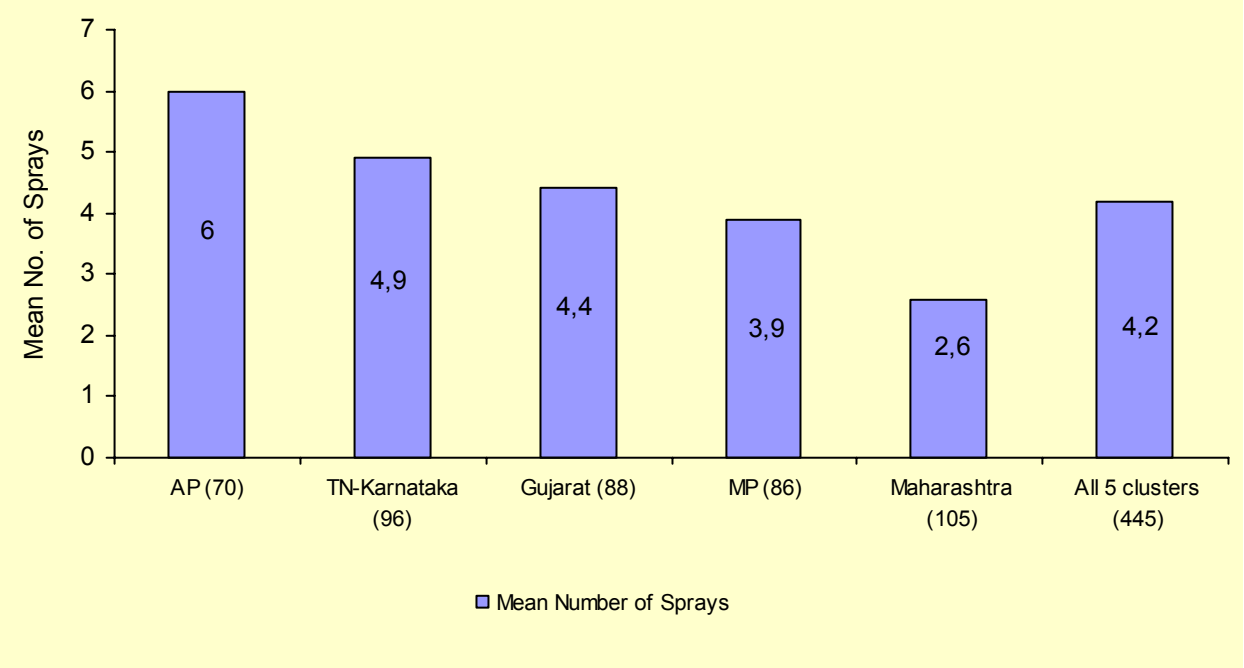
Comparative higher score for certified Bt cotton seed users shows good correlation and robustness of data points.

8 Cost Economics & Productivity

This section deals with looking at expenditure related aspects. It compares the return on investment for the cotton farmer who has used certified Bt cotton seed with a farmer who has used hybrid and ordinary cotton seeds. Comparison of return on investment has been done by asking the cotton farmers about the expenditure incurred and/or are planning to incur during current crop cycle and comparing the productivity expectation for this crop cycle. Within each cluster, expenditure and productivity expectation related insights have been collected for the seed category cultivated maximum by the cotton farmer. In this process, sufficient minimum respondents under each category have been insured.

Broadly, issues like number of sprays of pesticide used or are planning to use during current cotton crop cycle – for non-Bt cotton seeds and for the seed category cultivated in the maximum land area, important cost head wise expenditure break up and productivity expectations etc have been captured in this section.

8.1 Number of sprays of pesticide for Non-Bt cotton seeds



The graph above show that the cotton farmers from Andhra Pradesh who cultivated non-Bt cotton crop this year have used or are planning to use maximum number of pesticide sprays per acre of the cotton crop cultivation.

Cotton farmers from Maharastra who cultivated non-Bt cotton crop this year are expecting to use only 2.6 (mean value) number of sprays during current cotton crop cycle.

Last year, sucker pest attack (colloquially named 'Laliya') ruined both the crop - hybrid and Bt cotton equally.

"..Cotton crop was badly affected for 2 years consecutively because of 'laliya' (sucking pest attack). Bt cotton crop was affected more than Non-Bt hybrid crop from this attack..."
- One of the farmers from the cotton growing belt of Yavatmal district in Maharastra

"This year we are facing attack from 'Millibug' (colloquial name: safed masi / white fly, kind of sucker pest). In this attack, fruit (colloquially 'pan') becomes red and leaves and stems (colloquially 'chara') becomes dray. We tried 2 – 3 pesticide like Monocoto and some pesticide but in vain even for Bt cotton crop. Farmers do not know which pesticide to use? From other farmers we came to know about Confudour powder. Some others are using hippolin detergent powder spray with some pesticide."
-One of the farmers from the cotton growing belt of 'Karjan, Vadodra' in Gujarat

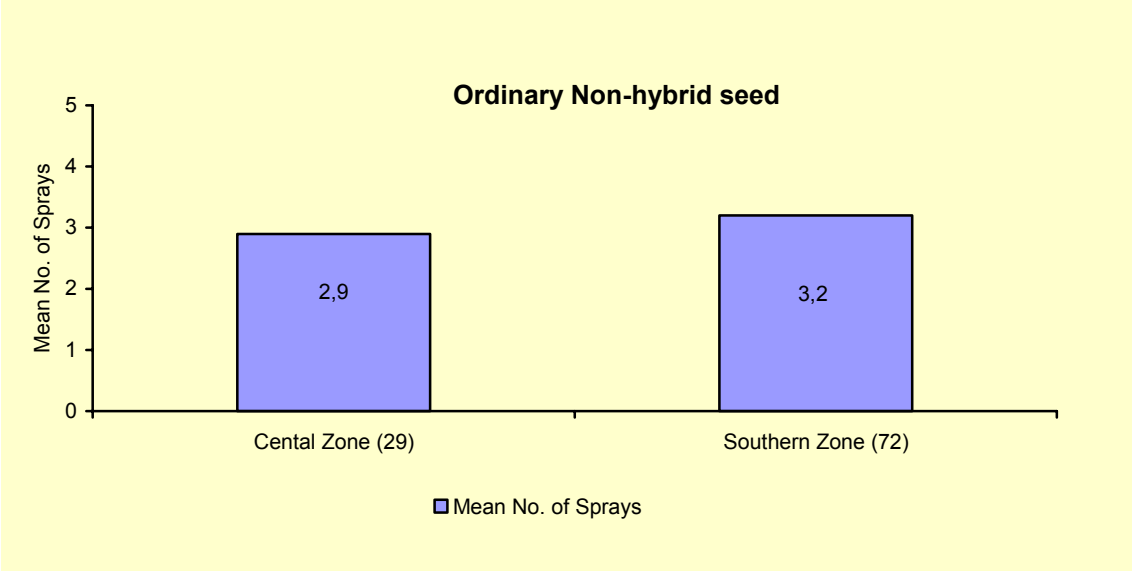
"..pesticide consumption is increasing - last year we did 4 sprays; this year we are expecting around 7 – 8 sprays out of which 5 – 6 sprays have already been done...."
- One of the farmers from the cotton growing belt of 'Padra, Vadodra' in Gujarat

8.2 Number of sprays of pesticide per acre

Number of sprays of pesticide per acre had been recorded for the cotton seed category, the farmer had cultivated in the maximum crop area. Thus the responses of all the three seed category users can be compared and the pesticide consumption patterns can be evaluated.

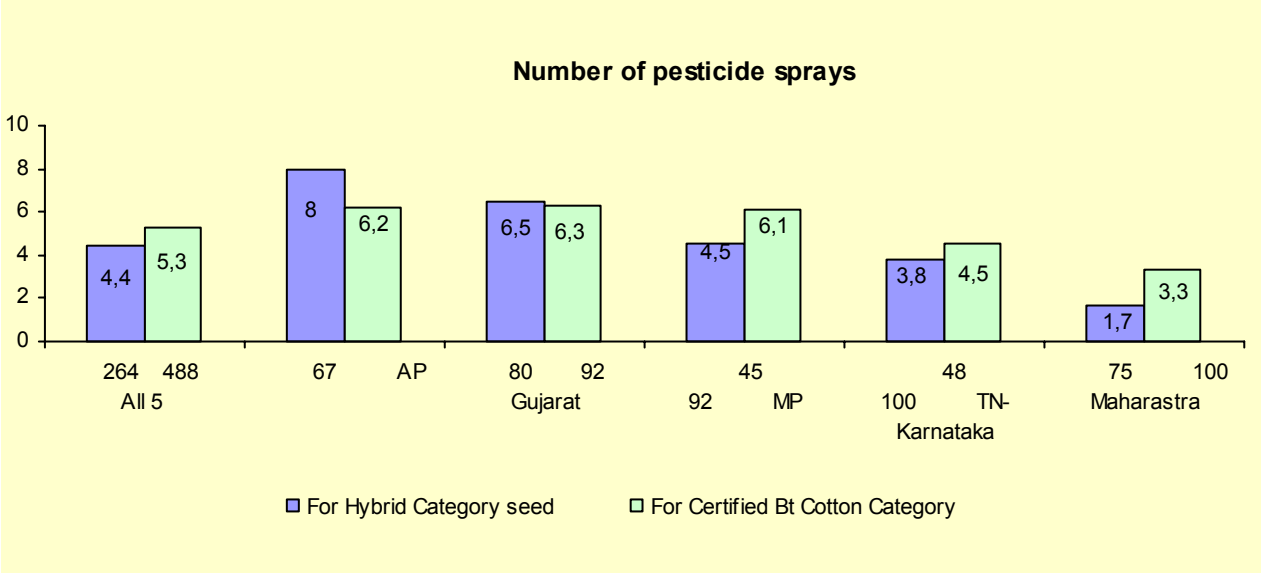
8.2.1 Ordinary Non-hybrid seed

Due to lesser number of respondents cultivating maximum area with ordinary non-hybrid seeds especially in central zone (only 29 out of sample size of 550 respondents) , data has been presented at the zonal level.



