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Bt Cotton and Livestock: Health Impacts, Bio-safety concerns and the Legitimacy of Public Scientific Research Institutions

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Since 2005, shepherds and farmers from different parts of India- particularly from the states of Andhra Pradesh, Haryana, Karnataka and Maharashtra have reported that their animals (cattle, buffaloes, sheep and goat) that have grazed on genetically modified cotton or have been fed genetically modified cotton seeds have fallen sick and in some instances have died.

Despite several reports and representations to the concerned regulatory and research bodies alerting them to the seriousness of the issue, there has been a persistent reluctance amongst the scientific establishment to respond, investigate and research into the problem. On the contrary the reaction of the establishment has been bureaucratic, dismissive of people's experiences, and has exhibited incapacity to respond to the communities needs. Fact finding studies carried out by veterinary scientists associated with independent research organisations have been perceived with suspicion by the establishment, who have been quick to dismiss them as being "exaggerated, blown out of proportion, and not based on sufficient research and "hard facts".

The mainstream scientific community argues that all safety tests have been done, demonstrating conclusively the safety of GM crops, and hence the technology cannot be held responsible for the altered health conditions of the animal that have been regularly falling sick after being exposed to Bt cotton crops.

However to date, not one public research institution has undertaken to systematically investigate the problem at the farmers field, and hence have no hard evidence to support their claims of “safety” (save the routine tests carried out prior to obtaining permission for commercial release of the crop). Each year however the animals belonging to shepherds and farmers continue to fall sick while they graze on Bt cotton, and there is not one National Research Institution willing to listen to them, and investigate and explore the field reality.

Public research institutions are loosing their legitimacy as independent institutions working in the interest of the country's citizens. It is our appraisal that scientists are occupied in lab-based science sponsored by corporations, rather than conducting citizens-based science, and apply their science to address and investigate problems that are experienced by citizens in distress.

In this paper, we explore these issues through retracing key milestones of livestock and the GM technology experience in Andhra Pradesh since the past 5 years.

History of Sheep, Goat and Cattle grazing on Bt Cotton fields in Warangal district, Andhra Pradesh (AP) , and its impact on their health:

Grazing on harvested crop residues that remain on the fields, is a regular and common practice of livestock owners in villages across the length and breadth of India, including in Warangal district, AP. Cotton became an important cash crop across Warangal district, in the early 1990s, gradually replacing the dryland food crops which predominated the region. Livestock owners had no option but to graze their animals on harvested cotton fields, which began to dominate the landscape. They continued to do so for nearly 12 years, prior to the entry of Bt cotton. Not once did farmers or shepherds experience morbidity or mortality in their animals due to the effects of their animals grazing on cotton fields. Warangal district became nationally and internationally “infamous” as the district where a large number of farmers had committed suicide, unable to cope with the cotton debt trap.

Bt cotton was commercially released in Andhra Pradesh in March 2002, after the Government of India granted permission to Mahyco-Monsanto, to market its Bt cotton variety in South India . In the Kharif season of 2002 the company released two Bt cotton hybrids MECH Bt 12, and MECH Bt-162. It was sown in approximately 9500 acres in Andhra Pradesh, which stands third in cotton cultivation in the country, with an area of 8,87,000 ha under cotton. In Warangal district of Andhra Pradesh, approximately 1200 farmers planted Bt cotton over 1500 acres in Kharif 2002-03.

2005-2008: Shepherds observe a difference in their flocks that are grazed on Bt cotton

In January 2005, which coincided with the third year (2004-05) of Bt cotton in Warangal district, the first incidences of cattle, goats and sheep dying after grazing on Bt cotton were reported by farmers from 3 villages in Atmakur Mandal, Warangal district, and the concerned farmers brought this to the attention of the local animal husbandry department. In this first year while certain civil society groups documented the matter and brought it to the attention of the Animal Husbandry Department, Warangal district, Andhra Pradesh, there was imprecise information on disease symptoms and species affected.

