

Effect of Bt Cotton on Small and Medium Scale Farmers' Income in the Telegana Region,  
Andhra Pradesh, India  
2002 – 2005

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The Effect of Bt Cotton on Small and Medium Small Scale Farmers' Incomes in the  
Telegana Region, Andhra Pradesh, India 2002-2005

Abstract

Valerie Laurie

February 26,<sup>th</sup> 2008

The objective of my practicum was to determine the real effect of Telegana farmers' use of Cotton with the Bt trait on their abilities to increase their incomes over 1-3 growing seasons, primarily from smaller scale farmers' perspectives, while taking into account farmers' existing vulnerabilities and the current policy environment. Data collection methods included group activities and semi-structured interviews. The study found that the farmers' use of Bt Cotton has generally had a marginal effect on their abilities to increase their incomes due to the effect of ongoing irrigation problems, the lack of affordable institutional credit, volatile cotton prices and other issues. The highly variable performance of Bt Cotton seed varieties, possibly caused by fraudulent seed in circulation, also posed hardships for many farmers. Overall, the practicum findings add to the debates about the effect of agricultural biotechnology use, particularly Bt Cotton, on the poor by showing that the use of the new technology did not significantly improve the lives of farmers because it was not accompanied by adequate policies or programs designed to address farmers' ongoing problems.

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## List of Acronyms and Abbreviations

- A     Acre
- (C)   Clarify: This abbreviation is used within direct quotations to indicate that the speaker was asked to clarify his or her answer
- CCI   Cotton Corporation of India
- CFW   Commission on Farmers' Welfare, Andhra Pradesh
- Dfid   Development Finance and International Development Department of the United Kingdom
- GEAC  Genetic Engineering Approval Committee
- ha     Hectare
- L.     Lakh (100,000 Rupees)
- R.     Rupee
- PPS   Pragathi Seva Samithi, a Non-Governmental Organization
- MARI  Modern Architects for Rural India, a Non-Governmental Organization
- NGO   Non-Governmental Organization
- RFW   Report on Farmers Welfare, Government of Andhra Pradesh

## **Chapter 1: Introduction**

The introduction of several varieties of cotton containing *Bacillus Thuringiensis* (Bt) to the Telegana Region of the Southern Indian state of Andhra Pradesh in the late 1990's by Monsanto and the Indian company<sup>1</sup> Mahyco caused a prolonged public debate in India and abroad over concerns about these products, the first transgenic crops introduced to India. It also caused groups which espoused extreme positions in the debate to generate a flurry of media reports and to carry out activities in India over their concerns about the potential impact of the use of Bt Cotton by farmers. Groups with clear mandates to keep these new varieties of genetically modified organisms (GMOs) out of India for environmental and philosophical reasons led campaigns, supported by study results, in an attempt to thwart the approval of the seed for commercial production by the Indian Genetic Engineering Approval Committee (GEAC)<sup>2</sup> and to sway public opinion. At the same time, seed company representatives, motivated by the desire to dominate the enormous and potentially lucrative Indian seed market and gain acceptance of these new varieties of GMOs in India, led equally persuasive campaigns supported by positive field study results from Southern India and from cotton growing regions in other countries. Unbiased accounts from farmers in Andhra Pradesh about the outcomes they experienced by using Bt Cotton were a rarity due to the polarization of the issue (Stone, 2004, 2007; Herring, 2006, 2007; Scoones, 2003).

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<sup>1</sup> Monsanto, a multinational company based in the USA currently has a 26% share of Mahyco (Scoones, 2003). Many other companies in India now have agreements with Monsanto to allow them to use the new technology (Herring 2007). Rch 2Bt from Rasi also was available at the time this practicum was conducted.

<sup>2</sup> An elaborate regulatory infrastructure for biotechnology exists at a national, state and district level in India. The Genetic Engineering Approval Committee is one of two of the federal institutional bodies with the mandate to approve applications for the commercialization of genetically modified products in the country. It is under the authority of the federal Department of Environment and Forests (Newell, 2007, p.186). See Dhar (2003) for a model of this infrastructure.

This controversy and confusing state of affairs intensified when three Mahyco/Monsanto varieties of Bt Cotton were approved for commercial production in six Southern Indian states including Andhra Pradesh in 2002. The decision resulted in challenges to the legitimacy of the field trials, upon which this decision had been based (Ministry of Environment and Forests (MEF), 2003). The GEAC, as a result, reconsidered its position and delayed its final decision until the spring of 2005 even though the varieties under review and other illegal variants were already in circulation in Southern India (Stone, 2007; Herring, 2006).

There was a clear need for qualitative social science research about the impact of farmers' use of Bt Cotton in Andhra Pradesh due to the polarization of the issue and the near absence of social science research on the topic. Qualitative research, employing participatory research methods, would reveal the outcomes of Bt Cotton use on farmers' livelihoods from their perspective rather than from the perspective of groups with vested interests in reporting certain outcomes. Existing research about the impact of Bt Cotton use on Indian farmers' livelihoods during the time of this controversy, aside from one social science study (See Stone, 2004), was also quantitative agricultural research. Qualitative social science research, unlike quantitative agricultural research, could uncover nuanced explanations of why farmers experienced certain outcomes through Bt Cotton use and investigate the socio-political realities rather than agricultural issues which influenced Bt Cotton farmers' experiences with Bt Cotton. More importantly, participatory social science research could determine the meaning and significance, if any, of an increase or decrease in farmers' income as a result of farmers' use of Bt Cotton given their existing vulnerabilities. Such information could also inform broader debates

about the potential impact of agricultural biotechnology upon poor people in developing countries.

The impact of farmers' use of Bt Cotton mattered because increasing numbers of farmers<sup>3</sup> in the Telegana Region, particularly Warangal District, the geographical focus of my research, were already using the new technology and a substantial number of farmers would be negatively affected if this technology was not suited for their needs given their existing challenges. People in Warangal District were already facing an agrarian crisis caused by a myriad of problems including volatile prices for cash crops such as cotton (Commission on Farmers' Welfare (CFW), 2005; Reddy, Vedantha, Rao, Reddy & Reddy, 1998) and there was widespread concern, as a result, that the introduction of Bt Cotton, a variety of seed which was much more costly than other hybrid cottons at the time and had special growing requirements, could possibly aggravate farmers' situations. In particular, activist rhetoric about Bt Cotton suggested that this new technology, once adopted, was likely to have a negative impact on the livelihoods of a significant population of small-scale farmers (43%)<sup>4</sup> in the state because of their already more precarious state compared to larger scale farmers in terms of access to credit and irrigation.

On the other hand, proponents maintained that even though Bt Cotton varieties were more expensive than other popular hybrids which farmers already used in Warangal District<sup>5</sup>, the use of the seed could actually lower farmers' management costs and result in a significant increase in farmers' incomes. Bt varieties contain a soil bacterium which ultimately kills insects in the bollworm complex and Cotton varieties with the Bt trait, as a result, had been shown to reduce farmers' pesticide costs compared to other popular cotton hybrids (OECD, 1994; FAO, 2004; Traxer, 2002; Thirtle et al., 2003). This special

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<sup>3</sup> Between 2003 and 2005 data from Warangal city seed vendors show that the market share for Bt hybrids increased from 1% to 20% to 62% (Stone, 2006).

<sup>4</sup> Holdings under 2 hectares (Aggarawal, 2006)

<sup>5</sup> Farmers in Warangal District have been using cotton hybrids since cotton production was introduced to this area in the 1980's. They do not practice seed saving for these hybrid crops (Shiva, Jarfri, Emani, Pande, 2002).

feature helps farmers decrease their costs providing that bollworms do not develop a resistance to the plants' pesticide qualities. Research in other countries and Southern India had also found that the hybrids with the Bt trait also had higher yields<sup>6</sup> produced better quality cotton lint and required less labour. These benefits all had the potential to boost farmers' incomes.

There was, however, a critical omission in the existing literature about farmers' experiences with Bt Cotton. Existing studies such as those previously mentioned and additional studies which pertained to biotechnology policy in India (Scoones & Scoones, 2003) did not review the federal and state agricultural policies and economic policies which helped and hindered Bt cotton farmers' efforts to "make a living" and the vulnerabilities and supports which farmers experienced, in part, due to the effect of these policies. In particular, studies which suggested that Indian farmers could remarkably increase their incomes by using Bt Cotton seed, (See Qaim and Zillberman, 2003; Neilsen, 2004) had not taken this existing policy context and farmers' existing vulnerabilities into account.

The focus of my practicum research, thus, arose from the need to investigate the actual outcomes of smaller scale farmers' use of Bt Cotton in context in the Telegana Region of Andhra Pradesh. The research problem was the real impact Bt Cotton use had on farmers' abilities to achieve outcomes that they considered important while taking into account existing vulnerabilities and the policy environment in which they were attempting to

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<sup>6</sup> The Bt trait doesn't necessarily have a bearing on yield; it is the performance of the hybrid which effects yield, however, increased yields are often reported as an outcome of cotton varieties with the Bt trait (Herring 2007; Stone 2007).

make a living. The research<sup>7</sup> I conducted in 2004-2005 established that the outcome which farmers considered most important in regard to Bt Cotton use was “increased income” and this outcome is given much more emphasis compared to other possible outcomes from Bt Cotton use in this practicum report.

The objective of my practicum, therefore, was to determine the real effect of Telegana farmers’ use of Cotton with the Bt trait on their abilities to increase their incomes over 1-3 growing seasons, primarily from farmers’ perspectives, while taking into account farmers’ existing vulnerabilities and the current policy environment. Thus, by meeting this objective, farmers’ experiences would be reviewed in context. The experiences of relatively small scale farmers (less than 4 hectares) were the main focus of this investigation given their greater vulnerabilities.<sup>8</sup>

Cotton farmers in the Telegana Region in Andhra Pradesh, as mentioned, were already facing many serious problems indicative of an agrarian crisis (Reddy et al, 1998) when Bt Cotton was introduced in 2002 and the introduction of Bt Cotton was promoted as a means to overcome many of farmers’ existing challenges (Stone 2005; Shiva, Jarfri, Emani & Pande, 2000). This practicum report will show that due to farmers’ existing vulnerabilities and the effects of the policy environment in the Telegana Region, Bt Cotton use did not improve farmers’ income to the extent claimed in the few studies available about Bt Cotton use in Southern India in 2004. Farmers’ existing realities mediated their ability to increase their incomes through Bt Cotton use to the extent that any benefits they obtained through Bt Cotton use were negligible. Such findings add to

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<sup>7</sup> The study, among other topics, investigated the impact of Bt Cotton use on all possible livelihood outcomes i.e. income, household food security, well-being, vulnerability and use of the natural resource base.

<sup>8</sup> The Agricultural Census of Andhra Pradesh defines marginal farms as 0-1 ha, small farms as 1-2 ha, medium farms as 2-4 ha and large farms as greater than 4 ha (Motiram, 2007).

debates about the impact of Bt Cotton use on “the poor” in India showing that agricultural technology change alone cannot meet the needs of smaller scale cotton farmers let alone poorer farmers.

### **Literature Review – Potential Impact of Bt Cotton use upon Farmers’ Incomes**

The fact that over 1,000 farmers committed suicide in the Telegana Region, primarily in Warangal District, between 1998 and 2002 shortly before Bt Cotton was even introduced (Chowdhary et al. 2002 as cited in Vakulabharanam, 2005) was an indication of the severity of the problems of farmers in this region. The suicides have largely been attributed to the financial stress small scale farmers experienced when they shifted crop patterns from food crops for subsistence to cash crops, including cotton, during the previous twenty years as a part of what has been coined a “Delayed Green Revolution.” These stresses were exacerbated by volatile prices caused by greater integration with world markets after the implementation of the New Economic Policy in 1991. Other challenges included declining water tables, pest resistance to pesticide and an acute insect infestation in the late 1990’s. Inadequate institutional supports for credit and irrigation along with poor agricultural extension services in many areas added to their plight (Reddy et al., 1998).

The introduction of Bt Cotton to the Telegana Region was viewed as a possible way for farmers to improve their situations primarily by increasing their incomes through the use of Bt Cotton. A widely circulated study conducted by a market research firm for Monsanto, in particular, claimed that farmers in Andhra Pradesh had increased their net profits by 5,138 R per Acre (92%) by growing Bt Cotton varieties (Nielsen, 2004; as cited in Qayum and Sakkahari 2005; as cited in Herring, 2007). Even articles published in

peer reviewed journals outlining field trials in Southern India in 2001 claimed that farmers could expect substantial yield gains and a reduction in pest damage (Qaim and Zilberman, 2003) although these studies were challenged on the grounds that these estimations had been based upon data supplied by Monsanto (Herring, 2007). Regardless of these promising claims, however, one cannot actually extrapolate the socio-political causes or the significance of an increase in profits to farmers from these findings.

Studies in Telegana district confirmed opponents' suspicions that farmers would not receive a greater income by using Bt Cotton and showed the limitations of Bt Cotton varieties' pesticide qualities. Several studies in Telegana District (Qayum & Sakkahari, 2002, 2004), have shown that the returns for Bt Cotton on the farm are actually lower than recorded in the academic studies and industry studies. These large, longitudinal studies in Telegana found that the need to apply pesticides for outbreaks of pests other than Bollworms and substandard cotton bolls that fetched lower than normal prices in local markets have caused Bt farmers to face "a loss at the end of the season" (ibid, p.32) compared to non-Bt Cotton farmers. The legitimacy of these studies and other studies<sup>9</sup> conducted by NGOs in Andhra Pradesh has been contested for a variety of reasons (See Stone, 2006).<sup>10</sup>

Therefore, one way out of this polarized impasse was to focus less on farmers' reports on their decreases or increases in income and to listen to farmers' accounts of the broader reasons for the outcomes they experienced and the significance to them of the outcomes they experienced with the new technology over several growing seasons. Such an

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<sup>10</sup> Many studies indicated that farmers' use of Bt Cotton resulted in positive outcomes in other developing countries (See Qaim & Krattiger 2000; Thirtle, Beyers, Ismael & Piesse, 2003; Elbehri & MacDonald, 2004; Qaim, Cap and Janvry, 2003; Traxer, 2002) and in several states in India ( Barvale, Gadwal, Zehr, and Zehr, 2004)

analysis, including a review of the policies which affect farmers' livelihoods, would augment these existing studies which focused on agricultural issues such as yield and pesticide use. The goal was to understand the context in which farmers strive to make a living and how this context influences their outcomes.