The table above shows that farmer cultivating cotton with ordinary seed use lesser number of pesticide sprays. During qualitative phase, it was revealed that farmers have lesser stake and relatively lesser expectations when they cultivate ordinary cotton seeds. These are generally cultivated in the rain-fed areas where risks of failure are relatively higher.

8.2.2 Hybrid non-Bt and Bt cotton seeds



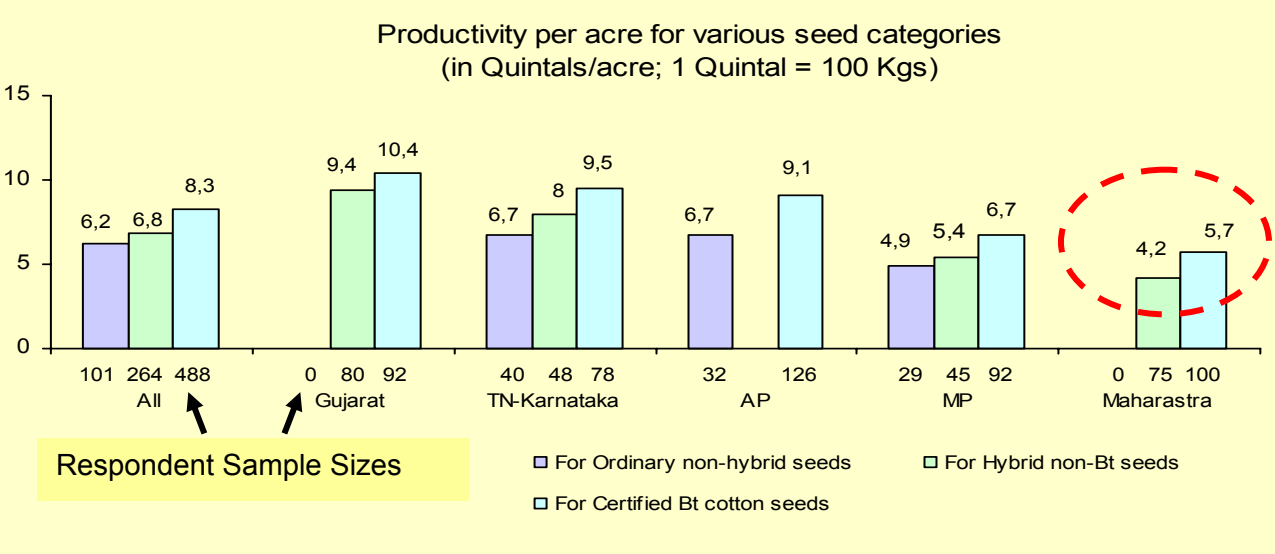
Comparative data between hybrid seed category and certified Bt cotton seed category shows different picture across different clusters. In Andhra Pradesh and Gujarat, hybrid seed users spray more pesticides than certified Bt cotton users. In AP, this difference is bigger than in Gujarat. Whereas the case is reverse with the MP, Maharastra and TN-Karntaka cluster cotton farmers.

Three reasons were identified for higher pesticide sprays in these clusters:-

- Awareness about which type of pesticide would be used for which pest attack was found to be leser.
- Farmers cultivating certified Bt cotton seed category treat their cultivation as 'Jersey Cow' that has a potential to provide better yields if they will properly care for their cultivation.
- In some of the regions, last year sucker pest attack equally ruined both Bt and non-Bt cotton crops. Farmers lacking the differentiation between Lepidoptera and Sucker pests are using the pesticides 'mixture' even for 'Lepidoptera' pests.

8.3 Productivity expectation per acre for various seed categories

As shown in the graph below, respondents were asked for the seed category cultivated in the maximum area. Productivity expectations in quintals per acre from the crop cultivated in the maximum farm area were asked. For Bt cotton, productivity expectation were highest at 10.4 quintals per acre in Gujarat and lowest at 5.7 quintals per acre in Maharastra across five clusters.



Juxtaposing the expenditure related insights, that were asked for various cost head for the seed category cultivated in the maximum area, with the productivity figure for various seed categories would compare the profitability/loss of Bt cotton for the cotton farmers.

Comparing the expenditure and productivity of Maharastra and Gujarat clusters as these are the cluster with the maximum and minimum percentage expenditure and productivity expectation difference while replacing hybrid non-Bt category with the Bt cotton seed category.

Activities	Maharastra		Gujarat	
	Hybrid non-Bt seeds	Bt cotton seeds	Hybrid non-Bt seeds	Bt cotton seeds
Expenditure in Rupees (4 cost heads) per acre	3325	4217	6696	7478
Expenditure – total (taking above expenditure to be 80% of the total) per acre	4156	5271	8370	9348
Productivity per acre expectation from table above (in Quintals)	4,2	5,7	9,4	10,4
Return in Rupees per acre (Assuming average rate of Rs 1600 per quintal between Nov 06 to March 07)	6720	9120	15040	16640
Profit per acre	2564	3849	6670	7293
Profit as percentage of investment	62%	73%	80%	78%

9 Intention to purchase and likelihood to recommend

This section probed into the farmers' intention to purchase and likelihood to recommend certified Bt seeds (with the farmers who are using it presently).

It also probed into the intention to purchase and likelihood to recommend 'Bt fruits and vegetables' with the farmers who would be interested in purchasing certified Bt cotton seeds in future also, after exposing the farmers with the following concept card.

About Bt Technology:
In this technology of seed production, a gene is injected to the seed for breeding. This gene is either naturally present in the environment or further modified by various companies to provide desired benefits according the crop where it has been injected. This technology can be used to develop the seeds of various fruits and vegetables. Hence, the desired benefits can be brought to various fruits and vegetables. These fruits & vegetables are similar to ordinary fruits and vegetables in looks and taste and are certified by Government of India for safer use.

Benefits of Bt fruits and vegetables:

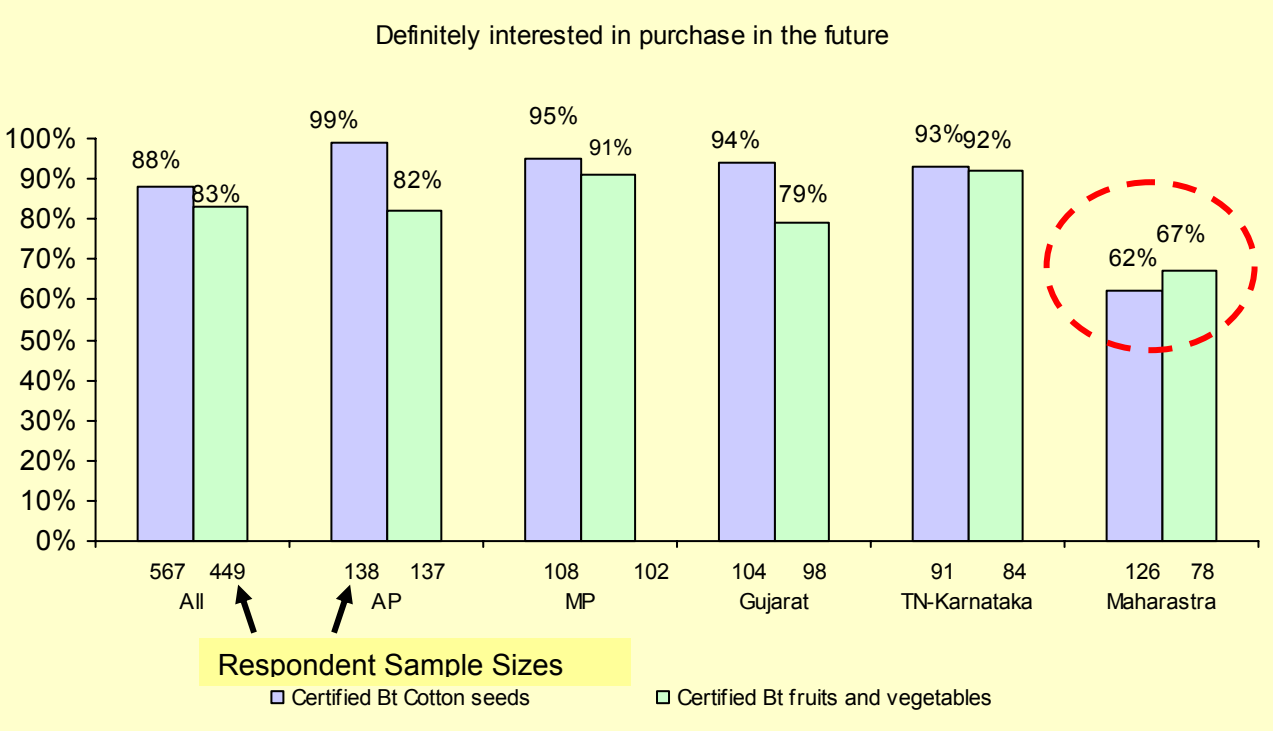
- Better nutritional value
- Better shelf life
- Homogeneous and better looks

However, Bt fruits and vegetables may be available at 10% - 20% higher prices of the prevailing fruits and vegetables.