The following year, between end-January and March 2006, shepherds from 4 villages spread across 3 Mandals (Station Ghanpur, Dharmasagaram and Hasanpartha) experienced large-scale morbidity and mortality within their sheep and goat flocks. In late March the shepherds reported this to the Andhra Pradesh Sheep and Goat Rearers Federation, who requested 2 independent research organisations to join them in carrying out a fact finding study of this event, in early April 2006. Veterinary doctors on the fact finding team, recorded the observations of the shepherds, where they reported that sheep that were let out to graze on Bt cotton fields began to exhibit symptoms such as dullness, cough, nasal discharge, reddish and erosive lesions in the mouth , bloat, blackish diarrhea and occasional red coloured urine, within 2 days of continuously grazing on the cotton crop.

Sheep Mortality was observed in the flocks after 4 days of grazing on the Bt cotton crop. Lambs aged 3-4 months and young adults between 1-2 years were worst affected. Unfortunately at the time of the investigation, there were no sick animals which could be examined by the vets to triangulate the information. Shepherds from one of the affected villages (village Madepalli), infact carried their sick animals to the local veterinary hospital as also to the main Veterinary Hospital located at the Animal Husbandry Department in Warangal town.

The local Veterinary doctors after noting the history of feeding reportedly asked them to stop grazing their sheep on the harvested Bt cotton fields. She also treated them with a combination of drugs (Atropine, Dexamethasone, Pregneselone) which are commonly used to treat cases of toxicity. The government veterinarians carried out post mortems on the dead sheep. The fact finding report noted that while the 4 villages yielded an approximate total mortality of 1820 sheep, with a history of having grazed on Bt cotton, there was urgent need for the government authorities to carry out a detailed investigation of the matter both at the field level, as also carry out further bio-safety studies where they simulated the field condition of animals grazing on harvested Bt cotton fields, so as to assess its impact on animals.

The report was submitted to State and National agencies responsible for taking action on the problem, including the Animal Husbandry Department, Andhra Pradesh (AHD, AP), the Indian Veterinary Research Institute (IVRI), the Sri Venkateshwara Veterinary University, Andhra Pradesh (SVVU) and the Genetic Engineering Approval Committee (GEAC), New Delhi.

In the last week of January 2007, the independent research organisations received reports from the AP Sheep and Goat Federation, that sheep were dying after grazing on Bt cotton fields in Warangal district. On 2nd February 2007, veterinary doctors from Anthra and representative

from the AP Sheep and Goat Federation visited the villages, located in Lingala Ghanpur, Parvatigiri and Zabharghad mandals. Shepherds reported the occurrence of similar symptoms as the previous year, in sheep which had grazed continuously on Bt cotton for 3-4 days. Symptoms in order of appearance included anorexia, cough and nasal discharge from the second day onwards, occasional difficulty in breathing, nasal discharge which was mucopurulant and / or blood tinged , red coloured urine, bloat from the 3rd day after grazing on the fields, eye swelling / face swelling, difficulty in standing and diarrhoea in a few sheep. There was mortality in some of the morbid sheep after grazing on Bt cotton leaves and pods continuously for 3-4 days.

This was the first year that veterinarians of the fact finding team were actually able to examine sick animals. There were 7 sick animals exhibiting symptoms such as anorexia, dullness, mucopurelent nasal discharge, cough , swelling of eyes , brownish diarrhea with mucus but without any smell (out of the seven animals 2 animals had smelly diarrhoea) and none of the animals were suffering from fever. The report emphasized that based on the experiences of shepherds, continued grazing on Bt cotton fields manifested in morbidity and mortality amongst sheep flocks in Warangal district, however it was confounded by the fact that some sheep and goat flocks which had also grazed on Bt cotton fields were clearly exhibiting symptoms resembling Peste du petits ruminants (PPR).