Theories specifically about the possible impact of agricultural biotechnology upon people in developing countries such as India are only in their formative stages (Otero, 1991; Buttel, 1999; Lewontin, 2000) due to the relatively recent emergence of the biotechnology issue; as a result, these theories could not tell one much about the current impact of farmers' use of Bt Cotton on their incomes given their existing vulnerabilities and their policy context. For the most part, these rudimentary theories investigate the relationship between technology change and changes in social organization in the future (Otero, 1991) or they are political economy oriented studies about the potential role of the agricultural biotechnology in the restructuring of the agri-food system (Lewontin, 2000; Buttel, 1999) through vertical integration. Neo-Marxian theorists, for example, contend that the introduction of biotechnology is ushering in a system of farming that will cater to the needs of massive agribusinesses rather than farmers and in such a system farmers will become a "proletariat class" as contract farmers rather than the relatively autonomous producers they are now because transnational companies will own all the means of production (See Lewontin, 2000). Similar cautions about greater corporate control of farmers' lives are echoed in Alternative/Eco-Feminist orientations (Shiva, 2000; Shiva et al., 2002,). These rather futuristic theories are useful in that they point to the possible root causes and possible future implications of farmers' use of Bt Cotton.

When agricultural biotechnology was first introduced much of the literature was framed to answer the question: “Can biotechnology meet the needs of the poor?” Thus, an over arching debate in the literature for more than a decade has been in regard to what impact agricultural biotechnology will have upon different aspects of the livelihoods of the poor (See Doyle, 1985; Qaim, Matin, Krattiger & Von Braun, 2000; Glover, 2003; FAO 2003; Lipton, 2007; Herring, 2003, 2006, 2007). The crux of this debate is that given the possible superior agronomic traits of agricultural biotechnologies, denying the new technologies to people in developing countries could block groups of relatively poor people from a technology which could ultimately improve the quality of their lives. However, given the uncertainty of the impact of the new technology on the livelihoods of the poor now and in the future, there is also a distinct possibility that allowing people access to this new technology might be harmful to individuals as well as entire nations (Herring, 2007). Herring, in his review of this debate concludes that the current consensus in the “policy and scientific community has been towards a settled science endorsing genetic engineering with precautionary caveats (ibid, p.1).”

This pragmatic approach to the issue makes sense on a superficial level although it is debateable whether cotton is a crop typically grown by the poor (Glover, 2003). It does not make sense to deny this new technology to an entire population given the possibility that Bt Cotton has superior agronomic traits capable of boosting yields and reducing pesticide use. Indian cotton production, in particular, is known for remarkably high rates of pesticide use, low yields and poor quality cotton (Technology Mission on Cotton, 2002) and farmers could possibly benefit from Bt Cotton use if feasible. Indian farmers needed to take advantage of any possible way to improve their yields and the quality of

their product after the implementation of the New Economic Policy of 1991 as they had to increasingly contend with imports of good quality cotton from other countries.

On the other hand, the reality is that there is a wide gap between policies in regard to the handling of genetically modified seed and products and actual practices in regions such as Telegana which makes this policy-focused approach to agricultural biotechnology problematic. Illegal variants of the new varieties were already in circulation before Bt Cotton was introduced in 2002 and this trend continues (Herring, 2007; Stone, 2007; Sakkari & Quayum, 2004) in spite of biotechnology policy to the contrary. Regardless of this disconcerting reality, the growing body of academic literature about biotechnology policy in developing countries including India has been about different aspects of biotechnology policy creation (Scoones & Seshia, 2003) and the involvement of corporate actors in policy creation (See Newell, 2007). The literature is not about the about the real life consequences of the circulation of fraudulent seed and poor management of Bt seed and products; no one knows for certain how farmers are coping in such an environment.

Regardless of the gaps and focus of the existing literature about farmers' experiences with agricultural biotechnology, such as Bt cotton, literature about the Green Revolution in India, does provide one with a few basic insights into the far reaching impacts of agricultural technology change upon farmers' livelihoods and specifically their incomes although the impending bio-revolution of which the introduction of Bt Cotton is a part is very much occurring under a different set of circumstances (Scoones et al, 2003).

The Green Revolution in India, which began in the 1950s, was intended to be a means to reduce poverty and establish self-sufficiency in food grains, ultimately to maintain stability in the region (Scoones et al., 2003). It is synonymous with the introduction of high yielding varieties of hybrid crops, particularly rice, wheat, and millets and the introduction of artificial inputs in order to make these crops productive. This push towards the intensification of agriculture was directed by federal policies and research in public institutions which was funded by private foundations such as the Rockefeller Foundation. The impending bio-revolution in India, of which the introduction of Bt Cotton is a part, conversely, has been implemented by transnational seed companies in conjunction with privately owned seed companies in India and occurs at a time when Indian agricultural policy has shifted even further towards an industrial agriculture model rather than a model in support of family farms (Scoones, 2003). Although it would be an oversimplification to suggest that the Green Revolution did not benefit private interests, the bio-revolution is directed even more towards market expansion and profit maximization of multi-national companies. In particular, it would appear that Bt Cotton is a gateway crop which plays an important role in the eventual introduction of transgenic food crops to India as the Bt trait is also used in food crops such as corn and potatoes. The introduction of Bt Cotton also comes at a time when companies are scrambling to patent germplasm originating from developing countries and having a presence in the country eases this process.<sup>11</sup> It is important to not lose sight of these realities as they are

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<sup>11</sup> Then (2000, p. 233) states: "For financial and legal reasons, companies operating internationally can easily control patents. Patents can be registered for a hundred countries at once through the European patent office. In addition, certain patent laws increase opportunities for large multi-nationals to control patents rather than small companies with limited research and development resources; for example, only varieties modified "in the lab" can be patented. As a result about 97% of patents issued world wide have their head offices in industrialized countries (UNDP 1999 as cited in Then, 2000 p.235).

crucial to understanding the introduction and potential impact of the new technology upon Indian farmers' livelihoods.

The Green Revolution, despite the benefits which were experienced by many Indian farmers and the establishment of national food self-sufficiency had far reaching negative affects due to several central tendencies which account for many of the problems experienced by farmers in India today (Ghosh, 1997). The Green Revolution, in India, in general, boosted crop yields and productivity, however, over time, farmers increasing reliance on artificial fertilizer and pesticides had damaging effects on the natural environment and farmers' health. In addition, the benefits in terms of increases to farmers' incomes declined over time due to insect resistance to pesticides, declining soil quality, and the associated increases in the costs of production. Renting land and cash crop production became a more lucrative enterprise than other types of farming for many land owners due to the increasing costs of production (Ghosh, 1997). Evidence also suggests that even though the Green Revolution increased food production and did avert wide spread famine it did not entirely reduce household food security as food surpluses were not distributed (Sen, 1981 as cited in Sen, 1999).

Bt Cotton, however, holds out the promise of breaking farmers away from the costly "pesticide treadmill" created by farmers' heavy reliance upon artificial pesticides and pest resistance but there are no guarantees that technology change alone will have a lasting effect. Farmers' experiences in the Green Revolution have shown that the impacts of new technologies are variable over time; pests, for example, develop resistance to previously effective pesticides. In keeping with this reality, Bt Cotton varieties need to be planted with refuge crops to maintain their pesticide qualities over time. Refuge crops

consist of three to five rows of non-Bt Cotton which are planted around a Bt crop in order to ensure that successive generations of insects maintain an intolerance for the Bt toxin by consuming a diet of not entirely of Bt Cotton. Critics, however, maintain that planting these rows in order for them to be devoured by bollworms will have a negative affect upon farmers' bottom lines. There is a chance that farmers will not adhere to this guideline due to this extra cost and Bt Cotton will cease to be effective.

Other lessons were also learned from the experiences of Indian farmers during The Green Revolution which might apply to the impending bio-revolution. Increases to income due to increased yields, were not uniformly experienced by all Indian farmers. The new technologies tended to be directed towards larger scale, more mechanized producers in the already more prosperous states and regions of the country in Northern India (Library of Congress, 2007) rather than poorer farmers. Indeed, farmers in Warangal District did not adopt the technologies associated with The Green Revolution until the 1980's (RFW, 2005). In general, richer farmers with access to the necessary irrigation to make hybrid seeds perform well and access to credit were the ones who benefited from the new technologies during the Green Revolution.

Bt Cotton, conversely, is considered to be "scale neutral" as preliminary research with small scale farmers in India and Africa (Jenkins, 2002, as cited in Hofs, Fok and Vaissayre, 2006; Thirtle, Beyers, Ismael and Piesse, 2003) has shown that even small holders can substantially benefit from Bt Cotton use. Although the technology itself can effectively be used by small holders one must question whether the returns on Bt Cotton are worth the higher costs to highly indebted Telegana farmers given their poor access to affordable institutional credit and other vulnerabilities such as sharply fluctuating prices

for cotton. A large percentage of Telegana farmers, for example, are reported to already have enormous debts; the present rate of indebtedness in farm households in Andhra Pradesh was 82% in 2001(National Sample Survey Organization as cited in Agarawal, 2006 p. 10.). These debts, often owed to private money lenders, were reported to be at rates of 36% (Qayum, Sakkhari, 2004). It is also necessary for farmers to finance the digging of bore wells to water their crops in this semi-arid area with a declining water table given the fact irrigation schemes are in decline and this expense adds to their large debt loads. Thus, one must question to what extent a new technology can actually cause a significant change in individual farmers' abilities to increase their incomes given all these existing constraints.

In summation, no one really knew if Bt Cotton, in actual use, had the potential to improve Telegana farmers' incomes to the extent claimed in the few industry and agricultural studies conducted in India (See Morse, Bennett and Ismael, 2004; Qaim and Zilberman, 2004 ) in 2004. Other more extensive studies in Telegana had found contrary results (Qayum& Sakkhari, 2004) for agronomic reasons but the findings of these studies had been contested (Herring, 2007; Stone, 2005). Most importantly, none of these studies or the other literature on the topic actually reviewed farmers' use of Bt Cotton in context even though farmers' existing vulnerabilities and the policy context likely mediated farmers' experiences with Bt Cotton. Therefore, no one really knew what impact this agricultural technology change had on farmers' abilities to increase their incomes, particularly from their perspective, given these constraints. On the other hand, farmers' experiences during the Green Revolution had shown that the impact of the introduction of new agricultural technologies on farmers' livelihoods is often highly variable from one

region to another region and impacts can change over time. In addition, Green Revolution experiences had shown that new agricultural technology can have far reaching, unintended effects if the introduction of new agricultural technology is not accompanied by appropriate government policy directed towards the management of the new technologies as well as policies directed towards the rudimentary needs of all farmers for irrigation, credit and household food security. Bt Cotton, however, was introduced in a very different time: agricultural policy was shifting towards policies to support an industrial agriculture model, economic policies were directed towards greater integration with world markets and multi-national companies had far more influence in India than during the Green Revolution.

### **Research Question**

Thus, in light of all the uncertainties about the impact of Bt Cotton on farmers livelihoods at the time the research for this practicum was conducted in 2004 -2005 a fundamental question motivated my research: Why and to what extent did small-scale and medium-scale farmers' use of Bt Cotton in 1-3 growing seasons cause a negative or positive impact on their abilities to increase their incomes in Warangal District in the Telegana Region of Andhra Pradesh given their existing vulnerabilities and the existing policy context?

### **Methodology**

The following methodology section provides an account of the way the data was collected to meet the study objective and definitions of key variables. Qualitative research about Bt Cotton in Andhra Pradesh was conducted during August – October 2004 and February 2005 in Warangal District in the Telegana Region in order to collect

data for the study. Janiah Mallikanti and Ramma Krishna, the research assistants/translators who worked with me on this study and I gathered information from twenty-six (26) individuals representing seventeen (17) households through two sets of semi-structured interviews in three villages (A,B,C). We also conducted two sets of group activities in a fourth village (D). Efforts were made to recruit a male and female from each household for the interviews and all groups activities were segregated by gender.

In order to structure my investigation in the field I turned to the sustainable livelihoods approach and framework. The United Kingdom Department for International Development (Dfid) Sustainable Livelihoods framework was used in this study as a useful tool to inform the research process. The framework provided a structure to assist in the research of the main factors that affect people's livelihoods using participatory methods and mostly micro-level analysis. These factors in the framework include people's vulnerability context: shocks such as natural disasters, seasonal changes in farmers' livelihoods and trends. Included in "trends" are economic trends. Other factors included in the analysis are an individual's capital; for example, financial capital such as access to credit and assets, and social capital such as access to family labour. Macro-processes are also included in the analysis as one looks at the influence of government policy upon individuals and vice versa. By applying this approach, we were able to determine the all factors which had a bearing upon the livelihoods of the participants in the study and provide participatory ways for the participants to assess how their use of Bt Cotton affected their income, household food security, well-being, the natural resource base and their vulnerability (See Appendix A). The bearing on income is primarily reported in this practicum report as the participants valued income more than other

possible outcomes and one of the goals of the sustainable livelihoods approach is to define and focus upon the outcomes which are most important to participants.

Information was collected about Bt Cotton's impact on the farmers' livelihoods for all of the three growing seasons during which Bt Cotton had been grown in Warangal District at the time of my research. Thus, data were collected during October 2004 about the one or two times the farmers had grown Bt Cotton during the previous two growing seasons (2002-2003 and 2003-2004). I returned to the field at the end of the third growing season in February 2005 in order to collect information mainly about farmers' experiences in the 2004 - 2005 growing season and to provide the farmers with an opportunity to assess their experiences with Bt Cotton overall.

The findings should be viewed as farmers' perceptions of Bt Cotton rather than hard data on the performance of Bt Cotton. Farmers generally did not keep records and in some cases they reported on their experiences many months after they harvested the crop and memories of events tend to erode over time.<sup>12</sup> Farmers, for better or worse, make decisions about what crops to grow in this manner not through controlled studies. An assessment such as this one provides one with an accurate view of the effect of Bt Cotton, in actual use, on farmers' incomes "as they see it" and their perceptions of the technology. Most importantly, the farmers' accounts about their experiences put the whole issue in context. Their comments tell us about the significance of certain outcomes to them and why certain outcomes occurred for small and medium scale farmers for reasons other than strictly agricultural causes.<sup>13</sup>

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<sup>12</sup> All of the interactions took place in Telugu and were translated "on the spot" to English and this reality might have affected the accuracy of the reported findings.

<sup>13</sup> Undoubtedly, farmers' perceptions are influenced by the experiences of others, media reports and so forth. We also collected data on these factors but they are not included in this report for the sake of brevity.

The participants were persons<sup>14</sup> who owned or rented land upon which Bt Cotton had been grown. The participants were categorized as marginal, small, medium and large-scale based upon the size of their land holding and based on the Agricultural Census of Andhra Pradesh cut-off points.<sup>15</sup> Therefore, small and medium-scale farmers, the focus of this study, were categorized as persons with holdings of less than four hectares.