Intention to purchase and likelihood to recommend Bt – fruits and vegetable was asked from the farmers who were definitely interested in purchasing Bt cotton seeds.

Farmers' intention to purchase Bt cotton and the Bt fruits and vegetables can be looked in parallel and thus the acceptability of the later can be extrapolated based on the performance of Bt cotton in various clusters.

9.1 Intention to purchase – Certified Bt cotton and certified Bt fruits/vegetables

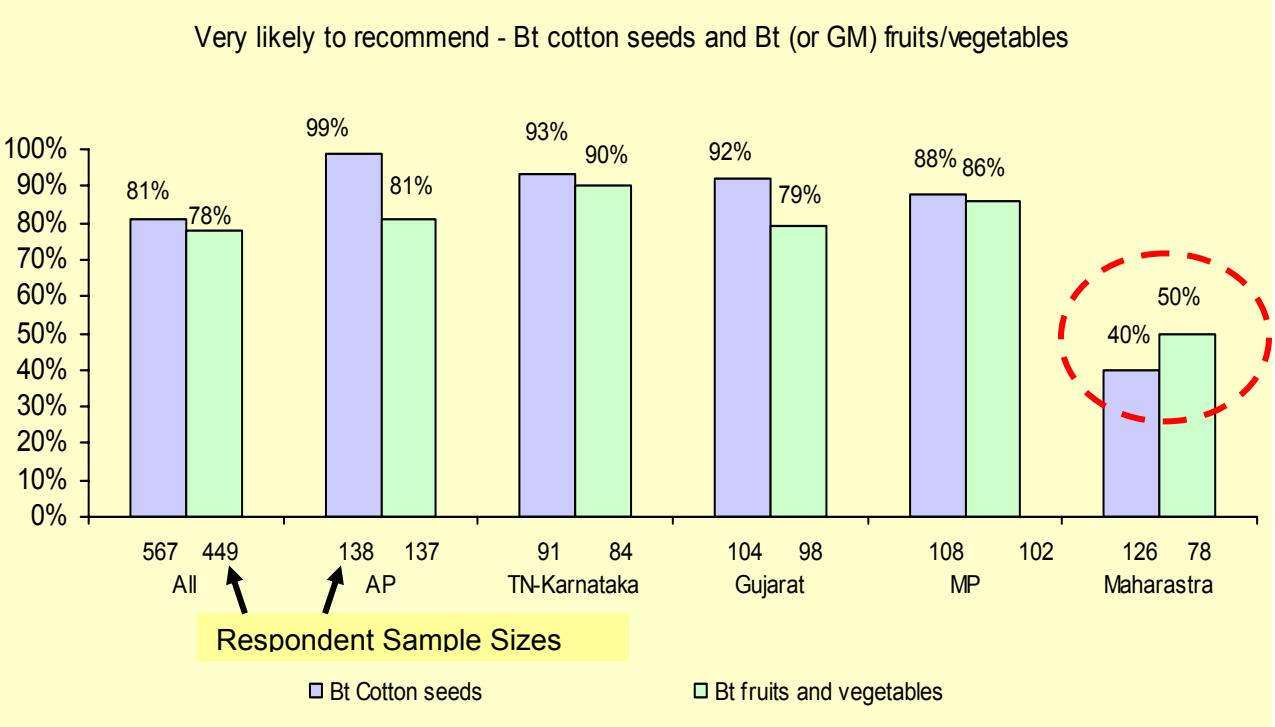


Interestingly, referring to Section 8.2.1, satisfaction among Bt cotton users of Maharastra with the seed category is very less, still 62% of them would be 'Definitely Interested' in purchasing the same. Out of these 62% of the farmers i.e. out of 78 respondent, 67% were 'Definitely interested' in purchasing Bt fruits and vegetable when they were exposed to the 'Bt fruit and vegetable' (or 'GM fruit and vegetable'). Maharastra is also the only state where percentage farmers who are 'Definitely interested' in purchasing 'Bt (or GM) fruits and vegetable' is more than the percentage of farmers who are 'Definitely interested' in purchasing 'Bt cotton'.

In Andhra Pradesh, overwhelmingly 99% farmers were 'Definitely Interested' in purchasing certified Bt cotton seeds in the coming crop cycles.

As far as purchase of 'Bt (or GM) fruits and vegetables' is concerned, TN-Karnataka and Madhya Pradesh clusters lead with 92% and 91% of the farmers 'Definitely interested' in purchasing it.

9.2 Likelihood to recommend – Bt cotton and Bt fruits/vegetables



Andhra Pradesh also leads when it comes to 'likelihood to recommend' Bt cotton seeds, overwhelmingly 99% farmers were 'Very likely' to recommend it to other farmers in the coming crop cycles.

As far as purchase of 'Bt (or GM) fruits and vegetables' is concerned, TN-Karnataka and Madhya Pradesh clusters lead with 90% and 86% of the farmers 'Very likely' in recommending it.

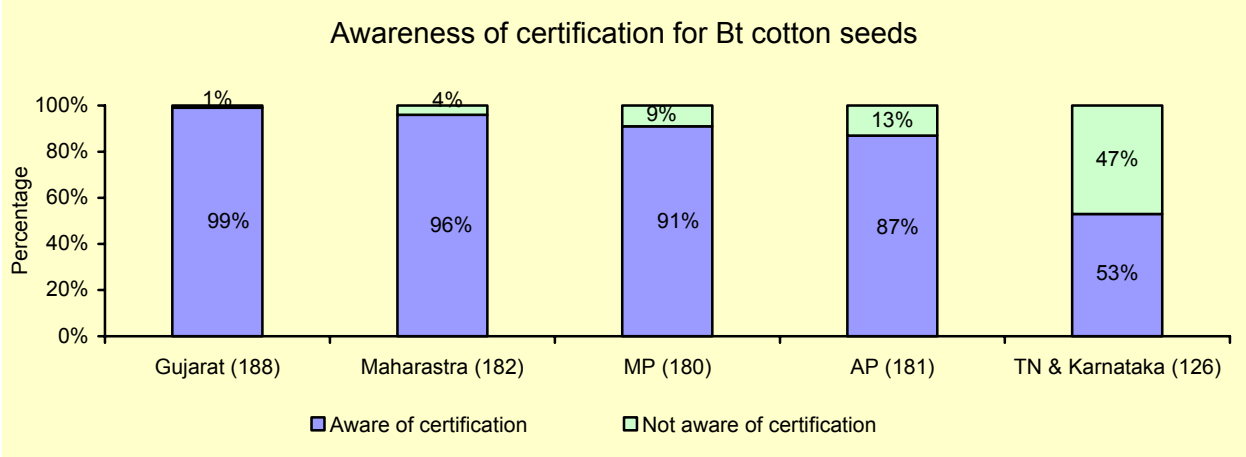
10 Conclusions

This section outlines the summary of the findings for the research study.

Awareness of Bt cotton

A major part of the TN-Karnataka cluster still needs to be educated about the Bt cotton category of seeds. In this cluster, as high as 30% of the farmers are not aware about this category of seeds. Awareness in Maharastra, Gujarat, Andhra Pradesh and Madhya Pradesh was however found to be cent percent.

The graph below also shows that even among those who are aware of this category, awareness about certification is considerably low in the TN-Karnataka cluster as compared to other state clusters. This shows there is a significant need of educating the farmers in this cluster.



Perception of Bt cotton seeds

Across the clusters, farmers hold a fairly positive perception of Bt cotton seeds. Taking into account all the factors - return related, input related, quality related and availability related - it is evident that Bt cotton seeds as a category has scored over hybrid non-Bt cotton hybrid seeds and ordinary seeds. The detailed perceptions have been explained below:-

Perception of Bt cotton seeds

Return Related	Across seed categories, Bt cotton is associated better with return related factors, e.g. Return on Investment and Quantity of output per acre.
Input Related	Bt cotton seed is perceived to be a yielding seed category if sufficient quantities of inputs e.g. fertilizers and water are provided.
Quality Related	It is also perceived to be a good cotton quality producing seed with a long staple length as the size of the cotton fruit is better. It is also perceived to be good during seed germination with a better pest resistance than that of other seed categories.
Availability Related	It has a positive association in terms of its availability and is also perceived to be lesser prone to crop failure, vis-à-vis other seed categories.

Satisfaction with Bt cotton seeds

The grid below classifies various aspects in terms of farmers' satisfaction with Bt cotton seeds on these and the relative importance farmers attribute to them while considering the purchase of cotton seeds.