Shepherds confirmed that except for sheep pox, none of the flocks had been protected against PPR or Haemorrhagic septicaemia. When the shepherds approached the local government veterinary doctor, (the Veterinary Assistant Surgeon or VAS), he advised them to stop grazing their animals on Bt cotton and treated the animals for poisoning (a drenching of egg whites and administered normal saline), indicating that the local veterinarians too suspected some sort of poisoning. The preliminary study reports were sent to the AHD,AP, IVRI, SVVU, and VBRI (Veterinary Biological Research Institute) Hyderabad, requesting them to investigate into the sheep mortality in Warangal.

In Adilabad district the first reports of cattle dying after grazing on Bt cotton fields came to light through media reports (The Hindu, March 5th 2007), which reported that cattle deaths had occurred in Tamsi, Bazar Hathnoor, Sirpur, Guddi hathnoor, Talamadugu and Bela mandals. The news report quoted the local VAS who were involved in treating the animals. According to the VAS, Adilabad, the symptoms in cattle that had grazed on the Bt cotton fields included convulsions, nasal discharge, vomiting, bloat, salivation, respiratory problems and diarrhea (bloody diarroea in a few cases). He has been working for eight years in this location and this was the first time he came across such cases. Symptomatic treatment for toxicity was given to the cases, and some animals responded while others died. He performed a post mortem on two bullocks from Talamadugu area, and sent the samples to VBRI for analysis.

These reports were submitted to the GEAC.

In the agriculture season 2007-2008, research organisations, decided to closely monitor sheep in a village adjacent to its area of work in Medak district, AP. In this village Bt cotton was cultivated, and shepherds had reported that they noticed some morbidity in sheep grazed on the Bt cotton fields in the previous year. The research organisation, ensured that the entire village

flock was protected against some of the key diseases that affect sheep which included ET, PPR, HS and sheep pox. In addition to the entire village flocks, the organisation closely monitored a group of 10 Deccani sheep that were being grazed on the Bt cotton sheep for the first time. 3 of the ten sheep began to exhibit symptoms of anorexia, nasal discharge and slight fever after a period of 3 weeks. The sheep were treated symptomatically, of which 2 recovered and 1 died. A post mortem of the dead animal was conducted and samples sent to the IVRI for testing along with samples of the Bt cotton plant (pods, whole plant, young leaves) on which the animal had grazed.

The organisation had intended to similarly monitor and ensure complete preventive health coverage for sheep flocks in Village Gummadivalli, Warangal district, a village that had consistently reported morbiditiy and mortality in sheep since the past 2 years. However due to lack of human resources and personnel it was not possible. Local veterinarians were repeatedly requested to protected the flocks against PPR, but in the event, only half of the flocks were protected against PPR. In February 2008, after the animals began to graze on Bt cotton harvested fields, shepherds once again reported that animals were exhibiting symptoms such as diarrhoea, nasal discharge, fever and death, but again it was difficult to differentiate whether it was PPR or some form of toxic response to the Bt cotton plants. Lack of personnel made it neigh impossible for the research organisation to conduct detailed fact finding, and shepherds were directed to the local veterinarians for assistance.

In the second week of March 2008, sheep morbidity and fresh mortality was reported from Pakala Mandal, Warangal district after the animals grazed on Bt cotton. In this case, veterinarians from the research organisation rushed to the village and were in time to examine the sick animals but it was too late to conduct a post mortem of the dead animal. The veterinarian examined the sick animals and recorded that the animals exhibited symptoms of fever , anorexia, mouth lesions with slight frothing. It was impossible to differentiate whether this was indeed due to the Bt cotton or was actually Blue tongue, which at the time was another disease widely prevalent all across Telangana regions of AP. The sheep had also grazed on Bt 1 (Bollgurad 1)and Bt 2 (Bollgurad II), which had been released commercially in that year. Anthra immediately called and informed the local Animal Husbandry Officials at Warangal Headquarters, requesting them to urgently send a team of veterinarians to investigate the problem. A team of veterinarians visited the animals, examined them and also collected blood samples from affected animals. The morbid animals subsequently died, but there was no veterinarian (either government or independent) to conduct a post-mortem.