Participant selection techniques varied. The people who participated in the participatory group activities in Village D in October 2004 and February 2005 were randomly selected from a list of the entire Bt Cotton farmer population<sup>16</sup> using a purposeful sampling technique.<sup>17</sup> All the people who grew Bt cotton in Villages A, B and C in 2004 were asked to participate in the semi-structured interviews in 2004 and these people were approached again in February 2005. Additional farmers were recruited through non-probability sampling in February 2005 in Communities A, B and C. The people who participated in the additional semi-structured interviews such as farm labourers, representatives of the Cotton Corporation of India representatives, academics, agricultural researchers, additional farmers and so forth were recruited through non-probability sampling.

Several means were employed to ensure trustworthiness of the data collected. First of all, during the group activities participants were periodically asked to confirm that they agreed with statements which were arrived at through informal consensus. Another

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<sup>14</sup> All of the participants were Hindu rather than other possible faiths as almost all people are Hindu in the villages in Warangal District and were unable to find Bt Cotton farmers of other faiths.

<sup>15</sup> The Agricultural Census of Andhra Pradesh defines marginal farms as 0-1 ha, small farms as 1-2 ha, medium farms as 2-4 ha, and large farms as greater than 4 ha (Motiram, 2007).

<sup>16</sup> The list was compiled with the assistance of a local NGO, Pragathi Seva Samiphi (P.S.S.)

<sup>17</sup> In October 2004 several of the small scale farmers who participated in the group activities had not had the opportunity to grow and harvest Bt Cotton for the entire growing season (5-8 harvests) as smaller scale farmers tried Bt Cotton, for the first time, later than large scale farmers. In order to include small scale farmers we needed to make this concession.

method to ensure the trustworthiness of the data was triangulation; the same data was gathered from a variety of different sources. Time Lines and Seasonal Calendars, for example, were conducted to collect information on the history of a community and seasonal trends from several different farmers in all of the villages; other interviews and literature reviews were also conducted in order to confirm this information.<sup>18</sup>

### **Data Collection Steps to Achieve the Objective and Measurement of Key Variables**

The objective of my practicum was to determine the real effect of Telegana farmers' use of Cotton with the Bt trait on their abilities to increase their incomes over 1-3 growing seasons, primarily from smaller scale farmers' perspectives, while taking into account farmers' existing vulnerabilities and the current policy environment. The experiences of relatively small scale farmers, farmers with holdings less than four hectares, were the main focus of this investigation given their presumably greater vulnerabilities.

There were several steps in the process. The first step was to determine what livelihood outcomes farmers defined as important in general and specifically in regard to Bt Cotton production. The second step was to see what impact Bt cotton use had on farmers' abilities to increase their incomes overall and to determine why positive or negative outcomes had occurred according to farmers' accounts. The third step was to investigate the agricultural and economic policies which effected farmers' existing vulnerabilities which had a bearing on farmers' abilities to increase their income.

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<sup>18</sup> Participants were also personally invited to a public presentation to present the findings and confirm the trustworthiness of data but the electricity was turned on at the same time; as a result, the farmers were watering their fields and did not attend the presentation. We could not reschedule.

## **Step One**

The first step was to determine what livelihood outcomes farmers defined as important, in general, and specifically in regard to Bt Cotton production. The first step of the research was met through the following data collection techniques:

**1.) Semi-Structured Interviews** - We asked semi-structured interview participants questions during the interviews in Villages A, B and C about their aspirations, beliefs and experiences that motivated them to use Bt Cotton. Most of the participants said they grew Bt Cotton to increase their incomes.

**2.) Semi-Structured Interviews and Focus Groups** – Semi-structured interviews with the farmers in Communities A, B and C and a focus group exercise in Community D helped to clarify how farmers define “a good life now and in the future.” (See questionnaire – “Good Life,” Question 10). These activities provided the researchers with a lot of data on the livelihood outcomes farmers considered important overall including income.

## **Step Two**

The second step was to see what impact Bt Cotton use had on farmers’ abilities to increase their incomes overall and to determine why positive or negative outcomes had occurred according to farmers’ accounts.

**1.) Semi-Structured Interviews** – In Step Two, participants were asked questions which allowed the farmers to assess every aspect of the performance of Bt Cotton and the impact on aspects of their livelihoods including the following: impact on the natural resource base, well being, vulnerability, household food security and particularly income

(See Appendix A and sub-headings in the questionnaire in Appendix B which are marked accordingly).

All of the variables which impinge upon income, such as pesticide costs, labour costs, number of pickings, yields, amount of pesticide used and so forth were taken into consideration by each participant in a systematic way during interviews in Communities A, B and C and each farmer assessed what impact Bt Cotton use had on his or her income overall (See subheading marked “Income,” beginning at question 12 on the questionnaire, and the final page of questionnaire in Appendix B). Farmers also told us about the factors which affected their profit margins which helped to determine why positive or negative outcomes occurred such as irrigation issues, crop failure, or a drop in prices.

**2.) Matrix Exercise and Focus Groups** – During a Matrix exercise in Community D, we also assessed the impact of using Bt Cotton on farmers’ incomes by asking them to compare their perceptions of Bt varieties to their perceptions of several popular hybrids they had grown in regard to 10 variables which have a bearing on overall profits. They also compared their anticipated and actual profits for each variety.

### **Step Three**

The third step was to investigate the agricultural and economic policies and farmers’ existing vulnerabilities which had a bearing on farmers’ abilities to increase their incomes. This data was collected in the following ways:

**1.) Timelines** – Both the semi-structured interview participants (Communities A, B and C) and the people who participated in the group activities helped us create Timelines for their communities in order to isolate the changes and trends in agriculture and

government policy and so forth in their communities leading up to the introduction of Bt Cotton.

**2.) Literature Reviews** – Information about relevant federal and state policies was collected in a variety of ways. A literature review of all the English language studies that have been conducted about Cotton production/ Bt Cotton production and government policy in Telegana Region was conducted using academic data bases and Google Academic. In addition, I was given several articles during the course of my research in India and these articles were reviewed for information about the affect of policies on farmers’ experiences in the Telegana Region. All of the studies were reviewed so that I did not introduce bias into the study by selecting certain studies over others. I noted when the material was from activist sites or seemed heavily biased and some of the more overtly biased articles were disregarded. My research assistant, Rama Krishna and I also collected all of The Hindu national newspaper articles pertaining to Bt cotton production in Telegana between June 2003 and April 2005.

**3.) Seasonal Calendars** – All of the participants who participated in the group activities in Community D and most of the participants in Communities A, B and C also created seasonal calendars to report on shocks, trends and seasonal changes in farmers’ income in order to collect data on farmers’ vulnerabilities.

**4.) Interviews** – In addition, sixteen (16) semi-structured interviews were also conducted with persons particularly knowledgeable about cotton production and cotton farmers’ issues such as academics, elders, cotton gin managers, cotton traders, researchers, government representatives and people associated with Non-Government Organizations

(NGO's) to gather information about farmers' vulnerabilities and government policies which pertain to farmers.

The approach described in "Experience, Research, Social Change - Methods from the Margins" (Kirby and McKenna, 1989) was used in this study to analyse the data from the interviews, literature reviews and the group activities. The information compiled and analyzed using the constant comparative approach outlined in this book on pages 128 - 154.

### **Summary of Chapters**

The next chapter reviews the literature in regard to key state and federal policies which have had a bearing on Bt Cotton farmers' livelihoods in Andhra Pradesh since the introduction of the New Economic Policy in 1991. This chapter illustrates that many of these policies in their effect have created a situation which makes cotton farming in Andhra Pradesh, particularly in Telegana, a risky livelihood strategy primarily due to a combination of factors including volatile cotton prices, increased competition with other cotton growing countries, poor maintenance of irrigation schemes and declines in institutional credit. The chapter also reports on the documented impact of these realities upon the welfare of farmers in the state. The poor regulation of cotton seed at point of sale poses further challenges. The implementation of Vision 2020, Andhra Pradesh's economic development policy, also creates new threats to small-scale farmers' current way of life.

The third chapter highlights the group activity results (Community D) and the results of semi-structured interviews (Communities A, B, C). After a brief discussion of farmers' vulnerabilities, several themes which emerged in the study findings are discussed in order

to indicate what factors influenced farmers' abilities to increase their incomes with Bt Cotton use. These themes are as follows: unpredictable performance of certain Bt seed varieties, spurious seed and debt; irrigation issues, Bt Cotton and debt; and volatile prices and exploitive behaviour from middlemen due to the poor regulation of dealings in markets. Following this section, I present a few worrisome trends in Bt Cotton production in order to further show that Bt Cotton use is a risky livelihood strategy and the marginal gains which many farmers reported during particular growing seasons and for certain Bt varieties can easily disappear if current trends continue.

The fourth chapter focuses upon the ways in which the study can inform debates about the use of agricultural biotechnology on the incomes of "the poor" and challenges the notion that cotton is even a crop of "the poor." I conclude that far from being either a dismal failure or a spectacular success as the literature suggests, farmers' experiences with Bt Cotton in Telegana indicate that, due to their existing vulnerabilities and the existing policy environment, the impact of Bt Cotton use on small and medium scale farmers' abilities to increase their incomes, was negligible but positive over three growing seasons although many farmers in communities A, B and C and to a lesser extent D experienced negative effects on their incomes in 2004-2005 due to crop failure. The effect of the use of Bt Cotton upon the incomes of farmers who participated in the study is not in keeping with the findings of industry studies (See Nielsen, 2004) or agricultural studies (Qaim and Zillberman, 2003). Nonetheless, the findings calls into question what groups are actually benefiting from the introduction of the new technology as the necessary supports are not actually in place in order increase the abilities "the poor" to increase their incomes.

## **Chapter Two: Federal and State Policies and Effect upon**

### **Rural Populations in Andhra Pradesh 1991 - 2005**

#### **Introduction**

This chapter describes the policy environment in which farmers in Telegana strive to make a living and the documented repercussions of these policies on poor farmers' lives, in order to place farmers' experiences with Bt Cotton, which are depicted in the next chapter, in context. Policies implemented after the launch of the central government's New Economic Policy of 1991 in regard to the "opening up" of markets, declines in institutional credit and the continued neglect of irrigation schemes in their effect caused income instability and distress in rural populations in Andhra Pradesh (Aggarawal 2006; Vakulabharanam, 2005) regardless of the existence of government programs intended to ease farmers' burdens. Moreover, the poor control of seed stocks, including Bt Cotton seed stocks and Andhra Pradesh's economic development plan Vision 2020 pose new threats to farmers' livelihoods now and in the future. At the same time, there is evidence that Bt Cotton varieties fared poorly in Telegana in 2004-2005 which suggests that Bt Cotton use, all things considered, is a risky livelihood strategy.

The Andhra Pradesh government is considered to be autonomous from the central government in regard to the development and administration of agricultural policy (Vakulabharanam, 2005; Dhar 2003) and state economic development policy. The Constitution of India, which outlines powers between the Central government and the states in the confederation, lists agriculture as one of the issues which is exclusively managed by individual states (Dhar, 2003). Nonetheless, government policies of Andhra

and Pradesh have generally reflected the dominant focus of federal government policies such as, in the 1960's, the stress on national food self-sufficiency and central control and the move towards economic liberalization policies in the late 1980's (ibid).

The New Economic Policy of 1991, the primary catalyst causing the liberalization of the Indian economy, has had far reaching effects on farmers' lives. The New Economic Policy was largely a structural adjustment program implemented by the International Monetary Fund and World Bank in response to a balance of payment crisis at a federal level. Under this structural adjustment program, agriculture was "accorded low priority compared to industry" (Ninan, 2000, p.5). As result of this policy, there was a move to de-regulate fertilizer prices and dismantle subsidies (Vakulbharanam, 2005). At the same time, the opening up of Indian markets without good regulation and supports such as adequate minimum support prices exposed farmers, many of whom were new to cotton production, to dramatic price volatility and resultant income fluctuation and debt. The poor maintenance of irrigation schemes and poor institutional credit caused additional challenges for farmers who were forced to seek out informal sources of credit.

Changes in policy associated with the New Economic Policy also allowed for genetically modified cotton to enter India although Monsanto has actually been in operation in India since 1949 as a heavy chemical distributor (Menon, 2005). Government policy changes in regard to the investment of foreign capital, however, made it possible for multinational companies such as Monsanto to embark on joint ventures with Indian companies such as Mahyco.<sup>19</sup> The liberalization of the seed industry,

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<sup>19</sup> The Indian Company Rashi also had a license to use the Monsanto Bt technology in 2004 – 2005 (Rch 2 Bt) and several other Indian companies have followed suite since then. (See Herring, 2007; Kirran, Sakkahari, 2005, p.31; Stone, 2007).

allowing for seed imports, also made it possible for Bt Cotton to enter India. Monsanto currently has a 26% share in Mahyco (Scoones, 2006).

This trend towards greater liberalization of cotton markets continued in the years after the New Economic Policy was announced. Import restrictions on Cotton, in particular, were opened up in 1994 as a result of changes in the World Trade Organization/General Assembly on Tariffs and Trade rules under the Agreement on Agriculture (Aggarawal, 2006 ) and as a result of the newly coined World Trade Organization rules in 2001 (Frankel, 2005) import allowances were expanded further.

The opening up of the Indian economy has had negative repercussions on Indian farmers' incomes. Economic theories in regard to comparative advantage would dictate that Indian farmers would benefit financially from the opening up of the economy to allow for agricultural exports but this reality has rarely been the result for cotton farmers in Andhra Pradesh. The opening up of the Indian economy has resulted in increased competition with other cotton growing countries which can produce cotton inexpensively given the relatively low import duty of cotton (Integrated Cotton, 2002). Chinese farmers, for example, also grow good quality Bt Cotton<sup>20</sup> and this country is emerging as one of the main competitors for the Indian market (Interview with Venkateshwastu of Balaji Industries, Gosssekunta, Warangal, Feb.15, 2005). In addition, countries such as the United States subsidize cotton production heavily, which results in overproduction and as a consequence the market has been smothered with inexpensive cotton which depresses world prices overall (Interview with Sakahari, 2005).

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<sup>20</sup> With technology from Monsanto and also with technology developed by the Chinese Academy of Sciences.

A federal program helps cotton farmers in Andhra Pradesh deal with the low prices resulting from competition with other countries and other factors by setting minimum support prices. The central government announces remunerative prices for different types of cotton each year and the Cotton Corporation of India (CCI), a public procurement agency, purchases cotton lint if the prices on the market dip below this minimum support price. Prices can drop for a variety of reasons such as lack of demand or the poor quality of the cotton. For example, in February 2005, according to an account in *The Hindu* newspaper, CCI stepped in and bought large amounts of cotton in Warangal District, as there was a tremendous glut on the market and prices were low. This cotton was purchased even though it was particularly sub-standard in terms of quality, as there were widespread fears that farmers would stage a riot if they were not reasonably compensated (Rao, Feb. 12, 2005). Minimum Support Prices for cotton are considered to be extremely inadequate by Andhra Pradesh's Department of Agriculture, however, (CFW, 2005 p.89) and the department has recommended increases in the rates paid to farmers. There is currently no minimum current price set for Bt Cotton varieties.