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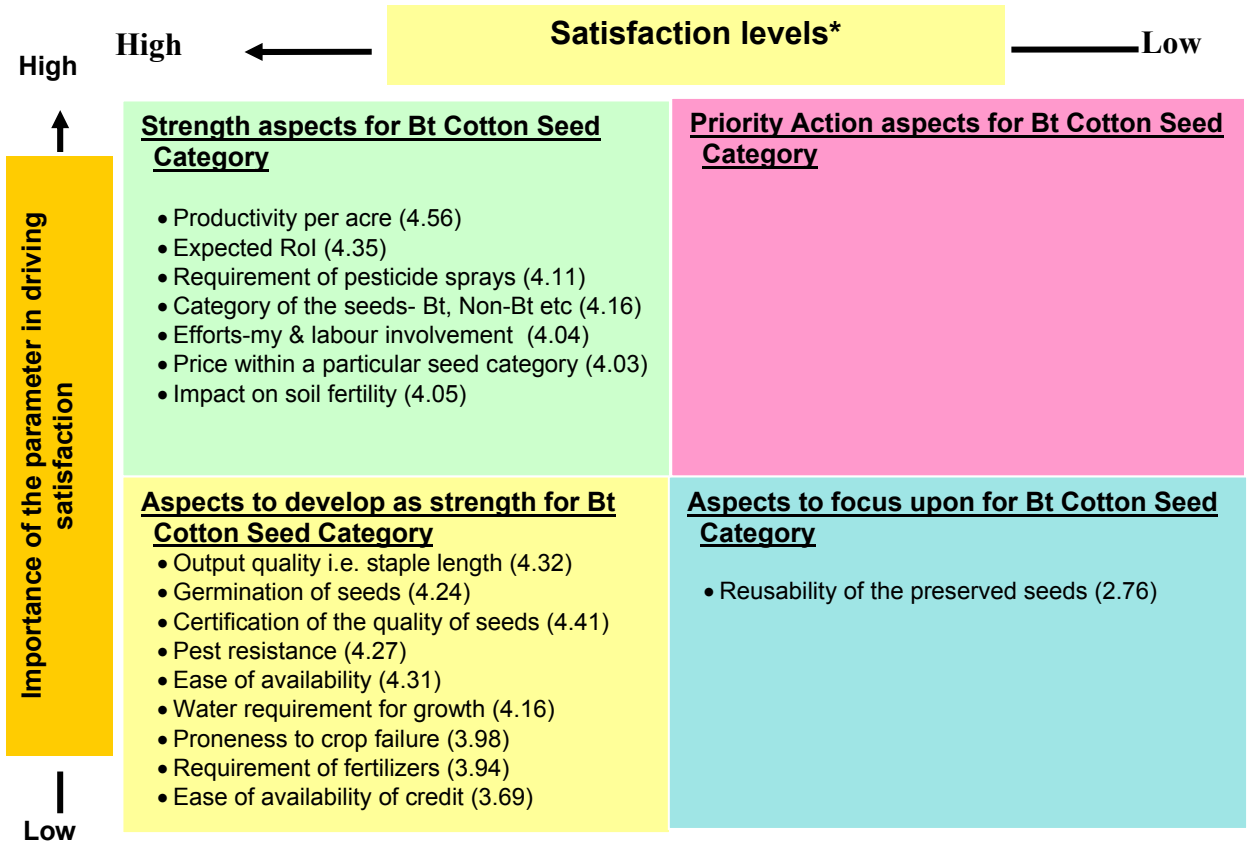


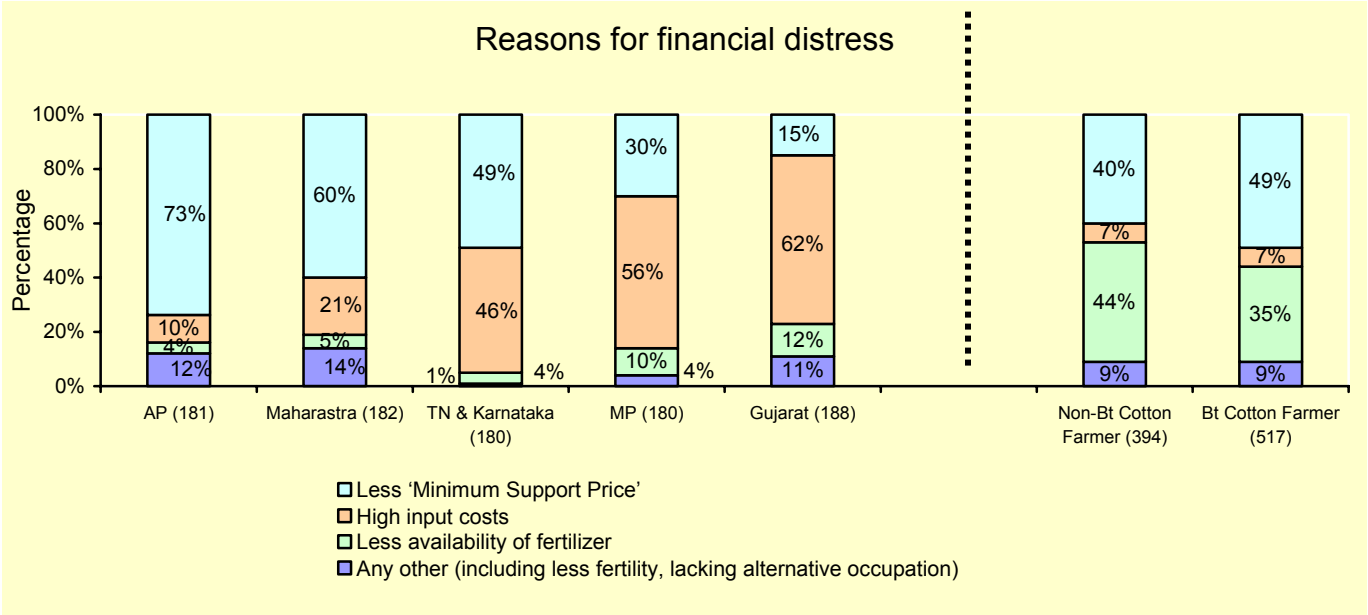
In the matrix above,

- If the mean satisfaction level score for a particular attribute is 'More than 3.5' out of 5, it is taken as high as far as satisfaction with that attribute is concerned.
- For a particular attribute if the beta co-efficient is 0.6 or more, it has been taken as important factor in deriving satisfaction levels.

Reasons for financial distress

While exploring the major reasons for financial distress, 'minimum support price' has been sighted as the most important reason for the financial distress. Other reasons for financial distress / suicides that were significantly highlighted during in-depth Interviews with farmers are:-

- Inability to pay back bank loans of the previous year that debars eligibility for the crop loan for next year. When farmers do not get full credit on their finance requirements from banks, they resort to other available options like approaching money lenders, who charge exorbitantly high interest rates.
- Sole dependence on agriculture is another prominent reason for financial distress observed during the qualitative phase. The situation worsens when the crop fails for more than one year.

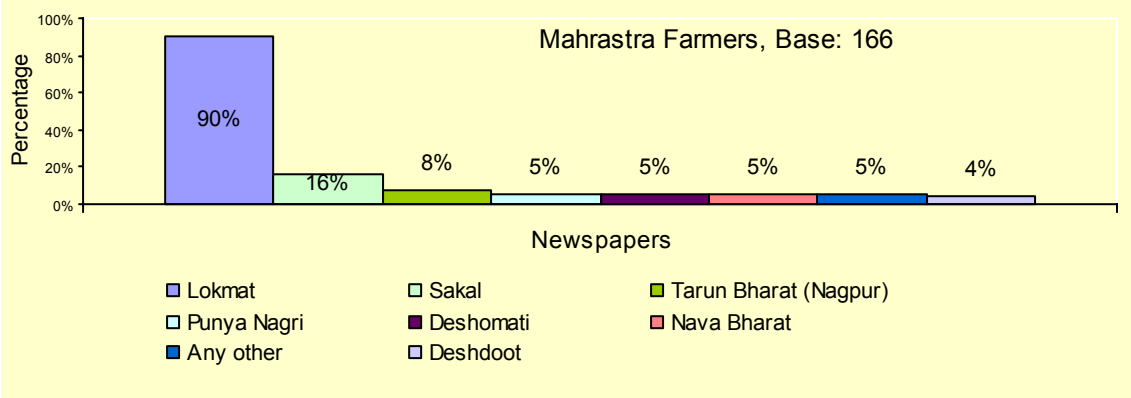


73% of cotton producing farmers from Andhra Pradesh and 60% of cotton producing farmers from Maharastra believe that a low 'minimum support price' fixed by the Government is the most important reason for financial distress among cotton growing farmers.

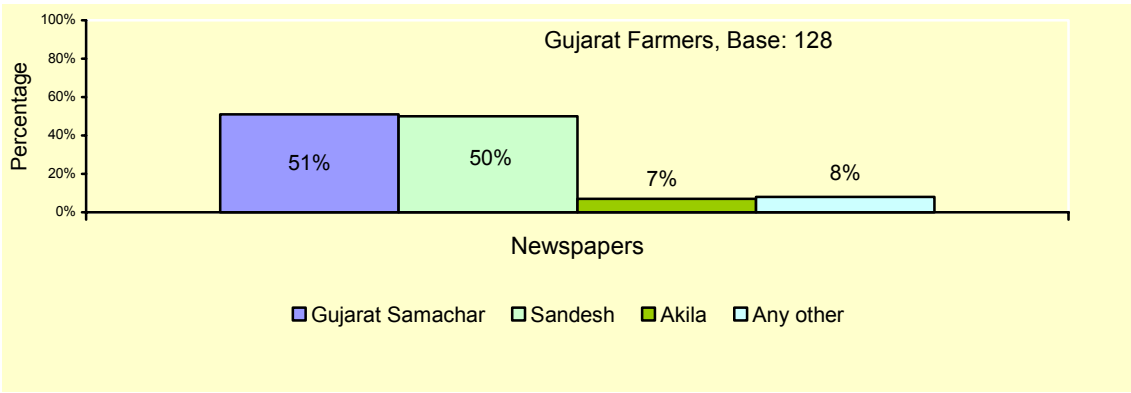
62% of cotton producing farmers in Gujarat followed by 56% of cotton producing farmers in Madhya Pradesh consider the high input cost to be the most important reason for financial distress.