In 2008-09, the researchers decided to closely observe the small ruminant population in 1 Panchayat which included the village Gummadivalli and 2 other villages, situated in Lingala Ghanpur Mandal, Warangal district. These villages had repeatedly experienced problems with sheep grazing on Bt cotton during the past 3 years. The shepherds observed that there appeared to be higher morbidity in animals that have been previously exposed to the Bt cotton, as compared to those animals exposed for the first time. Hence this region seemed to be most appropriate to study. Farmers were cultivating a cocktail of different “genetically modified cotton varieties” including Bt (2) or Bollguard II and Bollguard I from a range of companies.

Anthra focused on mobilising preventive vaccinations from the government animal husbandry

department, ensuring that all the small ruminants in the panchayat were vaccinated according to the government's schedule of vaccinations. Over 8000 sheep and goat were protected against Enterotoxaemia (ET) in June, PPR in August – September and HS in November 08. Animals were de-wormed twice during the year, and their health status monitored every month. Between June and November 08, the common diseases conditions observed and recorded by the Anthra Veterinarians in sheep and goat flocks in all 3 villages included non-specific fevers, foot rot, blue tongue, diarrhoea, bloat and lamb diarrhoea. These were treated symptomatically and there were no deaths recorded.

The panchayat flocks were healthy, in December 2008, prior to the shepherds introducing them to graze in Bt cotton fields. Shepherds let the sheep out to graze on Bt cotton fields by December 3rd week, earlier than previous years, due to early shedding of leaves, and limited foliage on standing plants. Hence, they were unable to graze their animals intensively on the fields (lesser duration per day and fewer numbers of days).

Anthra Veterinarians swung into action, pre-poned their plans and rushed to the village on receiving this news, and began to camp in the village from the last week of December. No sooner had they moved to the village, when shepherds began to report that select animals in their flocks were falling sick after grazing on Bt cotton harvested fields. Veterinarians were on the spot, to record the history, examine animals and observe the symptoms.

Narrowing down the symptoms: Towards describing the "Bt cotton syndrome profile"

The symptoms typically began in sheep and goats with dullness, after 3-4 days of grazing on Bt Cotton fields, followed by nasal discharge, cold, cough, respiratory distress (in some cases) and red urine in some cases. There was no fever. 2 bullocks also suffered from similar symptoms. There were 2 deaths (1 sheep, 1 goat) amongst the entire small ruminant population that grazed on the Bt cotton harvested fields. We have loosely termed this distinct correlation of history and symptoms as the "Bt Cotton Syndrome profile (BCS)". In 2008-09, because of careful preventive vaccination to rule out the potential occurrence of PPR, veterinarians were in a stronger position to narrow in onto the specific set of symptoms exhibited by animals that grazed on Bt cotton.

There was low morbidity of BCS (Bt Cotton Syndrome) cases linked to the history of sheep grazing on Bt cotton crops. Shepherds reported that those animals that tended to feed intensively on Bt Cotton bolls and leaves, exhibited the BCS symptoms earlier, than those which did not feed on the bolls. Grazing on the harvested cotton fields was complete by mid-January 2009.

The dead animals were post-mortemed by veterinarians, and the internal examination of organs revealed severe congestion and haemorrhaging in the lungs and trachea, and severe piticheal haemorrhaging in all other major organs (liver, kidney, heart, intestines). One of the animals in particular, showed intense discolouration of the intestines which had black patches , haemorrhages, and a cooked appearance. Widespread petichial haemorrhages were indicative of Pasteurella haemolytica. According to the owner of one of the animals, it had suffered from similar symptoms in the previous year. The histo-pathological diagnosis from IVRI (where the

PM samples were sent), showed that the goat suffered from acute broncho-pneumonia and enteritis suggestive of pasteurellosis. The sheep was diagnosed with chronic enteritis and nephrosis. Unfortunately as samples could only be sent on formalin, and not on ice, it was not possible to obtain bacteriological and toxicological analyses from IVRI.