There have been reports of other problems with the program. Farmers allege, in newspaper reports, for example, that due to the lack of regulation of market yards since the Congress party was re-elected and collusion between the CCI officials and traders farmers were not receiving a fair price ("Ensure MSP" Feb. 10, 2005). This situation resulted in protests, some of which ended in violence in February 2005 ("Cotton Farmers", Feb. 5, Feb. 10, 2005). Such media coverage could possibly be a means for rival political parties to win votes but other sources have found similar findings. The Commission on Farmers Welfare, a body which did an extensive study of the reasons for

agrarian distress in Andhra Pradesh, for example, also found through their interviews with farmers that “It is widely perceived that traders, millers and officials of Marketing Department [sic] join hands to bring down market prices during peak harvest season (2005, p.92).”

Liberalization has also had negative impacts on rural people’s welfare in Telegana. Researchers have also found that this opening up of the economy, the resultant price volatility in the 1990’s, combined with changes in input use in farming and changes in input markets caused “distress inducing growth” and “growth inducing distress” (Vakulabharanam, 2005, p. 989). Marginal farmers, landless labourers other groups were reported to have experienced significant declines in overall consumption during the 1990’s although this period was generally marked by high growth (Vakulabharanam, 2005) because food prices increased. Farmers in Telegana, as a means to overcome welfare declines and revenue falls, have increased “area, labour and use of inputs (ibid.)” As a result, of this “trade-off” of labour instead of leisure, indicative of the Chayanovian mechanism, “output growth and increasing distress” within rural populations are taking place at the same time. Thus, distress has induced growth in Telegana. In particular, farmers began working longer and harder because they shifted from traditional crops to crops such as cotton and chilli; these crops require more work than traditional crops (ibid).

Meanwhile, there is also evidence of “growth inducing distress” in Telegana. Vakulabharanam argues that “as input costs rise and output prices fall during liberalization, the real output growth that is derived from the heightened use of the costlier inputs increases the distress of the producers (2005, p. 989).” Farmers worked

harder but they did not receive greater incomes. In regard to cotton production in Telegana, in particular, the increased use of expensive inputs combined with the removal of subsidies and the deregulating of input prices has resulted in generally lower revenues for cotton farmers (ibid). Statistics from 1996-97, a year where the prices were particularly low, indicate that the returns on cotton cultivation were negative with a losses of 1,641 R per hectare in current prices (CFW, 2005, p. 4).

This trend of low prices and price volatility was also apparent during the time the research for this practicum was conducted. The price for cotton was 1, 800 R per Quintal (100 kg) in February 2005, for example, but during the previous growing season it had been as high as 3,000 R per Quintal (Rao, Feb 12. 2005). Dramatic price volatility presumably causes farmers to make poor choices about which crops to grow as they decide which crops to grow based on the market price and the price can severely decline by the next growing season.

Additional programs and policies were funded by the central and state government helped farmers deal with the high costs associated with the agricultural intensification in the past but these patterns of government spending changed with the liberalization of the economy of Andhra Pradesh. The most pertinent change which has taken place, aside from the deregulation of input prices, were changes in institutional credit (Aggarawal, 2006) although liberalization effected many other aspects of rural people's lives ( See CFW, 2005 ). Changes in institutional credit mainly amounted to a reduction in the percentage of small loans which were permitted by the national banks; bank staff became less likely to make loans for agricultural purposes particularly for small holders (Aggarawal, 2006). At the same time, "both the state and central government pushed for

the dismantling of the state supported credit system and an increase in interest rates (Vakulabharanam, 2005, p. 5).”

Rural people in India have always had the need to acquire informal credit from agricultural money lenders but the need for credit became more pronounced when farmers, most of whom were more accustomed to growing less capital intensive food crops, shifted production to cotton production in the 1990's. Large loans from non-formal sources such as village money lenders at high interest rates became a necessity as government programs did not provide other means for marginal and small farmers to secure credit for their inputs nor did the government provide adequate means to cushion farmers from price volatility.

Funding to dig bore wells, one of the most important causes of farmers' debts in Andhra Pradesh (CFW, 2005), also became a necessity due to the “deceleration of public investment and public neglect of traditional water sources” (Vakulabharanam, 2005, p. 5) in the 1990's and the irrigation dependent nature of most cash crops. Bore wells in particular represent an undesirable pattern of water use compared to canals and tanks as they tend to deplete ground water (CFW, 2005).

Although there have been recent improvements in policy, in terms of subsidized credit and price supports for Cotton growers as a response to the high rates of suicide (Aggarawal, 2005), recent statistics indicate that most credit was from informal sources at high interest rates. Seventy-six percent of farmers' credit in Telegana was from non-formal sources (Basu and Srivastava, 2005 as cited in Aggarawal, 2006)<sup>21</sup> with interest rates reported to be as high as 36% (Aggarawal, 2006; Quayum and Sakkahari, 2004).

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<sup>21</sup> This statistic might include the large percentage of attached labourers in Telegana, including Warangal, who are indebted to their employers (See Motiram, 2007).

Private traders also became involved in supplying credit because of farmers' need for credit and the poor institutional credit available after liberalization. Persons who sold seeds, pesticides and output for example, began to lend to farmers with the agreement that the farmer would sell his produce to the trader when the prices were at their lowest (Aggarawal, 2006).

Regardless of a lack of policies for affordable institutional credit and other supports, many pro-poor policies and programs which ensure farmers' welfare and finance agricultural expenses are still in place or have recently been introduced in the Telegana Region. Farmers, for example, receive highly subsidized rice through the Public Distribution System (Smitu, 1997) and the discounts are adjusted according to income. Subsidized kerosene is also available to farmers. In addition, in the spring of 2004 in response to concerns over the high number of suicides in the region the recently elected state government also started to provide free electricity, for a limited amount of time each day, in the rural areas so that farmers could run the pumps on their wells and irrigate their crops even though power subsidies such as these ones were initially removed with the introduction of the New Economic Policy. In addition, during the time I conducted my field research in 2004 and 2005 the government was threatening to charge the seed companies with unfair trade practices unless they lowered the price of Bt Cotton varieties. Other programs provide Bt Cotton varieties at a subsidized rate dependant upon the size of a farmers' landholding (Qayum, Sakkahari 2005). A Land Ceiling Act has also been in place in the state since the early 1970's and this act made available land to several marginalized groups that had been blocked from land ownership in the past

(interview with R.Murali of Modern Architects of India, Oct. 2004) although this land is often of poor quality.

Despite these seemingly pro-poor agricultural policies, the government of Andhra Pradesh has promoted the implementation of agricultural biotechnology and “Western style” intensive agriculture on large consolidated farms as means to reduce poverty through Vision 2020 and the Biotechnology Policy and critics maintain that such a shift in agriculture is not in the best interests of the poor. Vision 2020 is Andhra Pradesh’s economic development plan that was launched in 1999-2000. This highly contested policy, promotes changes in agriculture and a shift “from a predominantly agrarian to an industry and services led economy (State of Andhra Pradesh, 1999, p.168).” These changes are aimed at reducing the number of people employed in agriculture from 70% to 40% a generation (ibid) and implementing biotechnology use and extensive biotechnology research with foreign investment as the main means to effect these changes in the agricultural sector. A push to consolidate farms is also a component of the New Economic Policy presumably as a means to foster vertical integration by Life Science companies. Activists claim this shift to consolidated farms is already taking place in Warangal District in Telegana (Ainger, 2003) but there was no evidence of this trend in the villages where this study took place.

Poor regulation of the seed industry at the point of sale (Stone, 2002) in Southern India also poses problems for farmers as it creates opportunities for seed sellers to sell fraudulent Bt Cotton seeds created by Indian entrepreneurs and some of these varieties are of poor quality (Herring, 2007). The selling of seeds of dubious quality packaged as popular brands, or “spurious seeds” in the local vernacular, is also fairly widespread

(Stone, 2002; Stone, 2007; Herring, 2007). The poor quality cotton that CCI was compelled to purchase in Warangal in February 2005, which I have previously mentioned in this chapter, was produced from spurious seed which did not perform well (Rao, Feb 12, 2005). Improved legislation, however, to more harshly penalize persons who sell spurious seeds has recently been introduced (See CFW, 2005).

On the other hand, there is also evidence that even legitimate varieties of Bt cotton seed from reputable dealers have failed in Andhra Pradesh which suggests that Bt Cotton use is a risky livelihood strategy which has the potential to have a negative effect upon farmers' abilities to increase their incomes. Violent protests at seed dealerships in Warangal in October 2004 over the failure of certain varieties of Bt Cotton suggest that the seed did not perform well. Many farmers attempted to get compensation in Andhra Pradesh for crop losses in 2004 associated with the failure of Monsanto Bt Cotton varieties.

Controversies over seed quality and crop failure in Andhra Pradesh, however, need to be looked at objectively and in context particularly in regard to Bt Cotton. Farmers' demands for compensation in the event of failure are viewed in some cases as being opportunistic in nature in light of the fact that the failure of Monsanto Bt Cotton varieties in 2004, widely reported on activist websites, were largely confined to the Telegana Region (Herring, 2007). Herring (2007) in his analysis of the failure of Bt Cotton in Warangal District in 2004 stated that farmers who demanded compensation "were relying on a proved model of gaining resources and a history of success (Herring, 2007, p 15.)." The Telegana Region has a long history of Maoist inspired (Naxalite) activity and rather than risk another uprising, the district administration Herring argues (2007) was willing

to placate farmers with compensation as they have done for the failure of other crops in the past. The fact that the farmers only needed to prove they grew the Bt varieties not that their crops failed made this course of action a more likely possibility. At the same time, Herring (2007) argues that seed companies were more than willing to pay compensation to secure their market for the future.

There is also poor regulation of the management of Bt Cotton fields and products in Andhra Pradesh. No steps have been taken to ensure, for example, that the guidelines put forth by the federal body, the Genetic Engineering Approval Committee (GEAC) of the federal Department of the Environment, have been followed. These guidelines are in regard to the proper management of Bt Cotton fields and product in order to limit health, safety and potential environmental problems. Most importantly, there is currently no public or private agency which monitors whether farmers are growing refuge crops. Refuge crops, are crops of non-Bt varieties which are planted around the Bt Cotton crop to ensure continued bollworm sensitivity to Bt. Jurisdictional conflicts between different levels of government over the approval of Bt crops and destruction of illegal Bt crops have also occurred in recent years.<sup>22</sup>

## **Conclusions**

This chapter has shown that since the late 1980's and particularly since the implementation of the New Economic Policy in 1991 neo-liberal policies have increasingly created a situation where farmers in Andhra Pradesh are forced to contend with volatile prices for cotton due to greater integration with world markets; greater

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<sup>22</sup> Herring (June, 2006, p. 4) reports that in 2001 the GEAC recommended that an illegal cotton crop be burned in Gujarat but this recommendation could not be enforced. He also mentions, among other examples, that the government of Maharashtra announced the release of Bt seeds before it was approved by the GEAC.

competition with other cotton growing countries and an absence of adequate programs to provide for irrigation and credit. The lack of affordable institutional credit services, in particular, is causing farmers to incur debts at high interest rates with private money lenders and traders. Federal support programs for cotton farmers such as the Minimum Support Price for cotton are considered inadequate even by the Andhra Pradesh government and there is currently not a minimum support price set for Bt Cotton. There is also a wide spread belief that traders and CCI officials are in collusion to bring down prices. Meanwhile, Vision 2020 seeks to phase out farmers' way of life on small autonomous farms by significantly reducing the number of people employed in agriculture. The poor regulation of seed and Bt cotton production also poses a variety of potential risks.

The existing vulnerabilities of farmers and the present policy environment, in its effect, has been shown to already have had negative implications upon the welfare of many farmers, particularly small scale farmers (Vakulabharanam, 2005) and poverty rates in rural Telangana (Aggarawal, 2006). In particular, there are declines in consumption levels for small scale farmers and larger scale farmers are straining themselves to "make ends meet" indicative of the Chayanovian mechanism.

In conclusion, the chapter has shown that the existing vulnerabilities and policy environment experienced by all farmers in Telegana combined with evidence that Bt Cotton did not perform well in Telegana in 2004 – 2005 suggests that Bt Cotton production is a risky livelihood strategy.

### **Chapter 3: Results of Group Activities and Interviews in Villages**

In the previous chapters I have established the character of the existing policy environment and economic trends which have had a bearing on farmers' livelihoods in Andhra Pradesh and I concluded that Bt Cotton production is a risky livelihood strategy for smaller scale farmers given these realities.

This chapter highlights the group activity results (Community D) and semi-structured interviews results (Communities A, B, C). The results described in this chapter show that the performance of the seed is mitigated by the "effects on the ground" of macro-level policies, or lack thereof, which make the use of Bt Cotton problematic. Farmers are not increasing their incomes to much of an extent, if at all, by using Bt Cotton because of their existing vulnerabilities and the effects of these policies. On the other hand, they did report to like features of Bt cotton compared to other popular hybrids providing their Bt Cotton crops had not failed.

A lot of ground is covered in this chapter in order to report on the research results. The main vulnerabilities farmers disclosed during the research process are first briefly presented. The section which follows focuses upon the primary aspiration which motivated the participants to grow Bt Cotton, which was generally to increase their incomes in order to pay off debts, and how these aspirations compared to their ability to actually meet this outcome in Communities A, B,C and D. Several themes which emerged in the interviews in this regard are also discussed in order to indicate the non-agronomic reasons why farmers believed they experienced particular outcomes with Bt Cotton and the significance of the gains and losses in income they experienced.

A few worrisome trends in Bt Cotton production are presented, following the section on the impact of farmers' use of Bt Cotton on their incomes, to further show that Bt Cotton use is a risky livelihood strategy regardless of the fact that farmers liked some attributes of cotton varieties with the Bt trait. This section also proposes that the marginal gains which many farmers reported during particular growing seasons and for certain Bt varieties could cease to exist if insects in the Bollworm complex develop a resistance to the Bt trait and there is evidence that insect resistance is possible given the existing farming practices farmers reported. The findings also indicate that the threat of spurious seed, a drop in prices or crop failure is always a looming possibility which threatens to decrease farmers' incomes. The final conclusion is that even though Bt Cotton use did facilitate an increase in income in some cases, the gains were rarely significant to farmers given their existing debt loads. Bt Cotton use cannot eradicate farmers' fundamental problems.

#### **A. Three Common Themes in the Existing Vulnerabilities of Farmers in Villages**

There were three common themes in the experiences in terms of their vulnerabilities. All of these realities "on the ground" can be linked with the policy directions discussed in the last chapter such as declines in institutional credit; a lack of public investment in irrigation schemes; a greater integration with world markets; and inadequate minimum support prices and poor regulation of local markets. These themes are introduced here and recur throughout the chapter interwoven through farmers' accounts of their experiences.