11 Annexure

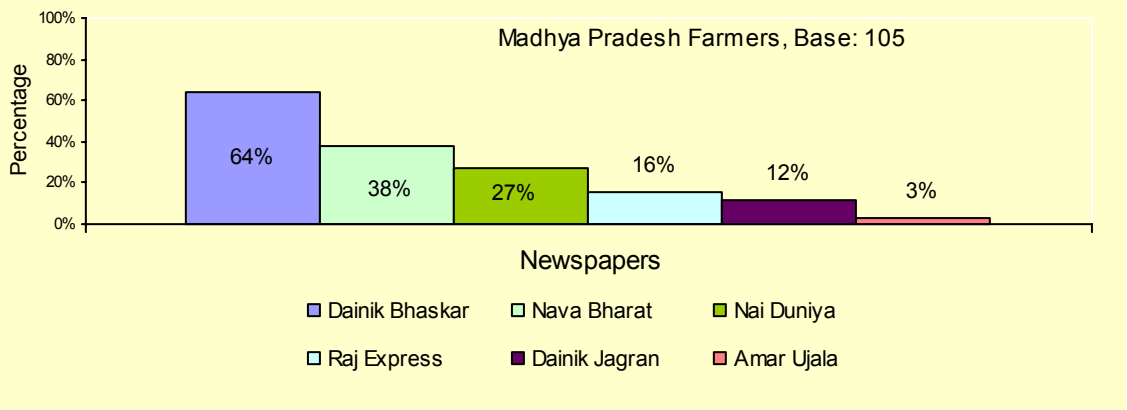
11.1 Newspaper reading habits



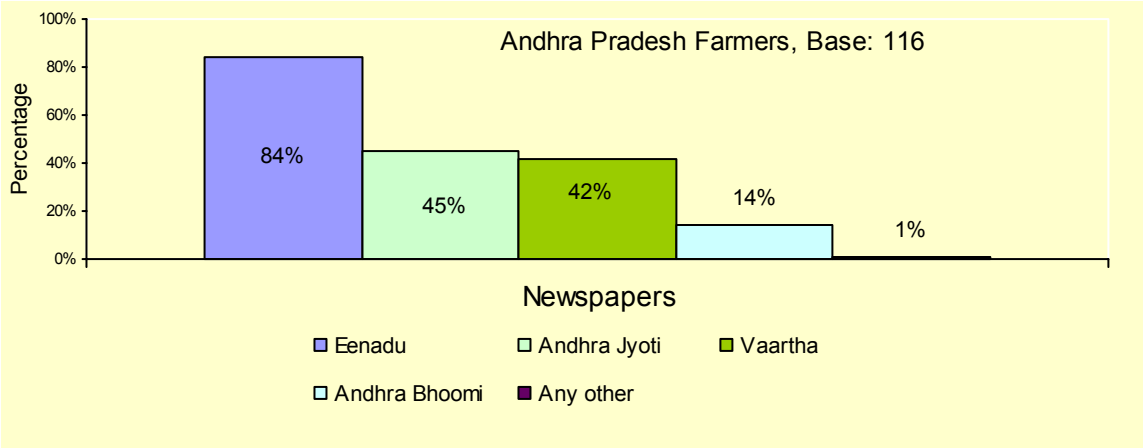
Lokmat (regional daily) is the single most popular newspaper among cotton growing farmers of Maharastra with a readability of 90%. It is distantly followed by Sakal at 8% and others with a readability of 5% or less.



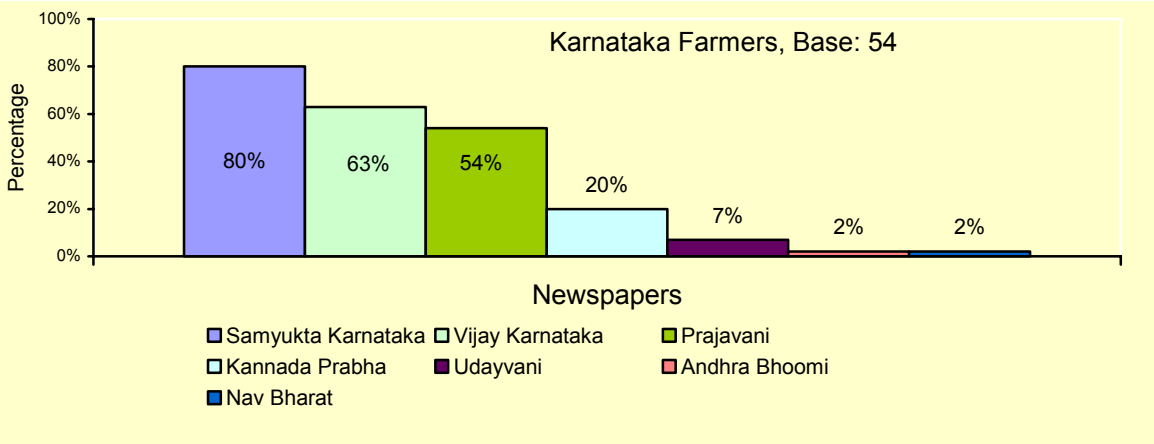
Gujarat Samachar and Sandesh are more or less equally popular among cotton growing farmers of Gujarat as far as readership goes with a readability of 51% and 50% respectively.



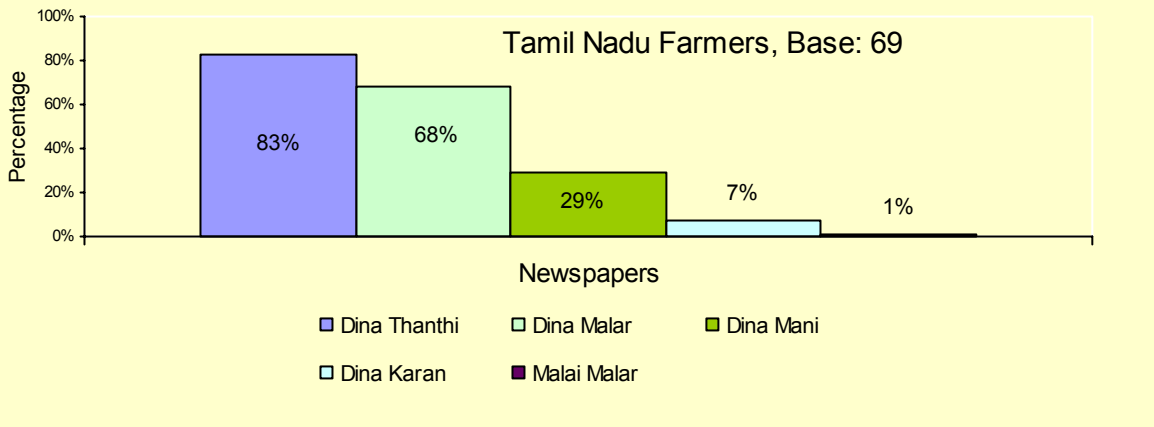
Dainik Bhaskar, hindi daily, has a readership percentage of 64% among cotton growing farmers of Madhya Prades. Nav Bharat and Nai Duniya are the 2nd and 3rd most read newspapers with a readership percentage of 38% and 27% respectively.



Eenadu has a readership percentage of 84% among Andhra Pradesh cotton growing farmers. Andhra Jyoti and Vaartha are competing with each other with a readership percentage of 45% and 42% respectively.

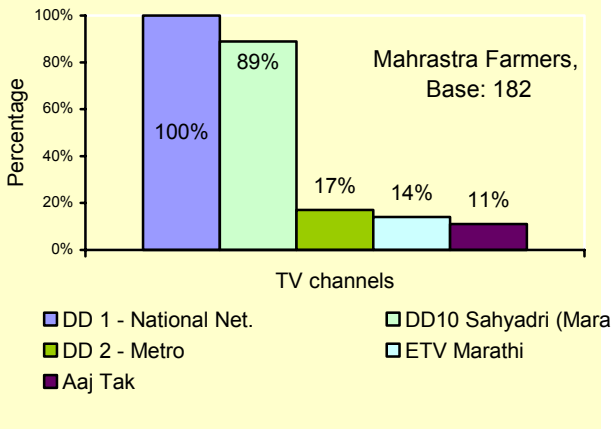


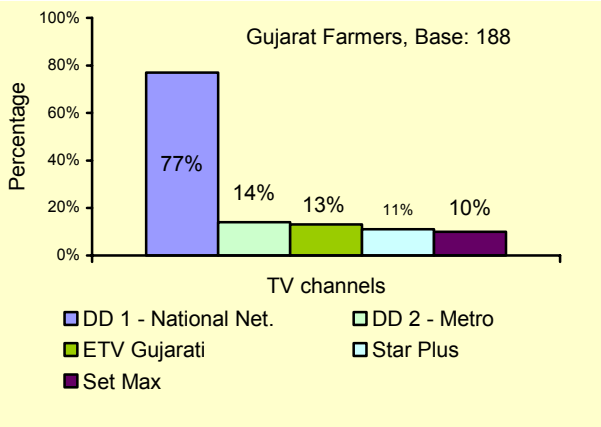
'Samyukta Karnataka' (regional daily) newspaper has a readership of 80% among cotton growing farmers in Karnataka. 'Vijay Karnataka', 'Prajavani' and 'Kannada Prabha' has a readership percentage of 63%, 54% and 20% respectively.