Some clarity with several questions: It appears as if some “stress factor” has affected individual animals resulting in reduced immunity, eliciting a possible allergic response in these animals, manifested symptomatically in the form of cold, cough and nasal discharge. Intense stress also probably results in the occurrence of Pasteurella haemolytica, in some of the animals with resultant death.

In this year, two factors stood out which were different from the previous 2-3 years:

i) All animals were vaccinated against ET, PPR and HS three major disease challenges in small ruminants.
ii) There was less availability of Bt cotton foliage on the standing plants, and thus the animals began to graze earlier than usual, and for lesser intensity on the Bt cotton crops.
iii) Animals were grazing on both Bt1 and Bt 2 cotton foliage.

The Stress factor could either be:
i) Bt toxin itself,
ii) Unknown / new toxin
iii) Allergenic protein
iv) Macro / micro mineral imbalances in the Bt cotton plant, (eg excess or deficiency of Nitrate, Nitrite, Selinium, etc) as a result of the Bt protein, which elicits a response from the animal.

It clearly calls for a more substantial study both at the field as well as “ex-situ” simulation level, which cannot be done independently by 1-2 research organisations.

The Response of concerned Line Departments, Research Institutions and Regulatory Bodies:

According to GEAC prior to the commercial release of Bt Cotton, studies to assess the toxicological effects of cottonseed were conducted in goats , by the Industrial Toxicology Research Centre, Lucknow, and no significant difference was found in animals fed on Bt and Non Bt cotton seeds. Similarly feeding trial experiments to assess the effect of cottonseed meal, was conducted in cattle, buffaloes, poultry and fish and all results showed that it was as safe and nutritious as non-Bt cotton seed meal. These studies were conducted by National Dairy Research Institute, Karnal on lactating cows, by Department of Animal Nutrition, GB Pant University of Agriculture Technology, Panthnagar on lactating buffaloes, by Central Avian Research Institute, Izzatnagar on poultry and Central Institute of Fisheries Education, on fish. Similar studies were carried out to test the safety of Bt II Cotton.

In 2005-06 when the first fact finding study was carried out by independent researchers, they requested the officials of the Animal Husbandry Department, Warangal to share the their observations of post-mortems they had conducted on the dead sheep/goats. The immediate

reaction of the officials was one of suspicion and distrust and they refused sharing this information. It was only after filing an RTI, that the Animal Disease Diagnostic Laboratory, AHD, Warangal parted with the information, where they have clearly mentioned case histories of animals having grazed on Bt cotton with their tentative diagnosis being that these were cases of poisoning mixed with incidence of pneumonia.

In response to the report received from the independent research organisations regarding mortality in Sheep flocks after grazing on Bt Cotton field at Warangal Andhra Pradesh, on June 1st 2006, the GEAC records in its minutes of their committee meeting that it deliberated at length and arrived at a general opinion that the report was highly exaggerated and is based more on hearsay than scientific facts. The committee cites the various feeding studies conducted as evidence and proof of safety. The Member Secretary recommended that the Department of Biotechnology (DBT) should sponsor a study to assess the problem at Warangal District with the help of local Veterinary Hospital in the district. The Committee requested DBT to expedite the study so that the allegation made by the NGOs can be brought to a logical conclusion. The Committee also agreed that, in future, leaf toxicity studies need to be included as part of the bio-safety studies. The Committee further decided to refer the matter to the State Department of Agriculture for a factual report on the allegation made by the NGOs and the findings of the post mortem report.

Close on to 3 months later, at a meeting held on 17th August 2006, the committee notes that it is yet to receive the response of the state government and they also suggest that they get the opinion of the IVRI. The Committee sought clarification from the representative of DBT on the action taken regarding sponsoring a study to assess the problem at Warangal District with the help of local Veterinary Hospital in the district, who in turn informed them that no proposal was received for conducting the study. The Committee in turn requested DBT to expedite the leaf toxicity studies study with the help of IVRI and local veterinary hospitals on a priority basis. The Committee also requested the Chairman to take up the matter with the Principal Secretary, State Dept of Agriculture, Andhra Pradesh for expediting the factual report on the sheep mortality case at Warangal.