### ***Vulnerability One – Large Debts at High Interest Rates***

Farmers, as a result of the high costs associated with farming need credit and most of the options available are just barely affordable because of high interest rates. Farmers in the villages reported that they use banks, seed dealerships and private lenders for credit. Many small, medium and large farmers who were interviewed reported using more than one credit source such as a private lender and a bank; given the small size of the sample it was impossible to determine if there were differences in the credit sources typically used by farmers with different sized farms. The average rate of interest that the farmers who participated in the study cited for a bank loan was 12% (1 R per each 100 R per month) and 24 % (2 R on 100 R per month) for a loan from a middleman or seed dealer which is less than the rates typically reported in the literature which often cite rates of 36% (See Aggarawal, 2005; Quayum and Sakhari, 2004). Small and marginal farmers who participated in the group activity in 2005, however, said that they typically get loans from the middlemen to whom they sell their cotton at the market instead of banks. The female participants who participated in the group activity in October 2004 also mentioned that self-help groups offer loans, at lower interest rates, for a small segment of their expenses but these loans are not sufficient to meet their needs for agricultural expenses.

Farmers reported heavy debt loads. The range in debt load for four (4) of the five (5) small scale farmers we interviewed was 50,000 R to – 2.5 L (250,000 R). The range of the debt load for five (5) of the eight (8) medium scale farmers we interviewed was 40,000 R to 2L (200,000 R). Most small and medium scale farmers interviewed, who were willing to report their incomes, claimed to break even most years or remain in debt although the average income of a farmer in Andhra Pradesh is 20,000 R (Frankel, 2005).

Farmers' debts have accumulated due to the costs of doing agriculture and a variety of other financial demands but only one farmer attributed his debt specifically to purchasing Bt Cotton seeds. Nonetheless, a farmer would require at least 4,000 R to 4,800 R to purchase fertilizers, seed and pesticides to grow one acre of Bt cotton and a \_ acre refuge crop if they purchased the required seeds for 1,600 R. Farmers who participated in the group activity and interviews in 2004 reported paying 1,600 R - 2,000 R in for a packet of Bt seed including refuge crop seed for one acre but most often they reported paying 1,600 R. The price of Bt seed, in accordance with government policy, is supposed to be lower than 1,600 R and the price should be adjusted according to a farmers' landholding (Quayum, Sakkari, 2005) however, farmers we interviewed were not purchasing seed at this lower price. A package of non-Bt hybrid such as Sumo, by comparison, sells for 550 R at the most and covers about one acre according to the farmers. Therefore, in order for farmers to benefit from growing Bt Cotton seed compared to regular hybrid cotton seed they would need to make more than 1, 463 R more overall on every 1.25 acres of Bt cotton they grow either through reduced pesticide use, greater yields or a variety of other possible means as the differential for the Bt seed compared to other varieties is about 1,463 R.<sup>23</sup>

Farmers also mentioned significant non-agriculture related costs and debts resulting from educational expenses, the construction of homes, medical bills and weddings. The decline in the quality of state operated grade schools, in particular, has resulted in a situation where farmers feel compelled to enroll their grade school children in costly private schools at a rate of 6,000 R per year per child.

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<sup>23</sup> This estimate includes the price of the refuge crop seed.

### ***Vulnerability Two - Debts to Dig Wells and Irrigation Issues***

The cost of digging wells was often cited as one of the significant debts of the farmers given the necessity of wells to irrigate crops in this semi-arid area (also See CFW, 2005) with declining water resources. Almost all of the farmers who participated in interviews said that the level of water in their wells had dropped by about thirty (30) feet in recent years. Many of the farmers attributed this drop simply to the drought conditions at the time although a few participants said they believed that the increased number of wells in their communities was over stressing the water table. Digging a borewell costs about 45,000 R – 1 L depending on the depth of the well according to the participants' accounts and families cannot easily cover this expense given their level of debt.

### ***Vulnerability Three - Volatile prices for cotton***

Farmers in the study villages, in keeping with the literature were also vulnerable to fluctuating and low prices for their crops and this reality obviously has an impact on their overall incomes. In the group activities in 2005 farmers reported that they received up to 2,700 R per Quintal<sup>24</sup> each time they went to market in the previous growing season (2003-2004) but the “going rate” had declined by about 1,000 R per Quintal in the 2004-2005 growing season. These figures are somewhat consistent with newspaper reports at the time which indicate that farmer received 2,400 R. – 2,500 R. in 2003 – 2004 and less than 2,000 R per Quintal in the 2004-2005 growing season which was below the minimum support price of 2,010 Rupees (“Ensure” Feb. 10, 2007).

Aside from the stresses created by the previously depicted issues participants in the study did not face some of the more serious vulnerabilities indicative of poorer rural people in Andhra Pradesh. The Bt Cotton farmers who participated in the study, for

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<sup>24</sup> Quintal= 220 lbs/100kgs

example, do not have the need to migrate for employment and they have assets such as land and homes. On the other hand, most of the farmers did not own farm machinery and many farmers expressed dismay over the unsuitability of their soil for cotton production. The study also found that Bt Cotton production did not have any effect on household food security according to the farmers. The farmers who participated in the group activity and interviews, in their estimation, continue to grow adequate food crops and purchase other foods that they are unable to grow regardless of the fact that they grow Bt Cotton. A few small scale farmers, however, were not self-sufficient in paddy.<sup>25</sup>

In terms of seasonality, farmers do not have any sort of “hungry period” during the year indicative of poorer populations although their budgets are stretched during the festival season during October – December. Women who participated in a group activity said that one of the reasons they like to grow cotton is that it allows their families to have a regular income especially during the lengthy festival season because cotton is harvested and sold regularly over several months unlike other crops such as paddy. Men, who participated in a group activity in October 2004, said that they make ends meet by using the money they make on selling maize to purchase inputs for their cotton crops but simply acquire loans if this cycle is disrupted by crop failure. Thus, they are not entirely dependant on the revenue from one crop to finance another subsequent crop. Small and medium farmers also paid a reduced price for rice and kerosene as a part of the government distribution program which helped “make ends meet.” Regardless of the

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<sup>25</sup> Small, medium and large scale farmers who participated in the group activities and interviews in October 2004 were generally able to meet 100% of their families’ rice requirements even though they were growing Bt Cotton. Seventeen of twenty women who participated in the group activity in October 2004, for example, were self-sufficient in rice through their own crops. The three small scale farmers who participated in this activity, however, were only growing Bt Cotton on their small landholdings (1.21 ha/3A). Women also reported that they purchase, or more often grow, sufficient pulses, lentils and vegetables to meet their families’ food requirements. Vegetables are purchased in the market during certain periods due to the climate.

farmers' abilities to cope and their assets many farmers expressed a sense of being overwhelmed by debt, hard work and the fate dependant nature of their lives as farmers when we asked them to describe their perceptions of a "good life now and in the future."

**B. Effect of the Use of Bt Cotton on Farmers' Abilities to Increase their Income –  
Results from Interviews in Villages A,B,C**

Farmers' responses in Communities A, B and C were varied. Small and medium scale farmers in Communities A, B and C who participated interviews reported marginal increases on their incomes for the first two growing seasons and generally poor affects on their income in the third growing season. When we interviewed the few farmers in October 2004, who had grown the Bt varieties in the past, they were generally pleased with the impact of Bt Cotton on their incomes in the previous 1-2 growing seasons (2002-2003 and 2003-2004) as the performance of the crop was good and the prices in the market had been high. In October 2004, however, the farmers were reporting problems with the 2004-2005 crop such as pest infestation and entire crops wilting and turning brown.

When we returned in February 2005, towards the end of the 2004-2005 growing season, many farmers particularly large scale farmers, reported that Bt Cotton use had a negative impact on their incomes over 1-3 growing seasons because they had experienced losses in the 2004-2005 growing season which they mainly attributed to the poor performance of the seed variety Mech 184 and in a few cases Mech 12 combined with the dramatic drop in prices. The shorter growing season (short duration) of Mech 184 also influenced farmers' profits as there were fewer pickings and subsequently lower yields.

Farmers' assessments need to be reviewed qualitatively rather than in a quantitative way to be understood but a breakdown of farmers' incomes over 1-3 growing seasons provide a glimpse of the wide diversity of farmers' experiences. Two (2) of the five (5) small scale farmers we interviewed reported losses overall. One (1) small scale farmer could not determine the impact on his income. The remaining two (2) farmers reported increases in income ranging from 1,500 R per acre for one farmer to 5,000 R per A per annum for the other farmer compared to the cotton varieties they typically grew.

Outcomes for the eight (8) medium scale farmers we interviewed were even more diverse. One medium scale farmer reported he had increased his income by 1,000 R per A by growing Bt compared to a Non Bt variety and he intended to grow only Bt in the next year. One farmer made 3,000 – 4,000 R more per A over one growing season compared to other varieties but he had planted earlier to avoid the pest cycle. Another medium scale farmer had better yields but he did not have an increase in income overall due to low prices. Another household suffered losses and was awaiting compensation. Another household that had suffered losses in 2004-2005 due to poor quality seed still increased their income slightly over two growing seasons but not to an extent that they were willing to grow Bt varieties again. Another farmer increased his income in 2003-2004 but he did not consent to an interview in 2004-2005 although he mentioned he had suffered losses due to poor performing seed. Another household reported that Bt Cotton use had increased their income over 1-3 growing seasons "slightly/not really much." The outcome for the last case was unknown as the farmer had not taken the cotton to market and only grew it over one season.

Four (4) of the five (5) large scale farmers interviewed felt that they had suffered losses or just “broke even” overall as a result of using the Bt varieties even though they did reduce their pesticide use. The experiences of these farmers, however, were not the focus of the study.

### **C. Thematic Accounts of Why Farmers Experienced Certain Outcomes with Bt Cotton in Communities A, B, C**

Farmers’ subjective accounts of the ways they believe their use of Bt Cotton affected their ability to increase their incomes provides a telling description of the shortcomings of Bt Cotton production as a livelihood choice, regardless of its positive attributes, given the affects of the policy environment and vulnerability context of farmers in the Telegana Region. This section shows that farmers’ difficulties in securing affordable institutional credit and their resultant debts; their irrigation issues and the failure of certain varieties for a variety of reasons combined with volatile prices causes the greater intensification of farming through the use of Bt Cotton to be a risky livelihood strategy which in its affect limited all Bt Cotton farmers’ abilities to increase their incomes. The next section shows how the effects of poor or absent policies affect farmers “on the ground.”

#### ***Theme One - Unpredictable Performance of Bt Seed Varieties, Spurious Seed and Debt***

The unpredictability of certain Bt varieties due to a variety of factors poses problems for farmers debt ridden farmers as it creates a situation in which farmers cannot really make informed decisions about which crops to grow. Although many of the farmers in the study, particularly large scale farmers in all three communities voiced concern over the performance of Mech 184, crop failure was not limited to this variety. Farmers also experienced poor returns with Mech 12. Conversely, one (1) medium scale farmer

reported remarkably good returns with Mech 184 which he attributed to his early planting which caused the crop to withstand the pest cycle more effectively. This farmer reported that he made 3,000 - 4,000 R more per annum by growing a Bt variety, which is close to the potential increases in income which are claimed for farmers in India in the Nielson Study mentioned in Chapter One, however, one must question the significance of this increase in income given this farmers' existing debt of 50,000 R (interview C04M Feb. 2005). Any gains would be lost on interest payments on his loans even though these loans were not for Bt cotton in particular.

This unpredictability is probably not unique to hybrids with the Bt trait; in fact, farmers generally believed that other cotton hybrids also performed poorly in 2004-2005 and this observation has been made by researcher in the field (Herring, 2007). The bottom line is that Bt seeds, at the time this study was conducted, cost much more than other popular hybrids and a loss is problematic for debt ridden farmers with limited means to recoup their losses if their crops fail.<sup>26</sup> Two (2) of the small and medium scale farmers we interviewed were actually seeking compensation for crop losses in the amount of 20,000 R to cover seed costs and loss of income.

Related to issues concerning the unpredictability of the seed, as discussed in previous chapters, is the existence of spurious seed. Several farmers attributed the failure of certain Bt crops to spurious seed. A farmer with a medium land holding, for example, said "I think I got duplicate [Bt] seeds because I got low yields. Some other people who bought from the same dealer also had bad results. [The] first year it didn't germinate properly. I paid 3,000 R for seeds [because he had to replant]. This year (2005) the yields are not

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<sup>26</sup> Farmers do not generally have crop insurance although farmers sometimes protest in Warangal District and demand compensation ("Cotton Farmers on Rampage," Nov, 7 2004).

good (interview B02M, Feb.2005).” The problems this farmer experienced, however, are not entirely the result of the unpredictability of varieties with the Bt trait. This farmers’ wife, in a separate interview, stated: “This year we incurred losses because of the low price. Not just because of [poorly performing]Bt cotton but because of the low price (interview B02F, Feb.2005).” In order to overcome this high unpredictability of the performance of the seed and market price volatility these farmers had decided to grow maize, groundnut and turmeric in the next growing season rather than cotton because it “gives a steady income (interview B02M, Feb.2005).” This example shows how multiple factors, which are all tied to policy, collide causing poor returns for farmers.

Another farmer explained that the potential of acquiring spurious Bt seeds, given the lack of regulation of the input vendors, results in farmers having to pay an advance for seed. The male, medium scale farmer stated: “You have to pay an advance when you get seeds so that you will get the best quality as there is more demand. If you want the best quality for the field you have to pay an advance and get original seed. If you get seeds later in the year the seed might not be good seed. It might be a duplicate (interview C03 Feb.22, 2005).” Thus, farmers need “cash in time” to pay for good quality seeds and this is not always possible for cash strapped farmers. This farmers’ assertion is backed up by research in Warangal District which has found that due to inadequate seed supplies of Bt Cotton from official sources an underground market of sub-standard seed has been created to fill the void (Herring, 2007).

### ***Theme Two - Irrigation Issues, Bt Cotton and Debt***

The primary irrigation issue related to Bt Cotton production and the impact on farmers’ income pertains to the high cost of digging bore wells. In order for Bt varieties

to thrive, like all cotton varieties, they need good sources of irrigation. Most of the farmers who participated in the interviews had adequate sources of water through bore wells and canals but a few farmers raised issues in regard to inadequate irrigation. Almost all the farmers said that the water level in their wells had significantly dropped in recent years but not to an extent that they were without water. Solely rain-fed crops were not the norm for farmers who participated in this study although many farmers in Telegana, poor farmers in particular, rely on solely rain-fed crops which suggests that farmers growing Bt Cotton in 2004-2005 were wealthier farmers. In addition, at the time this study was conducted Telegana farmers were receiving free electricity in the study villages in order to allow them to run their wells. Thus, the primary issue in regard to irrigation is that farmers are paying to dig wells on their own without subsidies from the government.