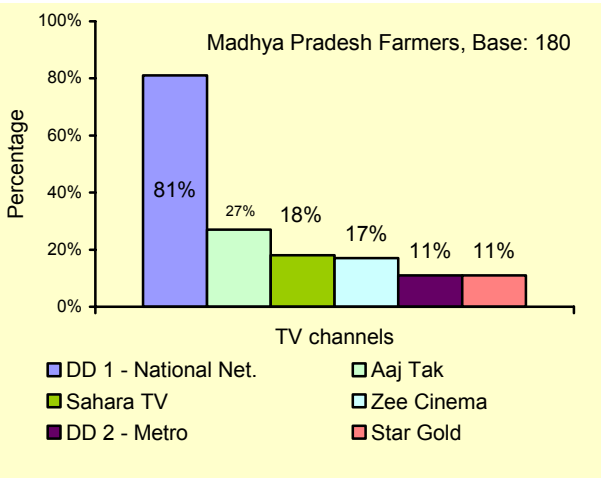


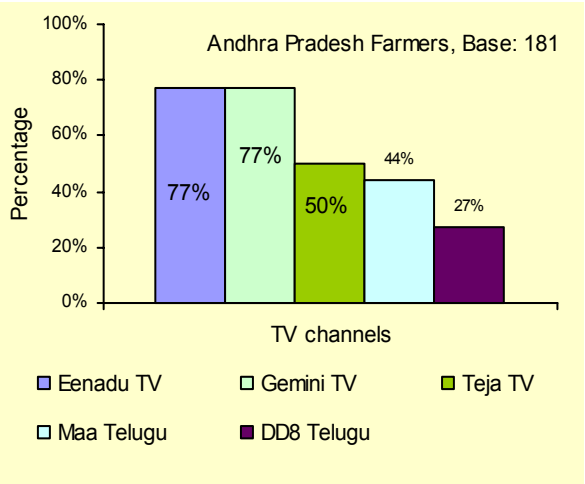
Most readable newspaper among cotton growing farmers of Tamil Nadu are Dina Thanthi and Dina Malar with the readability of 83% and 68% respectively. Dina Mani and Dina Karan has a readability of 29% and 7% respectively