According to a letter written by the Director, AHD, AP to the Commissioner and Director of Agriculture, GOAP in September 2006, Bt cotton plants on which the sheep had grazed were sent to different institutions, and the results yielded a mixed bag of information:

i) The Andhra Pradesh Forensic Science Laboratary (Red Hills, Hyderabad) reported that the Bt Cotton was positive for organophosphates
ii) The Indian Grassland and Fodder Research Institute (Jhansi) informed the department that Gossypol analysis was not possible in their laboratory.
iii) The Western Regional Disease Diagnosis Laboratory, (Pune) informed the AHD that the samples were positive for Nitrates and Nitrites, which was tested using DPB reagent. Leaves were found to be comparatively strongly positive for Nitrates, in excess of 2%. The samples were negative for HCN, which was tested by the pictrate paper test method
iv) The Department of Agriculture Biotechnology, College of Agriculture, ANGRAU (Hyderabad) reported that the Bt protein content was 5 microgm/gm in both leaf and boll samples which was within the maximum tolerable limits reported as 5-10 microgram/gm. The

pesticide analyses found traces of pesticides in bolls and leaves (ppDDE- 0.0339 ppm in bolls and 0.0976 ppm in leaves; Endosulfan sulfate- 0.0368 ppm in bolls and 0.0454 ppm in leaves and ppDDT- 0.0979 ppm in bolls and 0.889 ppm in leaves.
v) Post mortem samples were sent to the Veterinary Biological Research Institute (VBRI), Hyderabad, who reported the presence of Nitrites and HCN on qualitative analysis of post mortem samples, sent to them.

Based on the above, the AHD Director concluded that the sheep deaths in Warangal district might be due to high content of Nitrates/Nitrites, residues of HCN and organophosphates., and that Bt protein levels in the plant were within the “tolerable range”. It does not mention whether this refers to being tolerable levels for animals to graze on or any other parameter. It is to be noted here that VBRI authorities informed independent researchers, that they do not have the facilities to test for Bt protein in animal post-mortem samples that are sent to them.

In 2007, with fresh reports of cattle and sheep deaths from 2 districts of Andhra Pradesh, observed and recorded independently by local departmental veterinarians and autonomous researchers alike, several institutions from the local to state and national levels got involved, which we attempt to summarize in the table below (Table 1). The drama which unfolded was a vivid example of how individual institutions abdicate their responsibility and are only too eager to absolve themselves of all responsibility instead of plunging in whole heartedly to investigate and get to the root of a crisis.

A key milestone was a meeting organised by the Director, AHD to which he invited members of the Shepherd Unions, research organisations and scientists from the veterinary university in AP to discuss the Bt cotton and sheep issues. He had invited the Monsanto-Mahyco representatives to answer the questions of the participants. The company representatives presented their study findings, but the audience had several questions and pointed our serious gaps in the biosafety studies carried out till then :

i) All the feeding trials experiments presented by Monsanto, involved feeding Bt-cotton seed meal or crushed cotton seed to buffalos, goats, fish, chicken, cows and none of the trials involved feeding fresh plant material (stem, leaves, pod, seed etc). None of the trials involved grazing sheep/cattle on standing harvested plant material continuously. The field mortalities of animals had occurred after grazing on standing plant material. Hence the above studies were invalid as far as fresh materials.
ii) None of the studies reported had been carried out on sheep and bullocks. They had been done on goats, poultry, fish and buffaloes.
iii) Dr Mohan, Director , AHD pointed out that it is well known that toxins such as Gossypol get denatured when crushed/deoiled, and thus denatured cottonseed meal / cake/ seed, has no Gossypol toxin effect. However what is the similar effect on BT toxin / protein? Is the toxic effect different in cottonseed meal (which is denatures) and fresh plant material? This does not come out clearly through the studies presented.
iv) All the studies were performed or financially sponsored and monitored by Monsanto and Mahyco Limited , who have clear profit and commercial interests in proving the safety of Bt cotton. Hence these study results are questionable with respect to their unbiased nature.