The story of a small scale farmer reveals how the high cost of paying to dig a well burdens farmers due to their existing vulnerabilities. One woman we interviewed increased her income by 1,500 R over one growing season by growing a Bt variety but she had also recently spent 45,000 R to dig a new well. In total, her accumulated debt from private lenders was 1 Lakh (100,000 R). This debt had accumulated for agricultural expenses including the cost of two previously dug wells which had “dried up” and the cost of a house. She also mentioned that her maize crop had failed in the previous year. She was unaware of any government programs which would help to finance well construction. Thus, this example, illustrates that because of the lack of programs to finance irrigation schemes and because of a lack of programs to help farmers finance well construction, farmers exist in a precarious state and even an increase in income from Bt

Cotton use, such as 1,500 R in this case, is not remotely sufficient to cover the cost plus interest of the infrastructure required to grow the crop and her other crops.

Farmers' accounts also confirm that irrigation, rather than rain fed conditions are necessary for Bt Cotton production. A small scale farmer, reliant on canal that had run dry, for example, blamed the poor performance of Bt on an inadequate supply of water. He stated: "There was a drought in Maharashtra. There is no water coming from Maharashtra. If there was water for the cotton field I would have gotten a second crop [and higher yields] (interview B04, Feb, 2005). Nonetheless, he was pleased with the performance of the Bt variety as he spent 4,000 R less on pesticides than he had on his cotton crops in previous years but this estimate does not take into account the higher cost of Bt Cotton seed. He was not certain of his overall income when we interviewed him as he had not yet taken his cotton to market.

***Theme Three - Volatile prices and exploitative behavior from middlemen due to the poor regulation of dealings in markets***

Prices for cotton are often low as a result of many problems such as poor quality cotton lint; overproduction locally; and global overproduction as a result of heavily subsidized production in other countries. Aside from these issues, farmers told us about the problems they face in local markets which affect their incomes. The following accounts focus upon common problems farmers face in their dealing with market personnel due to the poor regulation of local markets. These problems are common to all cotton farmers, not just Bt farmers, but their stories further show the factors which impinge upon farmers' ability to increase their incomes when they grow Bt Cotton given the context where they are striving to make a living. Farmers' strategies to maximize

their investment in this unfair situation, which I describe in the next section, are also causing them to violate guidelines in regard to Bt Cotton put forth by the Genetic Engineering Approval Committee in regard to the proper handling of Bt Cotton.

Many male farmers' comments attributed low prices to exploitive behavior by middlemen and the staff at the markets and other farmers' blamed this overall state of affairs on poor regulation of markets by government. One large scale farmers' comments are indicative of the comments of other farmers. He said "There is more yield in the [region]. [We are even] getting yield from other districts. The cotton growing area has grown. The government is not taking care of prices in the market. They are not making sure that the prices are [fairly] fixed - by demand or by the traders. Not all the cotton is getting the Minimum Support Price. It is the concerned authorities' fault. The concerned officials are not taking care of it properly (interview with A02, Feb, 2005)."

Many farmers accused the market personnel in the open markets of "looting" and generally unfair practices. Farmers' mentioned that due to an over supply of certain commodities they are receiving low prices for many of their crops and then these crops are later sold at a much higher price by the middlemen. Another male medium scale farmer mentioned that the traders in the market set the prices for cotton too low by mutual agreement and speak in Hindi to each other as a way to ensure the farmers, who overwhelmingly speak Telugu in Telegana, are excluded from the process interview (interview with S in village C, Feb.22, 2005). Other farmers also alluded to collusion of this sort and such findings are in keeping with newspaper reports I mentioned in the last chapter. Even the report of the Commission on Farmers' Welfare mentions the problem

of collusion. The medium scale farmer described this phenomenon as “merchants forming a link” as they are all from the same “petty merchant” caste groups (ibid).

This poor regulation of markets also results in highly erratic, unpredictable prices for cotton. The following quotation reveals a large scale farmers dismay with the lack of control over pricing. He stated: The newspapers and political speakers say the farmer is king but all the government policies are against farmers’ interests. Farmers are not getting any help from the government. A month ago the price for cotton was 2,950 R per Quintal. Now price is 1,900 per Quintal. Merchants say some reason [make up some reason] to reduce the price. Middlemen and merchants are getting more money! (interview A02, Feb, 2005).”

Another farmer indicated that there are limitations on what farmers can do to improve their ability to increase prices and subsequently their incomes in such a situation. He explained that an attempt to halt this price setting was met by traders taking their business elsewhere. He said: “It is not about drought, or insect infestation, it is about the low cost in recent months. The merchant chairman demanded a better price but merchants stopped buying because they couldn’t afford more. What can one person do? It [the low price] is because of the cotton they get from other districts. (interview B03, Feb.22, 2005).” In addition, middle men legally sell cotton grown in Andhra Pradesh in other states if the prices are high there although farmers cannot legally sell their cotton out of state on their own.

Farmers, however, have developed a number of strategies to ensure they receive the highest possible price for their cotton lint. Farmers who have the storage space store cotton lint until the off-season when the prices are higher. This strategy is believed to be

more common with wealthier farmers because such farmers have savings to carry them over until the off season. Farmers also told us that some farmers sprinkle water on the cotton so that the weight is greater which positively affects the price.

Farmers also mix poorer quality cotton with better quality cotton to make the cotton appear to be of better quality overall as the whiteness and brightness and length of the lint fibers (staple length) of the product have a bearing on the overall price. It is not known what risks are associated with mixing Bt Cotton with other varieties but concerns relate to the fact that cotton byproducts are sold for animal feed and oil for human consumption. The Genetic Engineering Approval Committee has recommended that the varieties not be mixed because of potential risks (GEAC, 2002). Nonetheless, farmers in the study reported mixing Bt and non-Bt cotton varieties to improve the overall quality of the lint and for practical reasons.

Overall, there was a high degree of fatalism implicit in remarks of many of the remarks of the farmers who participated in the interviews. One small scale farmer, for example, stated: I have been doing agriculture since I was fifteen (15). Bt doesn't protect me from shocks. It doesn't make much difference [whether I use Bt or not]. I don't have savings or debts; we are living like that (interview C07M, Oct, 2004)" Thus, this farmer implied that there is really never anything new "under the sun" which will change his ability to increase his income; he has accepted the fact that farming as a livelihood choice just allows one to "break even." This sentiment was common for small and medium scale farmers which perhaps accounts to some extent for their willingness to try the Bt varieties and use the varieties again even after crop failure. One medium scale farmer, who had made a good return, 2,000 – 3,000 R more than usual by growing Bt Cotton, further

explained that even good returns from Bt cotton don't really make much difference given the "big picture." He stated: "Even with this extra income it doesn't make us secure. So we go for more borrowings (interview C03, Feb, 2005)."

#### **D.Impact of the Use of Bt Cotton on Farmers' Income – Results from Group**

##### **Activities in Village D in October 2004 and February 2005**

The findings of the group activities in Community D were similar to the findings in the other communities in some respects but there were also differences in experiences.

Farmers who had grown Bt Cotton in the second growing season and the small number of farmers had grown the crop in the first growing season reported an increase in income.

The group of male farmers expressed dismay with their incomes in 2004 – 2005 mainly due to the fact that the performance of the seed was not sufficient to compensate for the dramatic drop in prices. On the other hand, the group of females was pleased with the impact of their use of Bt Cotton on their incomes during the same growing season.

Farmers in Community D also fared poorly when they had poor access to irrigation which is consistent with the findings in the other communities. On the other hand, the farmers did not report problems with spurious seed in Community D.

In Community D we collected more detailed data about farmers' perceptions of the attributes of Bt Cotton compared to other popular hybrids rather than their experiences in the market and their debts. We found that farmers, who had experience growing Bt varieties, believed that Bt varieties would result in greater profits compared to most other popular hybrids. For example, in October 2004 both a group of males and a group of females reported that the Bt varieties Mech 12 and Mech 162 would result in comparatively greater profits given their superior traits compared to the non-Bt varieties

Brahma and Bunny. In February 2005 both a group of females and a group of males reported that the use of Bt varieties Mech 184 and Mech 162 would result in higher profits than the non Bt variety Sumo. Farmers also reported in February 2005 that the variety Rch2-Bt would result in greater profits than the all the other Bt and non-Bt varieties.<sup>27</sup>

The group activities which took place in October 2004 were with mixed groups of small, medium and large farmers but the groups consisted exclusively of small and medium farmers in October 2005.

Three (3) of the four (4) groups who participated in the group activities during October 2004 and also in February 2005 stated that the primary reason that they grew Bt Cotton was to ultimately increase their incomes. Women who participated in the group activities in October, another group of women who participated in group activities in February reported increased income as their primary reason for growing Bt Cotton. All twenty (20) of the women who participated in the group activity in October 2004 were pleased with the performance and the returns on their crop although not all the participants had grown and harvested the crop for an entire growing season. Fifteen (15) of the sixteen (16) women who participated in the group activity in February said that they had increased their incomes overall, taking into account the low prices, in the 2004 – 2005 growing season. The group of males who participated in the group activities in

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<sup>27</sup> In October 2004 participants compared the performance of Mech 12 and Mech 162 to Brahma and Bunny and in February 2005 they compared Mech 184 and Mech 162 to Sumo. There was some uncertainty whether the variety Rch2 which was also used as a means of comparison in February 2005 was the Bt variety Rch2 Bt or just Rch2. For this reason, results for February 2005 about the better effect of Rch2Bt on incomes should be read with caution. Nonetheless, all the other Bt varieties fared better than the non-Bt varieties compared to the other popular hybrids, Sumo, Brahma and Bunny.

October also increased their income although their top priority was generally to reduce the management required for their cotton fields.<sup>28</sup>

The fourth group, the group of small male farmers who participated in February 2005 was not pleased with Bt Cotton on their incomes given the decrease in prices for cotton. Only three (3) of the sixteen (16) group activity participants said they actually improved their income although the profits of those persons who increased their incomes were slight. Two (2) participants said their incomes had remained the same. Eleven (11) of the farmers said their income had decreased.

All three (3) of these participants that increased their incomes had grown the same variety (Rch2Bt) but several other farmers also grew this variety but several other farmers who also grew this variety did not have an increase in income although they were otherwise pleased with this varieties' performance. This finding suggests that the attributes of this variety were not the sole reason for this positive outcome. This finding further shows farmers' inability to predict the performance of varieties with the Bt trait.

All three (3) male farmers whom reported increases in income in February 2005 had particularly good means of irrigation unlike other farmers which is the likely cause of the positive performance. This is an important finding as it shows how Bt Cotton varieties, probably like other cotton varieties, need sufficient water to thrive. This finding is also consistent with the findings in the other three communities.

There is no easy solution to farmers' irrigation issues. Farmers told us that the water requirements for other cash crops grown in Telegana such as paddy and chilli are actually greater than cotton. Crops which require less water are generally traditional food grain

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<sup>28</sup> Management in this context refers to reducing the amount of effort or labour required to weed, spray, water, and pick the crop.

crops and farmers did not express an interest in eking out a subsistence existence given their aspirations, definitions of a good life now and in the future and existing debt loads.

Farmers have aspirations for their family members that require money that subsistence crops cannot provide for them. Fourteen (14) of the sixteen (16) women who participated in the group activity in February 2005, for example, who had children, had enrolled their children in private school regardless of the cost and the work required to cover the fees. The cost of a private school is about 6,000 R per child according to the women who participated in the group activities in February 2005 whereas the tuition for a year in the state schools is about 200 R a year (Interview with R Murali, Oct 28, 2004 ). Regardless, farmers' comments during the group activities and interviews indicated that they feel compelled to enroll their children in these private schools, due to the poor quality of the public school system and their desire for a better life for their children.

#### **E. Worrisome Trends with the Potential to Effect Farmers Incomes in the Future**

Farmers' accounts from Communities A, B, C and D revealed a few worrisome trends. Aside from the fact the profit margins farmers are experiencing by growing Bt Cotton were slim or non-existent due to crop failure and a drop in prices in 2004- 2005, the study also found that several of the farmers are not growing refuge crops. The decline of refuge crops, as mentioned in earlier chapters, will result in increased resistance to the Bt toxin in insects in the Bollworm complex and will ultimately decrease farmers' incomes.

Bollworm resistance to Bt also has negative implications for organic cotton farming.

The majority of farmers who participated in the study did plant refuge crops, however, a sizeable number of the participants did not grow refuge crops given the small number of people interviewed. Seven (7) of the eight (8) male marginal farmers who participated

in the group activities in February 2005 said that they do not grow refuge crops although they grew them in the past growing season and two (2) other farmers we interviewed, a medium and a small farmer, were also not growing refuge crops.

A medium scale farmer we interviewed, who had experienced losses, said the reason why he did not grow refuge crops as follows: “We did not plant refuge crops because the last time all the pests were on the refuge crop and we didn’t get profits. We thought: What is the point? If the pests go on the Bt they will die anyway (interview B03M, Feb 2005).” This statement indicates an erroneous belief that was common to most of the farmers. Seed dealers had generally told farmers to plant refuge crops but they had told them that the refuge crop would create a protective barrier around the crop not that the crop was necessary to ensure that a diet of Bt Cotton would continue to be toxic to bollworms.

In a similar way, the farmers had not been informed that Bt cotton varieties are transgenic and the long term health affects on livestock who consume the Bt crop waste material as fodder are not known. It is also not known if the milk of these animals is fit for human consumption. GEAC guidelines (2002) recommend that animals not eat the crops but we observed domestic animals eating the waste materials in the cotton fields in Warangal District while conducting this research.

### **Conclusions to Chapter Three**

Several themes emerged during the study that suggest that small and medium scale farmers in all the study villages have precarious lives as Cotton farmers as they do not have all the supports they require although they are able to cope by acquiring large debt loads. This livelihood strategy is a pragmatic choice borne out of necessity and a desire

for a better life for themselves and particularly for their children but the long term sustainability of such a choice given the price volatility of cotton is questionable. A few government programs which provide subsidies on rice and free electricity to run their wells, however, do help farmers cope. The greater intensification of farming through Bt Cotton, however, given the slim profit margins associated with its use, cannot fix farmers' fundamental problems which they told us about during the research process. The problems, as mentioned, are the result of policies which do not meet their needs for affordable institutional credit, funding to dig wells; quality seed and better control of dealings in markets.

Nonetheless, farmers are not hapless victims, the farmers, have found strategies to make the most money possible on their investment through "mixing" and "waiting until the prices were higher." Many farmers also reduce their risks through the strategies of growing a variety of crops, including food crops, which protect them from immiseration in the event of crop failure.