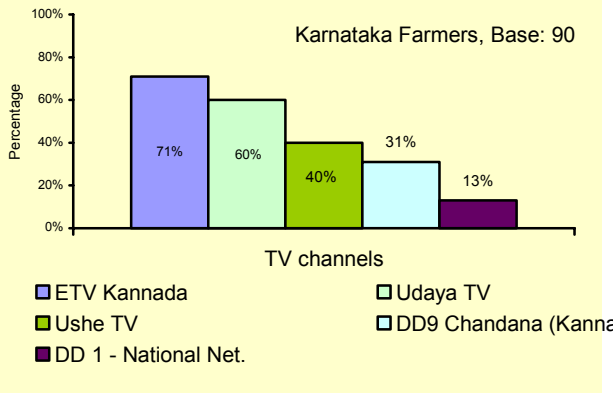
11.2 Popular television channels

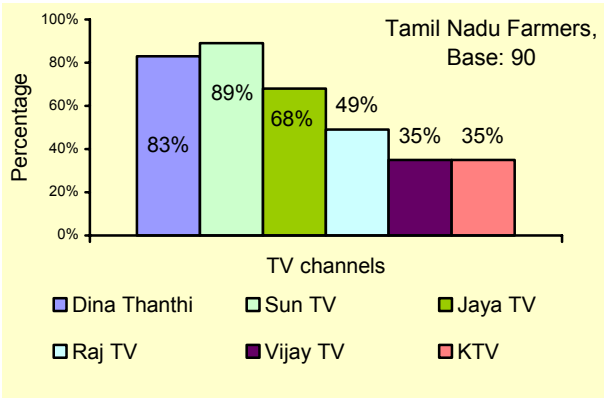




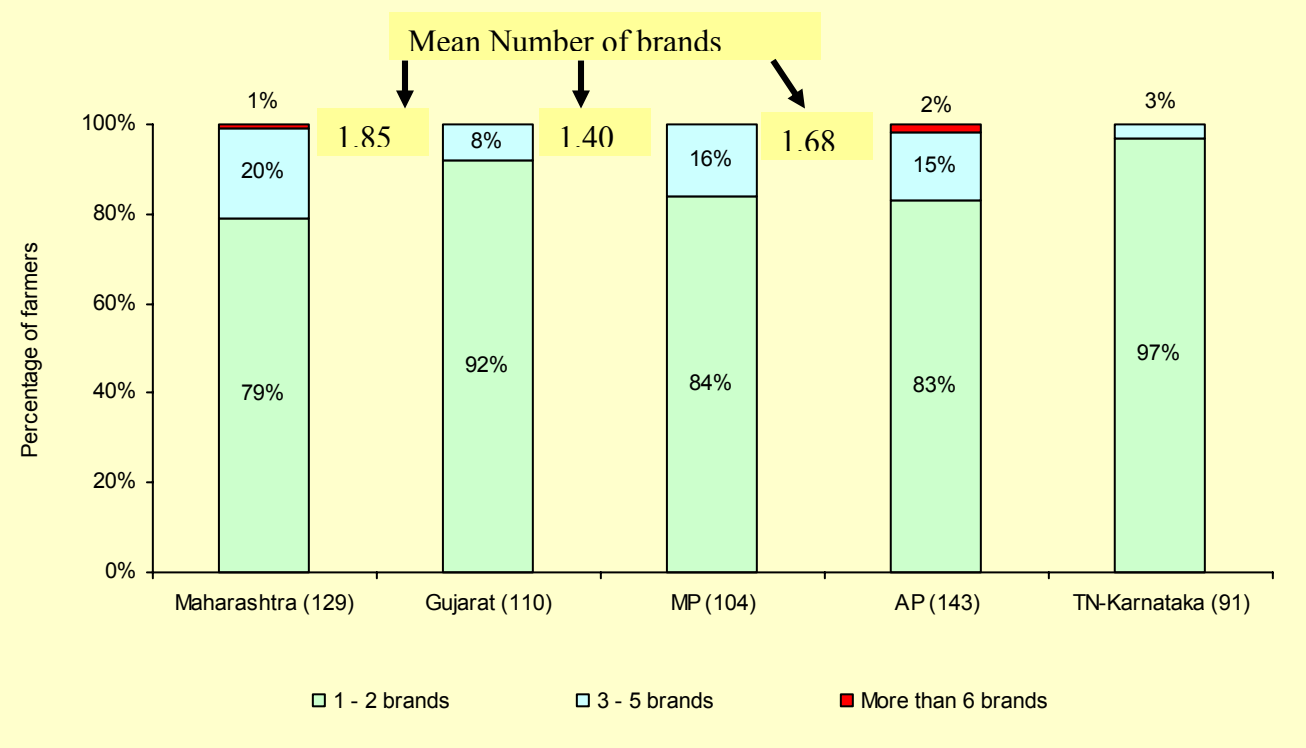






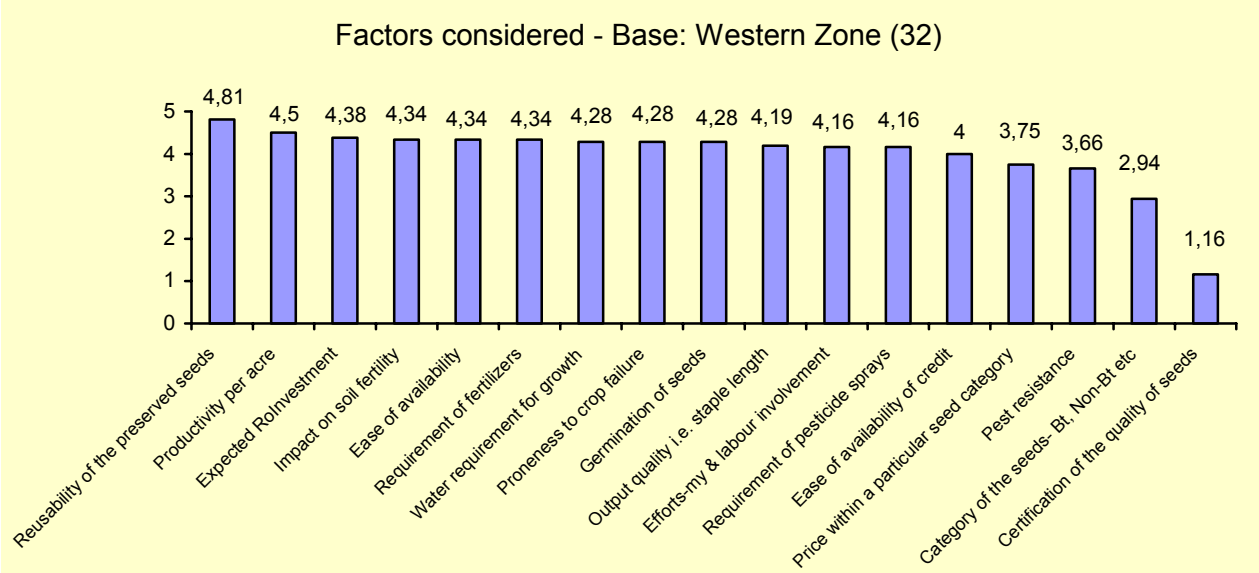


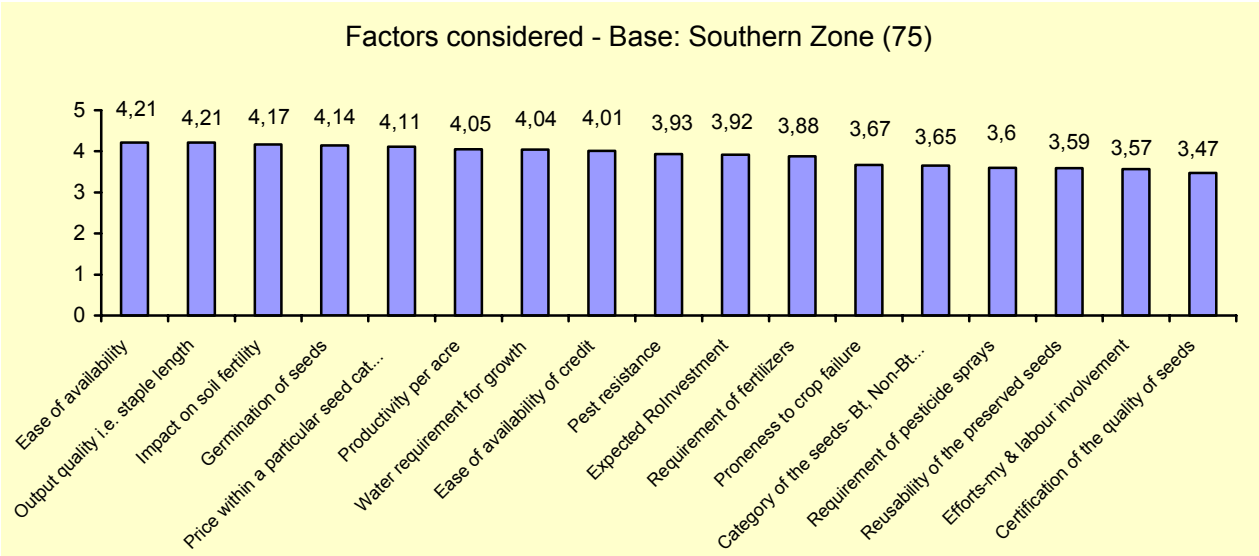
11.3 Number of Bt cotton seed brands used during current crop cycle



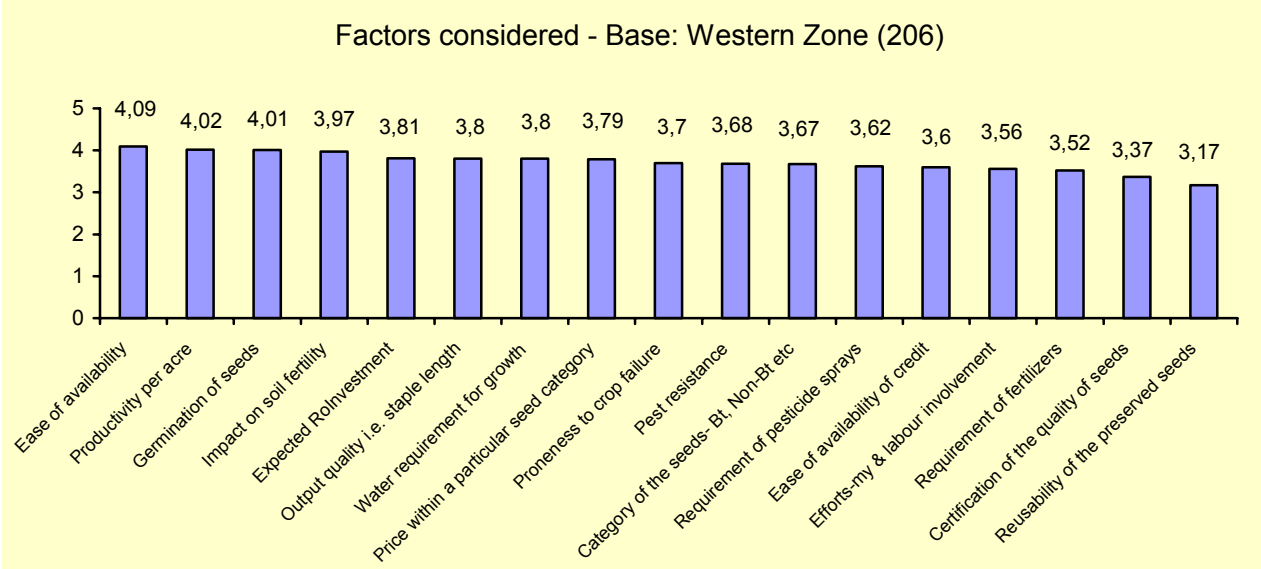
11.4 Satisfaction on the factors with respect to usage of various cotton seed categories