During the course of the meeting scientists from the Department of Pharmacology, SVVU, presented the University Research Plan to study the effects of BT cotton / BT protein on Small ruminants titled " Studies on the toxicity of Bt cotton plants incorporated in the feeds of small ruminants" . A project titled 'Studies on the toxicity of Bt-cotton plants incorporated in the feeds of Small ruminants of Registrar SVVU, Tirupati was sanctioned by the University. The principal investigator, assured the meeting participants that the research was completely funded by University Research Grants (and not Monsanto).

One of the positive fall outs of the meeting and interaction was that the Director, AHD, sent a letter to the GEAC in May 2007. In the letter he reported that there were reports of sheep mortality in February and March 2006, when samples were anlaysed the death may be due to high levels of Nitrates / Nitrites residues of HCN and organophosphates and that Bt toxin level in the plant samples were within tolerable range. The letter re-iterates that mortality reoccurred in February and March 2007, and this time around the samples tested at IVRI and VBRI found that the samples were negative for HCN , Nitrates, Nitrites, Alkaloids and Glycosoids and that the results of Gossypol and Bt protein was awaited. He stated that bio-safety studies have not been done on applied aspects like grazing animals on harvested bt cotton plant, and urges the GEAC to ensure that this is carried out.

At the 78th meeting of GEAC held on 22nd June 2007, they minute that the report received from AHD, AP was forwarded to Director IVRI, ANGRAU, ICMR, NIN and CCRI.

Minutes record that IVRI has sent a report to GEAC regarding BT cotton and goats where they state that limited studies have been conducted by the institute on goats and lab rats, fed with BT cotton left overs. The results indicate no un-towards clinical effects. However histopathological studies on rats are under process. Bt Cotton samples tested in the toxicological lab in the centre showed absence of HCN, nitrate, nitrite, alkoloids and glycosides. The centre was also of the view that there were other diseases prevalent on the area at the time of sheep grazing on Bt cotton. IVRI sent a communiqué to the GEAC stating that they "requested" NGO Anthra to provide PM (post mortem) samples from animals for differential diagnosis., but samples had not been received as yet. They also said that they told the NGO that they should inform the centre in future so that a team can be deputed from IVRI. The GEAC requested its Member Secretary to forward this information to the State Dept of Agriculture and AHD, for action.

The GEAC again suggests that in all new events, applicants must include plant parts such as leaf, shoots, pods , bolls in addition to seeds in animal feeding studies for bio-safety evaluation and the protocol to be devised with IVRI

In July 2007, civil society organisations meet with the veterinary scientists of the SVVU who are involved in designing and implementing the research, to request them to include a test group of sheep that were grazed on the harvested Bt cotton crop (leaves, bolls, seeds etc), as all the test groups described in their protocol, were only to be fed Bt cotton leaves alone in a cut and carry fashion.

Passing the Buck: Authorities quote one-another to "prove the safety of the technology"

In January 2008, the 82nd GEAC meeting was held where the committee reversed their earlier decision that future animal studies must include feeding studies on all parts of the plant including leaves! While earlier they had indicated to the M/S Mahyco that they had to perform this study on goats using transgenic Bt brinjal leaves , the committee arbitrarily reversed their earlier decision saying their was no scientific rationale or value addition to be obtained by this feeding study. This was justified by stating that analytical reports received from IVRI and the AHD,AP has conclusively confirmed that sheep death in AP cannot be attributed to Bt cotton.

The committee concluded there is no need for conducting these trials on Bt brinjal on the following grounds:

- Brinjal leaves is not a part of the natural diet of goats
- Purified Cry1 AC protein has been tested extensively for its safety and impact of the event containing this gene on human and animal health both in pure form and in plant parts across the world and in India.
- Expression of the protein in leaves are same as in other plant parts on which studies have been conducted, hence there is no need to conduct the trials on leaves

In February 2008, research organisations used RTI to request IVRI to send copies of the reports which they had submitted to GEAC, based on which the GEAC had arrived at this decision that sheep deaths are not due to Bt protein. On 26th February 2008, IVRI sent a response stating no studies have been done by the Dept. of Animal Nutrition, and the IVRI has not submitted any reports to GEAC.