Therefore, farmers' use of Bt Cotton did not have much of an impact, for better or worse, upon livelihood outcome farmers valued (increased income) over 1-3 growing seasons regardless of the performance of the Bt Cotton varieties. These findings show that findings and estimates in regard to the increases in income which farmers' could experience as a result of Bt Cotton use in India (See Neilsen, 2003 ;See Qaim and Zillberman, 2003), and are misleading because farmers' use of Bt Cotton seed was taken out of context. As mentioned in Chapter One, the Nielsen study, conducted by a market research firm for Monsanto and distributed widely, in particular claimed that farmers would increase their net profit by 5,138 R per Acre (92%) by growing Bt Cotton varieties

and this figure is far above the gains that farmers reported in this study. Research conducted seed companies and scientists usually don't take into account the fact that farmers have to contend with volatile prices, inadequate irrigation and spurious seed which negatively affects their abilities to increase their incomes. Such projections also do not take into account unfair dealings in the market.

This chapter has also shown that given the fact the reported gains in farmers' incomes are so slight and bollworm resistance possible if the reported trend that farmers are choosing not to grow refuge crops is widespread the small gains that some farmers reported could easily disappear in future growing seasons.

## **Chapter Four : Conclusions**

When this study was conducted in 2004 – 2005 there was a need to conduct participatory research which investigated the broad array of outcomes that might or might not result from Bt Cotton use in India as there had been a polarization of the issue in India and farmers' opinions about the impact of their use of the seed on their livelihoods, described in context, were lost in the rhetoric. At the same time, sales of fraudulent Bt Cotton seeds, some of which were of poor quality, and legitimate Bt Cotton seeds were increasing in Telegana (Herring, 2007; Stone, 2007).

There was a need to investigate, using qualitative, social science research rather than quantitative agricultural research, the impact of the introduction of agricultural biotechnology upon farmers' abilities to increase their incomes from their perspective. In particular, it seemed that a participatory approach augmented by a review of the policies which effect Bt cotton farmers' lives could offer new insights into farmers' realities and inform the ongoing debates in regard to the impact of agricultural biotechnology, particularly Bt Cotton, upon the poor (See Doyle, 1985; FAO, 2003; Glover, 2003; Herring, 2007; Lipton, 2007).

The research question which motivated this research was as follows: Why and to what extent did small-scale and medium-scale farmers' use of Bt Cotton in 1-3 growing seasons cause a negative or positive impact on their abilities to increase their income in the Warangal District in the Telegana Region of Andhra Pradesh given their existing vulnerabilities and the existing policy context? First of all, the impact of the use of Bt Cotton on farmers' abilities to increase their incomes was generally positive for small and

medium scale farmers<sup>29</sup> but largely negligible over 1-3 growing seasons for the farmers we interviewed in Communities A, B and C. Our research found the majority of small and medium scale farmers we interviewed believed their use of Bt Cotton generally had a slightly positive impact on their abilities to increase their incomes compared to popular hybrids over 1-3 growing seasons providing that the Bt variety did not fail outright in 2004-05. Group activities in Community D also indicated that farmers felt that use of the Bt varieties, Mech 184, Mech 12, Mech 162, would result in greater profits than the use of the popular hybrids, Sumo, Brahma and Bunny and for the most part their perceptions were consistent with their experiences.

Increases in farmers' profits in the three (3) communities where we collected data on incomes, however, even for farmers who fared remarkably well, were generally not consistent with those projected for India in the AC Nielsen Study (See Quayum & Sakkahari 2005; See Herring 2007) or in other projections for India (See Qaim & Zillberman, 2003). The findings were also not entirely in keeping with the results of the Qayum and Sakkhari studies in Telegana but this much larger quantitative study which was conducted in a much wider variety of communities may have been best able to produce an accurate conception of the majority of farmers' profit margins than this small study which focuses on a small number of cases.

A simple comparison of the reported profits of the farmers in this study to other study results, however, cannot tell the whole story from farmers' perspective nor explain the reasons why certain outcomes did occur which was the priority of this study. We found that the changes in policies since the onset of India's Economic Policy (1991) and the inadequacy of other policies have set the stage for the many problems Bt Cotton farmers

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<sup>29</sup> Holdings less than 4 ha in keeping with the Indian Agricultural Census cut-off points

experience although useful government programs to provide free electricity and public distribution systems help farmers cope with many challenges.

In this report, I have described several themes which emerged during the group activities and interviews which suggest that small and medium Bt Cotton farmers' abilities to increase their incomes are hampered by the "effects on the ground" of certain government policies. These effects on the ground include the volatile nature of cotton prices and variations in the performance of Bt cotton varieties possibly due to spurious seed, combined with farmers' existing debt loads at high interest rates. The ability of Cotton farmers to make a good income is also hindered by exploitive behaviour by traders at local markets given the poor regulation of these markets. Many farmers are also experiencing difficulties due to inadequate irrigation and the necessity financing well construction given the poor government support in this regard. I have also shown that due to the narrow profit margins and the fact that many farmers do not grow refuge crops, there is a possibility that the small gains some farmers are currently experiencing will be destroyed by bollworm resistance in the future. We also found that the ever looming threat of acquiring poor quality seed because of poor point of sale regulations poses a serious potential threat for Bt Cotton farmers. As mentioned, I also provided evidence to suggest poor quality or spurious Bt Cotton seed might already be in circulation according to the farmers.

The truth of the matter, however, is that small and medium scale farmers in India are expected to do what farmers have been unable to accomplish in other cotton growing countries and Bt Cotton use adds new challenges to the mix. The cotton industry is heavily subsidized in other countries such as the United States and China because it is

difficult for farmers to maintain their livelihoods as cotton farmers given the challenges of the natural environment and the costly necessities of irrigation, paid labour, seed and other inputs. These subsidies in their effect, depress world prices overall due to overproduction. In addition, it has long been known that international markets are rigged in favour of the United States.<sup>30</sup> Contrary to what one might expect, this reality also makes Bt Cotton production particularly risky as farmers do not benefit from beneficial terms of trade. Therefore, the findings of the practicum research show that in order for farmers' to increase their incomes in a significant way by using this new technology debates and policies in regard to biotechnology use need to take into account the specific existing policy environment and vulnerability context of farmers. Of what benefit is a new agricultural technology if the supports are not in place to ensure it will benefit farmers and the prices for cotton fluctuate so widely it does not matter if the new technology "works"?

### **Benefits to Poor Farmers?**

As mentioned in Chapter One, however, the over arching debate in the literature during the last decade or more, has been in regard to the potential impact of transgenic, agricultural biotechnology such as Bt Cotton upon the poor (Qaim, Matin, Krattiger & Von Braun, 2000; Persley, 2002; Glover, 2003; Herring; 2003,2006, 2007; Lipton, 2007). The crux of this debate is that given the possible superior agronomic traits of agricultural biotechnologies, denying the new technologies to people in developing countries could block groups of relatively poor people from a technology which could ultimately improve the quality of their lives. However, given the uncertainty of the impact of the new

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<sup>30</sup> This reality was only officially accepted by an appeals panel of the World Trade Organization in March 2005 (Herring, 2007, p. 4) but changes in policy have not yet taken place.

technology on the livelihoods of the poor now and in the future, there is also a distinct possibility that allowing people access to this new technology might be harmful to individuals as well as entire nations. The consensus in the scientific community and in regard to policy is to endorse GMOs with precautionary caveats (Herring 2007).

The experiences of farmers who participated in this study show that there are flaws in this exaggerated conception of an entirely positive outcome or a solely negative outcome for poor farmers as a result of Bt Cotton use; the findings also show that this easy consensus in the scientific and policy arenas in favour of a reliance upon agricultural biotechnology policy is problematic in light of reality. First of all, Bt Cotton use, for the most part, was shown to be neither a tremendous success nor an outright failure over 1-3 growing seasons for small and medium farmers as this polarized conception of the issue suggests although many farmers who participated in this study fared poorly in 2004-2005. In addition, given the many assets of the farmers we interviewed<sup>31</sup> who were growing Bt Cotton, at least in 2004-2005, this seed was hardly being used by the poorest farmers in Telegana although given the widespread rise in the popularity of this new technology (Herring, 2007) this reality may no longer be the case. In particular, most of the farmers who participated in this study had adequate sources of irrigation and this reality is not typical for most small holders in Andhra Pradesh.<sup>32</sup> Nonetheless, Cotton is not a subsistence crop or a typical small-holder crop; it is debatable if Cotton is even a crop of the poor (Glover, 2003).

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<sup>31</sup> On the other hand, larger, longitudinal studies such as the many studies conducted by Qayum and Sakkahari may have better captured the experiences of poor farmers given their larger number of participants and the wider variety of districts where they conducted their research. Overall, they found negative effects on farmers' incomes.

<sup>32</sup> 57% of the area of Warangal is irrigated (CFW, 2005)

Regardless of whether the participants in this study actually constitute the “poorest of the poor,” they voiced more concern over the impact of fluctuating prices on their incomes rather than seed performance which perhaps reveals the real means to benefit relatively poor farmers. Farmers said a small increase in profits was a moot point given their existing debt loads and unpredictable price fluctuations caused by a variety of factors including poor regulation of local markets.

Farmers’ experiences also show the limitation of this easy consensus in policy and scientific communities in regard to the assumption that agricultural biotechnology policy will be sufficient to thwart any negative effects associated with the new technology. Our research found that that regardless of the existence of policies to the contrary, poor quality, fraudulent varieties are in circulation in at least three of the communities where we conducted research and this reality has been causing many hardships for farmers. In addition, due to the lack of regulation of Bt Cotton fields and for practical reasons, many farmers in the study were not growing refuge crops. This situation poses serious potential problems for farmers, including organic farmers in the future.

In order for Bt Cotton technology to benefit the poor, changes in public policies and government programs are necessary to provide farmers with better means to cope with Bt Cotton production but it is questionable whether this theoretical possibility is likely to be a reality. Expanded extension services might ensure that refuge crops are grown. Better regulation might ensure that local markets are fair and that seed supplies are of sufficient quantities and of good quality. Better irrigation schemes could also boost Bt Cotton farmers’ yields. On the other hand, such changes do not alter fluctuating international prices for cotton although crop insurance could offer farmers’ some degree of assistance.

Changes in policies to better help small scale farmers cope with their realities, however, are largely inconsistent with the current agricultural development model Vision 2020 which is directed towards the consolidation of farms and wide-spread use of agricultural biotechnology. In addition, the Andhra Pradesh government is highly indebted to foreign creditors that would be unlikely to support a shift away from an industrial agriculture model.

Thus, farmers' use of Bt Cotton had a limited potential to provide substantial benefits to the poor, in terms of enhancing their abilities to increase their income, given Bt Cotton farmers' existing vulnerabilities and their existing policy context at the time this study was conducted in 2004-2005. Given this fact, further investigation is required to see if it is in farmers' best interests to introduce food crops such as corn and potatoes with the Bt trait to the Indian market as planned for the near future. On the other hand, the cost of the new technology has, however, dropped since this study was conducted to be more comparable to the price of other popular cotton hybrids (Herring, 2007) and this reality would have a positive effect on farmers' bottom lines. In addition, it is possible that small gains each year could have a positive cumulative effect providing that Bt resistance does not occur.

Whether it is by design or a lucky accident, it would appear that Monsanto, more than the poor, stands to benefit from the introduction and uncontrolled spread of Bt Cotton varieties in Andhra Pradesh.<sup>33</sup> The introduction of Bt Cotton allows this multi-national company to expand its market for Bt Cotton and ease any resistance to the introduction of food crops with the Bt trait. This introduction into the Southern Indian market, as

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<sup>33</sup> See Herring (2007) for a discussion on how different groups of poor, rural people such as farm labourers in Andhra Pradesh could benefit from Bt Cotton production.

discussed in Chapter Two, was made possible through a variety of changes in economic policy introduced with the New Economic Policy of 1991 and changes in WTO rules.

### **Suggestions for Further Research**

Farmers seem to require a practical tool such as a computer program which they could use at an Information Technology Centre. This tool would allow farmers to track all their expenditures for labour, inputs and so forth and compare them to their returns on their cotton crops so that they can make accurate assessments of their overall profits and losses as they did in this study. Farmers' difficulties in assessing their profits or losses in regard to Bt Cotton use, given the complexity of this task, and the fact they generally do not keep records was evident during this study and other studies (Stone, 2007). Participatory research about this topic would clarify farmers' specific needs in this area.

### **Closing and Epilogue**

The objective of this study was to determine the real effect of Telegana farmers' use of cotton with the Bt trait on their abilities to increase their incomes over 1-3 growing seasons, primarily from farmers' perspectives, while taking into account farmers' existing vulnerabilities and the policy context. In summary, the existing vulnerability context and policy environment experienced by all farmers in Telegana, such as, but not limited to, volatile prices for cotton caused by greater integration with world markets; poor control of dealings in markets; poor access to affordable, timely institutional credit; irrigation problems; and the poor regulation of vendors at the point of sale causes the greater intensification of farming through the use of Bt Cotton to be a risky livelihood strategy which had not improved most small and medium scale farmers' abilities to increase their incomes to a significant extent at the time the research was conducted in 2004-2005.

Regardless, of the current and potential effect of Bt Cotton use on farmers' livelihoods "the genie is out of the bottle." A recent account (Herring, November 2007, p.12) from a farmer indicated that "Bt hybrids have taken over Andhra Pradesh generally." Although the specific varieties under review<sup>34</sup> when this study was conducted in 2004-2005 were rejected for commercial production in 2005 due to pressure from civil society groups (Herring, 2007) these varieties and many other Bt Cotton varieties are widely available in Southern India.

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<sup>34</sup> Mech 12, Mech 162 and Mech 184

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**Appendix A - Definitions of Outcomes Used in the Study based upon Department for International Development Guidance Sheets (1999)**

<b>Possible Positive Outcomes to which farmers aspire</b>	<b>Definitions</b>
(More) income	Increased household income
(Increased) well-being	Better physical health; better mental health; feeling better about one's self; better self esteem; a sense that one is celebrating one's cultural heritage
(Reduced) Vulnerability	Less seasonal dips in food security and income; better able to withstand financial shocks; increased savings
(Improved ) Food Security	Being able to acquire more food and/or more nutritious food for immediate or extended family
(More) Sustainable use of the Natural Resource Base	In regard to practices that are less damaging to the environment in the short term and the long term – mainly in regard to seed, water, and soil

From: Sustainable Livelihoods Guidance Sheets, 1999

## Appendix B - Final Interview Guide

### Introduction

Thank you for participating in this study. We will be asking you several questions about your experiences growing Bt Cotton. Please make any comments you would like to make. If you do not understand the question or would like to mention something else about your experiences with Bt Cotton that we have not mentioned, please let us know. The interview will take twenty minutes to about an hour to complete. We can complete the entire interview today or we can come back at another time (convenient to you) to do the rest. Today we will be mainly talking about the Bt Cotton crops you have grown and harvested [in the past].