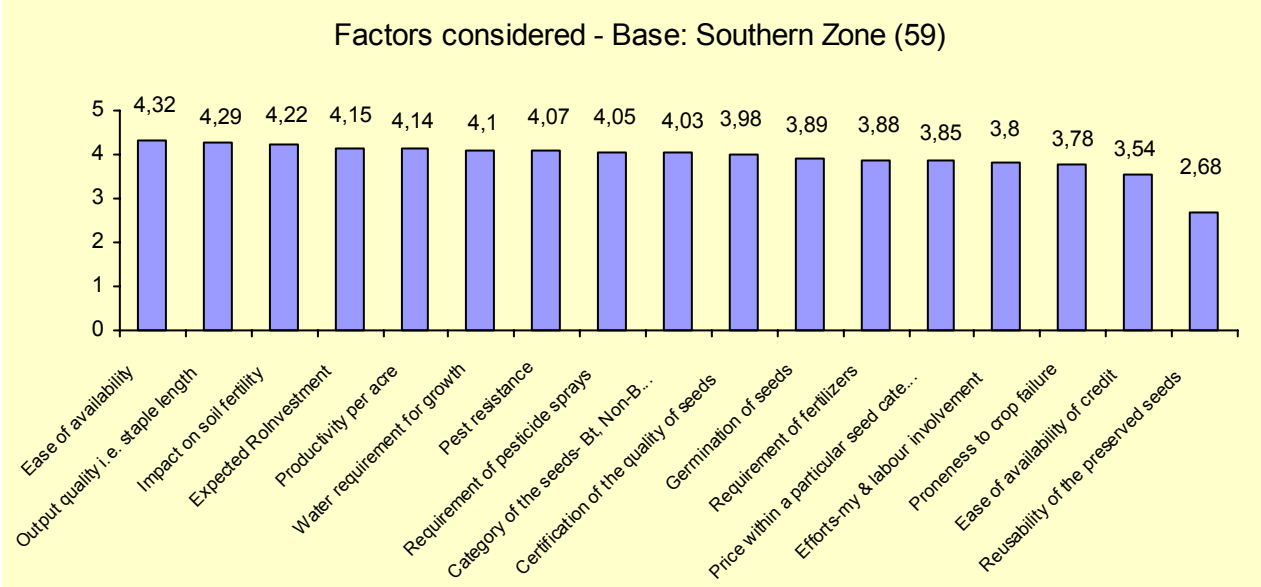
11.4.1 Ordinary Non-hybrid cotton seeds



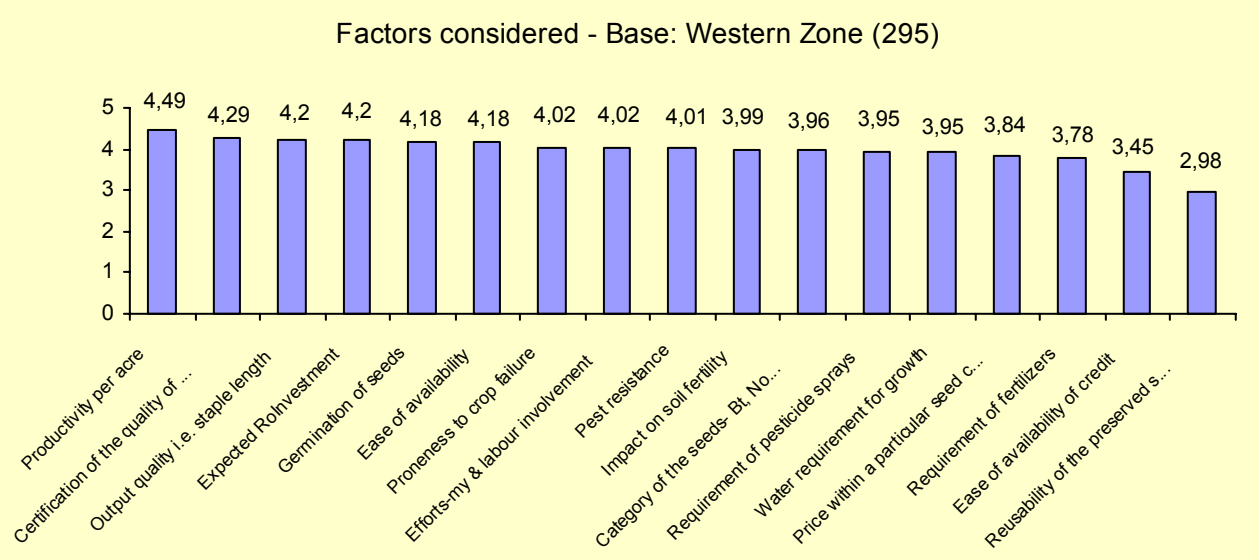


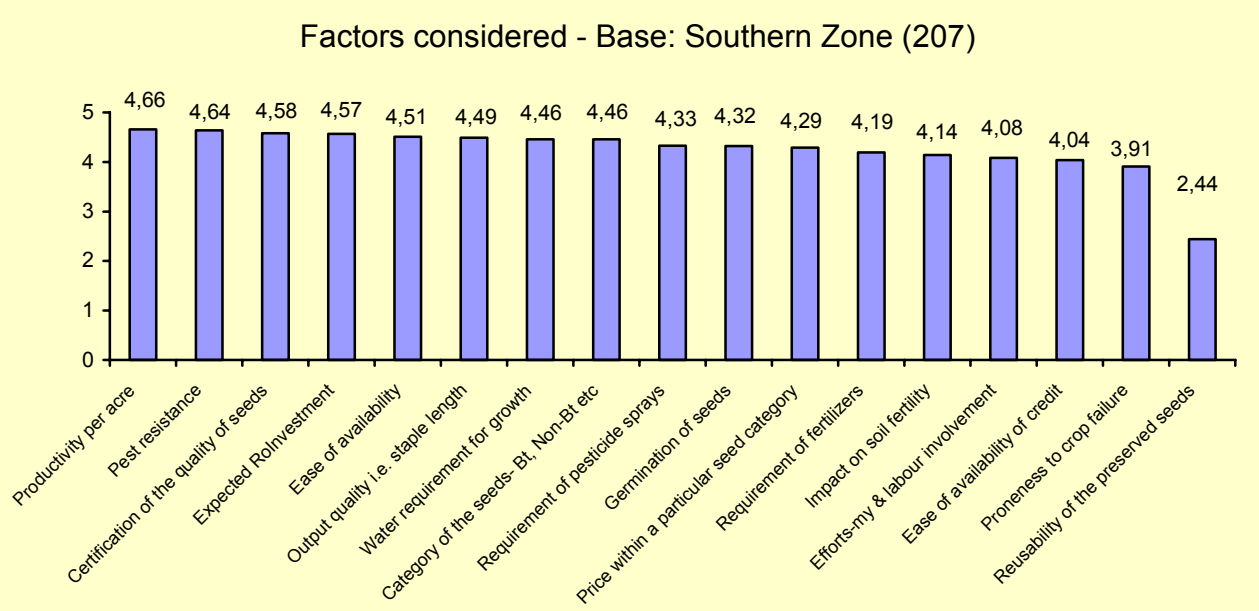
11.4.2 Hybrid Non-Bt cotton seeds





11.4.3 Bt cotton seeds





11.5 Unaided recall for Top 10 certified Bt cotton seed companies/brands

All (5 clusters)	Maharastra	Gujarat	MP	AP	TN & Karnataka
577	129	110	104	143	91
RCH brands (Rasi Seeds) (69%)	Ankur 09 / 651 (Ankur Seeds) (84%)	RCH brands (Rasi Seeds) (73%)	RCH brands (Rasi Seeds) (81%)	NCS - 145 (Bunny) / 207 (Mallika) / 913 (Nuziveedu Seeds) (74%)	RCH brands (Rasi Seeds) (45%)
Ankur 09 / 651 (Ankur Seeds) (42%)	RCH - brands (Rasi Seeds) (67%)	Ankur 09 / 651 (Ankur Seeds) (60%)	Mech - 12 / 162 / 184 (Mahyco) (51%)	RCH brands (Rasi Seeds) (74%)	MRC - 6301 / 6322 / 6918 (Mahyco) (31%)
NCS - 145 (Bunny) / 207 (Mallika) / 913 (Nuziveedu Seeds) (38%)	NCS - 145 (Bunny) / 207 (Mallika) / 913 (Nuziveedu Seeds) (54%)	VICH - 5 / 9 / 111 (Vikram Seeds) (45%)	Ankur 09 / 651 (Ankur Seeds) (39%)	Brahma Bt (Emergent Genetics) (31%)	Brahma Bt (Emergent Genetics) (23%)
Mech - 12 / 162 / 184 (Mahyco) (31%)	Mech - 12 / 162 / 184 (Mahyco) (28%)	Mech - 12 / 162 / 184 (Mahyco) (34%)	ACH - 11 - 2 (BG - II) (Ajeet Seeds) (35%)	Tulasi - 4 (Tulasi Seeds) (29%)	Mech - 12 / 162 / 184 (Mahyco) (20%)
Brahma Bt (Emergent Genetics) (19%)	Brahma Bt (Emergent Genetics) (27%)	NCS - 145 (Bunny) / 207 (Mallika) / 913 (Nuziveedu Seeds) (25%)	ACH - 155-1 / 33-1(Ajeet Seeds) (26%)	Mech - 12 / 162 / 184 (Mahyco) (22%)	Ankur 09 / 651 (Ankur Seeds) (15%)
Tulasi - 4 (Tulasi Seeds) (16%)	Tulasi - 4 (Tulasi Seeds) (16%)	Tulasi - 4 (Tulasi Seeds) (15%)	MRC - 6301 / 6322 / 6918 (Mahyco) (26%)	JK Durga / Varun (Event 1) (JK Seeds) (14%)	KDCHH - 9632 (Krishidhan) (12%)
MRC - 6301 / 6322 / 6918 (Mahyco) (16%)	ACH - 155-1 / 33-1(Ajeet Seeds) (14%)	MRC - brands (BG - II) (Mahyco) (14%)	MRC brands (BG - II) (Mahyco) (20%)	MRC - 6301 / 6322 / 6918 (Mahyco) (12%)	NCS - 145 (Bunny) / 207 (Mallika) / 913 (Nuziveedu Seeds) (12%)
MRC - 7201 / 7301 / 7329 / 7347 / 7351 (BG - II) (Mahyco) (11%)	KDCHH - 9632 (Krishidhan) (12%)	MRC - 6301 / 6322 / 6918 (Mahyco) (10%)	GK - 205 / 207 / 209 (Ganga Kaveri Seeds) (18%)	Ankur 09 / 651 (Ankur Seeds) (10%)	GK - 205 / 207 / 209 (Ganga Kaveri Seeds) (5%)
ACH - 11 - 2 (BG - II) (Ajeet Seeds) (10%)	ACH - 11 - 2 (BG - II) (Ajeet Seeds) (12%)	JK Durga / Varun (Event 1) (JK Seeds) (4%)	JK Durga / Varun (Event 1) (JK Seeds) (13%)	KDCHH - 441 (BG - II) (Krishidhan) (8%)	NCEH - 2R / 3R (GFM Event) (Nath Seeds) (5%)
VICH - 5 / 9 / 111 (Vikram Seeds) (10%)	MRC - brands (BG - II) (Mahyco) (10%)	JKCH - 99 (Event 1) (JK Seeds) (4%)	Tulasi - 4 (Tulasi Seeds) (13%)	PRCH - 102 / 103 / 2270 (Pravardhan Seeds) (8%)	JK Durga / Varun (Event 1) (JK Seeds) (4%)

11.6 Aided recall for top 5 certified Bt cotton brands

II (5 clusters)	Maharastra	Gujarat	MP	AP	TN & Karnataka
577	129	110	104	143	91
RCH brands (Rasi Seeds) **(69%)**	Ankur 09 / 651 (Ankur Seeds) **(84%)**	RCH brands (Rasi Seeds) **(73%)**	RCH brands (Rasi Seeds) **(81%)**	NCS - 145 (Bunny) / 207 (Mallika) / 913 (Nuziveedu Seeds) **(74%)**	RCH brands (Rasi Seeds) **(45%)**
Ankur 09 / 651 (Ankur Seeds) **(42%)**	RCH - brands (Rasi Seeds) **(67%)**	Ankur 09 / 651 (Ankur Seeds) **(60%)**	Mech - 12 / 162 / 184 (Mahyco) **(51%)**	RCH brands (Rasi Seeds) **(74%)**	MRC - 6301 / 6322 / 6918 (Mahyco) **(31%)**
NCS - 145 (Bunny) / 207 (Mallika) / 913 (Nuziveedu Seeds) **(38%)**	NCS - 145 (Bunny) / 207 (Mallika) / 913 (Nuziveedu Seeds) **(54%)**	VICH - 5 / 9 / 111 (Vikram Seeds) **(45%)**	Ankur 09 / 651 (Ankur Seeds) **(39%)**	Brahma Bt (Emergent Genetics) **(31%)**	Brahma Bt (Emergent Genetics) **(23%)**
Mech - 12 / 162 / 184 (Mahyco) **(31%)**	Mech - 12 / 162 / 184 (Mahyco) **(28%)**	Mech - 12 / 162 / 184 (Mahyco) **(34%)**	ACH - 11 - 2 (BG - II) (Ajeet Seeds) **(35%)**	Tulasi - 4 (Tulasi Seeds) **(29%)**	Mech - 12 / 162 / 184 (Mahyco) **(20%)**
Brahma Bt (Emergent Genetics) **(19%)**	Brahma Bt (Emergent Genetics) **(27%)**	NCS - 145 (Bunny) / 207 (Mallika) / 913 (Nuziveedu Seeds) **(25%)**	ACH - 155-1 / 33-1(Ajeet Seeds) **(26%)**	Mech - 12 / 162 / 184 (Mahyco) **(22%)**	Ankur 09 / 651 (Ankur Seeds) **(15%)**