Information	
1. Farmer's identifying number	
2. Village	A B C
3. Mandal	
4. Total land holding of the farmer ( <i>end the interview if his/her total land holdings are over 16 acres</i> )	
5. Years producing Cotton?  When did you start producing cotton?	
6. How long have you been farming here?	

7. Type of Irrigation (in acres)	Bore Well	Tank	Canal	Others	Rain-fed	Well
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8. Waste or fallow land (in acres)

9. Live Stock and Heavy Machinery (record)

10. **Good Life** - When you see a family that is better off what is their life like? What is the life of a better off family like? What do farmers such as yourself need to have for a good life (now and in the future)? What are the tangible/intangible things you need to have a good life as a farmer? Why? (If applicable – participant might have already answered this question)

**Introductory Questions**

1. Warm-up question – Just to confirm, how large is your Bt Cotton crop in Khariff 2004–2005 ? What variety of Bt Cotton are you growing? Mech 12, Mech 162, Mech 184 (Circle) Rch2Bt?

2. Warm-up Question - What crops are you growing during this season (2004 –2005)?

Record the data below:

Number of Crops	Name of the Crop	Acreage	Rainfed? Y or N	If irrigated some other way - How?
1.				
2.				
3.				
4.				
5.	Variety of Cotton			

(Bt Varieties = Mech 12, Mech 162, Mech 184 and Rch2Bt)

3. How many times have you grown Bt Cotton and harvested it 1 or 2 or 3 (Circle)

4. How did you first hear about Bt Cotton? When was that?

5. How many acres of Bt Cotton did you grow in a.)Khaniff 2002 –2003 (Record on table below) and b.)Khariff 2003 -2004? (Record on Tables Below)

(Bt Varieties = Mech 12, Mech 162, Mech 184 and Rch2Bt)

Khariff 2002- 2003 and 2003 –2004 (Record the Data below)

Year	Acres	Irrigation -Type	Comments(Bt. Variety)
Khariff 2002 -2003			
Khariff 2003 -2004			

6. a.)What other crops were you growing when you grew Bt Cotton in a.)**Khariff 2002 – 2003** Can you show me how you used your land? [**Land Mapping** -Do a participatory exercise, a modification of mapping, in order to have the farmer depict the crops he has grown and the number of acres for each crop, if his literacy level makes this step necessary. Attach this document with the farmers identifying number and fill in the matrix above.)

**Khariff 2002 – 2003** (Record the data below: )

Number of Crops	Name of the Crop	Acreage	Rain-fed? Y or N	If Irrigated - How?
1.				
2.				
3.				
4.				
5.				

6. b.) What other crops were you growing when you grew Bt Cotton in **Khariff 2003 - 2004**? Can you show me how you use your land? (Do a participatory exercise, a modification of mapping, in order to have the farmer depict the crops he is growing and the number of acres for each if his literacy level makes this step necessary. Attach this document with the farmers identifying number and fill in the matrix below.)

What is the Bt variety you were growing?

**Khariff 2003 – 2004** Record the data below:

Number of Crops	Name of the Crop	Acreage	Rainfed	Irrigated - How?
1.				
2.				
3.				
4.				
5.				

**Objective One - Reasons why participants use Bt Cotton - aspirations, beliefs**

7. Why did you decide to grow Bt Cotton? What were you hoping would happen? Are there any other reasons why you decided to grow this crop?

*(Probe up to two times to obtain additional reasons. In all cases aim to find out the deeper rather than superficial reasons why he/she chose to grow the crop and put the three answers in one or more of the five possible output categories if possible (ie. more income, increased well-being, reduced vulnerability, improved food security and a more sustainable use of the resource base - see matrix at the end of the questionnaire to show how these possible answers are defined.)*

**Do not read**

Reason (circle near applicable answer)	Participant's Comments
More Income	
Increased Well being	
Reduced Vulnerability	
Improved Food Security	
More Sustainable Use of the Resource Base	
Don't Know	
<b>Other</b>	

***Additional Instructions** - If the participant comments that someone suggested he do it or there was a government program ask the following: why did you decide to go ahead with it? What did you hope would happen if you grew it? If the participant says he/she grew the crop before and that is the reason why he grew it again ask him/her to elaborate why he/she decided to plant the crop again and what he thought would happen if he/she grew it. If the participant says her husband makes all those decisions ask: What did you hope would happen?*

8. So you say that you decided to grow Bt Cotton because (insert the participants' first reason here). Can you tell me a bit more about this? *Ask this question only if it makes sense to ask for additional information on the reasons. Some explanations might be self-explanatory or may have been already given in the previous question. Ask this question for the second and third reasons, as well.*

Reason	Comments
First Reason	
Second Reason	
Third Reason	

9. I'd like to know if any other factors had a bearing on your decision. For example, did more income, increased well-being, reduced vulnerability, improved food security and a more sustainable use of the resource base have any bearing on your decision? [*Ask the participant about any other possible broad outcomes he or she has not already mentioned and probe the participant to elaborate.*] See the matrix of the definitions of these terms, on the last page.

Why did you expect that \_\_\_\_\_ (Insert Answer from Questionnaire used in October 2004)

10. Summary

11. Are these the three main reasons why you chose to grow Bt Cotton? Where/how did you get that information?

1.

2.

3.

*Change the top three reasons, as necessary, and record. This question is extremely important and the interviewer will come back to this answer towards the end of the interview.*

12. **Income** – We would like to know more about the income you received from growing Bt Cotton in Khariff 2004-2005.

a.) First of all – what was your yield on your Bt Cotton crop?

b.) How does this compare to the non-Bt Cotton crops that you have grown

a.) during the same growing season

b.) in other growing seasons?

c.) How many times did you pick the Bt Cotton crop compared to other cotton crops you have grown? More or less or the same? (*Circle*) Did picking the crop more or less (*Circle*) have any effect on the amount of time you had to do other things?

d.) Have any other factors influenced your returns on your last Bt Cotton crop?

e.) Did you use more or less or the same amount of pesticide on the Bt crop *compared to other Cotton crops you have grown?* (*Circle*).

How much did the pesticide for the Bt crop cost?

How does the amount of pesticide you use compare to other crops you grow?

f.) What was the quality of the Bt Cotton crop? Did the quality effect the price in a positive way, a negative way or not at all?

g.) Do you have any debts ( that are the result of growing Bt Cotton ie.borrowing money specifically to buy this seed) ? How much are your debts? Is your debt to a private lender, a bank or someone else?

At what interest rate?

h.) What about your health? Have you been able to work more or less or the same amount (*circle*) because of your use of Bt Cotton?

i.) **Income and factors that influence income such as government programs and extra time-** Do you get any kind of subsidy and or money from the government, to help you farm or feed your family? (if necessary, probe- rice, kerosene, anything else?)

j.)Do you spend more time or less time tending to your Bt Cotton crop compared to other crops you have grown? How is that?

k.) How do you use this extra time you have gained? OR what has been the result of this extra time you are spending tending to your crop?

l.) **Income and factors that influence income such as Global commodity prices and local market fluctuations** - Has the price you received for your cotton changed since you have been farming?

Please tell me about this?

m.) **Linking micro and macro** –

Do you have any way to check global market prices?

What would you say causes the prices to change?

What year did you have the best returns on Cotton considering your costs?

n.) **Income –Conclusion** - Overall, considering all these variables, what has been your income using Bt Cotton and is this income greater, lesser or the same than income you have received from growing other crops?

13. **Food Security** – a.)Has this (change) had any impact on your ability to feed your family? Yes, No, Maybe, Dk (circle)*If yes, Probe and Clarify- ask: I just want to make certain that this change in your ability to provide food for your family is the result of growing Bt Cotton. Continue to the next set of questions.*

b.) Are there any other factors that have caused changes in your ability to feed your family?

c.) Do you still grow food crops for your own consumption?

d.) What crops do you grow and in what amount of acres, if possible?

e.) Do you grow more, less, or the same amount of food for your own consumption compared to when you didn't grow Bt Cotton?

Did you grow more or less or the same amount of food, when you grew other varieties of cotton?

14. **Well-being (health)and Income-** a.)Has your health or the way you feel (mental health)changed or stayed the same because of your use of Bt Cotton? [*Probe and Clarify*]

15. **Well-being (health) and Income**-a.)Do you use more, less or the same amount (*Circle*) of pesticide with Bt Cotton compared to other crops you have grown? [*Probe and Clarify.*]

16. **Well-being (health) and Income** – a.)Has your increase or decrease of pesticide had any impact on your health?

b.) Has your increase or decrease in the use of pesticide had any impact on your income?

14. **Income** – If applicable – a.)Have you had to go elsewhere (migration) to find work?

b.)Why?

c.)Have you had to work for other farmers?

d.)Why?

e.) Have you had to sell any of your land? Why? To whom did you sell your land ?

f.)Were you able to save more, less or the same amount of money (than usual) the last time you grew Bt Cotton? Why?

g.) How does this compare to other crops you have grown?

15. **Well-being (cultural heritage)**– a. I've heard that sometimes people in Andhra Pradesh do rituals concerning seed. Do you have/ or have you had rituals or special practices concerning seeds? [*If the participant looks confused add the following: For example, I've heard that women are responsible for selecting the seeds that will be grown each year and there are certain ritualized practices around this seed selection.*]

b.) Do you/Have you follow(ed) rituals such as these? Have you noticed any changes in these kinds of rituals? (not necessarily these rituals but rituals like these?)

c.)How do you feel about these changes? Have you noticed any other changes in the way people farm in your community?

d.)Such as?

e.)What do you think caused these changes and what do you think of them?

16. **Well-being** -If applicable-How do feel about these changes you have described to me such as (insert responses from above here)?

17. **Well-being** If applicable-How do feel about these changes you have described to me such as (insert responses from the earlier question here)?[*Considerable care should be taken asking this question if farm family members have experienced negative effects .*]

**18. Vulnerability – Do a quick Timeline and a quick Seasonal Calendar for the household with the participant and attach them**

**Objective Two – Impact upon ability to create or maintain Sustainable Livelihoods**  
Sustainable Use of the Resource Base (ie. Issues pertaining to the use of Soil, Water and Seed)

**18. Soil and Decomposers**-Ask the participants to pick up a handful of soil from three different places in their Bt Cotton crop and assess the quality on a range from: very poor, poor, good, very good. Ask them to discuss the cause of the quality of the soil and whether the poor soil has any impact on their ability to make a living. Ask them why the quality is the way it is. Have they noticed any changes when they used the Bt Cotton?[Analysis - Determine the percentage of the families in each participant group that fall into each category and categorize why they feel the soil condition is as it is.]

**19. Water Management** – We discussed earlier how you irrigated your crop. a.)Please show me how you irrigate your crop. (Record whether there are shallows and deep tube wells. If so, ask whether this is typical of farmers in this area.)  
Have you noticed any differences between the Bt Cotton crop and other crops in terms of the amount you need to irrigate it? Do you irrigate all the types of crops that you grow?

*[Analysis - Shallows and Deep Tube Wells indicate that the system is not ecologically secure. ]*

**20. E.S –Biodiversity/Biosafety Issues** - Have you ever mixed Bt Cotton and non-Bt Cotton before marketing it? Why?

**21. E.S -Biodiversity Issues/Biosafety Issues** –Do you mix Bt Cotton and non Bt Cotton when you plant it? How do you store it? Has anyone talked to you about why refuge crops are used?

How/Where do you plant refuge crops?

**22.Back to Objective One -Conclusion**

Based upon what you told me in regard to your aspirations and beliefs for planting Bt beliefs for planting Bt Cotton in the first place, insert the participants' three reasons (expected outcomes) for growing Bt Cotton from Question 7 would you say that the growing of Bt Cotton met these expectations or not? To what extent? [For the final interview – For all the times you grew Bt Cotton]

Will you plant it again? Why?

Reasons	Comments
1.	
2.	
3.	

Sustainable livelihoods is a way of making a living where your needs are met but the needs of the future generations are also taken into account. It is a way of making a living that ensures there are adequate resources in the future..... Does growing Bt Cotton help you create and/or maintain sustainable livelihoods?

Is growing Bt Cotton better or worse at helping you create or maintain sustainable livelihoods compared to other crops you have grown, including other varieties of Cotton?

22. **SES** - We need to know a bit more about you. All of your response will be confidential and anonymous. If you are uncomfortable providing an answer to any question please let us know. We can skip questions you prefer not to answer. Simply let me know that you prefer not to answer the question by saying "skip that question." How many people are in your family (that live here)? [Do a participatory exercise if necessary using match sticks to determine the family composition – number of adults, males, females etc. ]

23a) First of all, to which caste do you belong?

24. What was your overall income during the following years: (*Circle*) a.) Khariff 2002 - 2003      b.) Khariff 2003 -2004      c.) 2004 -2005?

25. What are your main income sources (along with agriculture?)

Incomes Sources	Income 2002 -2003	Income 2003-2004	Income 2004-2005

26. What is the highest grade you have completed?

27. Can you tell me more about your family background? For example, what is the religious affiliation of you and your family?

28. What is your age and date of birth?

Conclusion - Are there any other aspects of growing Bt Cotton that you would like to discuss?

Do you have plans to grow more Bt Cotton next season (Kharif 2004 – 2005) More, Less, Same

### **Additional Clarifying Questions**

1. What percentage of your food needs are met by your own crops?

Paddy

Tumeric

Red Gram

Green Gram

Other – (Specify)

2. Do you have any plans to grow more Cotton next season (Kharif 2005-2006) More or less of the same amount? Why? Will you devote more or less land to crops for your own consumption in Kharif 2005-2006?

3. Do you have to sign any sort of contract agreement when you buy seed?

4. What impact did growing Bt Cotton have on the following over 1-3 growing seasons? (See Definition of Terms matrix, on the next page).

### Definitions of Terms

Possible Positive Outcomes the farmers aspired to/experienced	What comments fall in this category
1. (More) Income	In regard to increased household income
2.(Increased) Well being	Better physical health, better mental health, feeling better about one's self, better self esteem, <i>a sense that one is a modern farmer keeping up with the times?</i> , a sense that one is celebrating one's cultural heritage
3.(Reduced) Vulnerability	Variable – less seasonal dips in food security and income, more able to withstand financial shocks, savings
4.(Improved ) Food Security	Being able to acquire more food and/or more nutritious food for immediate or extended family
5.(More) sustainable use of the Natural Resource Base	In regard to practices that are less damaging to the environment in the short term and the long term – mainly in regard to seed, water, and soil
Don't know	Participant is unable to come up with an outcome he/she aspires to
Other	Other items that do not logically fit within this categorization

Based upon the Department for International Development Sustainable Livelihoods Guidance Sheets (1999) definitions



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