Following on this response from IVRI, once again civil society filed an RTI to GEAC in March 2008, requesting copies of reports submitted to them by AHD, AP and IVRI as mentioned in their 82nd meeting. On March 13th 2008, GEAC basically sends a series of letters which had been submitted by different wings of the Animal Husbandry Department, AP, the IVRI and SVVU in 2007, and attempt to pass this off a “conclusive proof that Bt cotton is safe, based on extensive analytical studies:

- Copy of letter of AHD Director to GEAC dated 9/5/2007, wherein the Director basically states the need for further biosafety studies should be done to assess the impact of Bt cotton on sheep that continuously graze on Bt cotton.(see foot note vi)

- Copy of letter from JD Ranga Reddy district, Andhra Pradesh dated 14/8/07 addressed to the Ministry of Environment and Forests, stating no deaths of Bt cotton and animals were reported from Ranga Reddy district in that year. This “support evidence” makes little sense, as a proof that sheep cannot die when grazed on Bt cotton fields.

- Copy of a letter sent by IVRI to GEAC, dated 16/6/07 in response to a letter received by them from GEAC where they were requested by GEAC to “comment” on sheep mortality following grazing on harvested Bt cotton fields in Andhra Pradesh. In this letter the GAC also asked the IVRI to conduct trials with sheep being fed with Bt cotton harvested plant residue over an extended period of time to ascertain its biosafety. The IVRI responds in its letter that to date it has only done limited studies on rats and goats fed with Bt cotton left overs, indicating no

untoward clinical effects. However certain histopathological results were still being processed. The Bt cotton samples tested in their lab showed the absence of HCN, Nitrate, Nitrite, Alkaloids and Glycosoids. They advise the GEAC that the NGO Anthra has been asked to send samples, and because they have not sent samples, they cannot arrive at a conclusion. They also request GEAC to inform them if any clinical trials are being conducted and to send samples of Bt cotton plants and the morbid samples of anmals that have grazed on these plants alon with the history.

 Copy of letter from SVVU dated 22/6/07 from the Associate Dean, where he quotes that the results of testing Bt cotton in 2006 and 2007 revealed contradictory results, by which there is no conclusive evidence whether HCn, Nitrate, Nitrite and other chemicals are or are not involved in sheep mortality. He clearly states that the biosafety studies on grazing sheep on Bt cotton crop are lacking and it is thus essential to conduct such studies and to analyse gossypol and bt protein content in the plant at different stages of growth in different plant parts. He suggests a comprehensive study is done before arriving at any conclusions.

In short - none of the “evidences” can be passed of as evidence of safety by any stretch of imagination, and yet the GEAC blatantly misrepresents to its citizens, that they have fool-proof evidence of safety. If anything 3 of the 4 letters of evidence actually are stating the need for comprehensive testing!

Based on this information, research organisations file yet another RTI with the IVRI in March 2008, referring to their letter to GEAC dated 16/6/07, requesting them to send their reports of experiments. In response the IVRI sends Xerox copies of research protocol and methodology to test for HCN,Alkaloids, Glycoside, Nitrate, Nitrite. They also send a report of toxicity assessment of feeding Ethanolic extract of BT cotton leaves and seeds in Rats, but they do not send the results of feeding trials on goats, while this was specifically asked for through the RTI. None of these results mention testing of Bt protein content in animals.

In March 2008, post mortem samples of dead sheep from Medak are sent for testing where a special request is made to test for presence or absence of Bt protein both in the plant and the animal samples, in addition to other regular tests. IVRI sends results of tests conducted on the Bt plant samples which are posted back dated 16/4/08 which states that:

Bt cotton pods: are positive for saponin, and negative for nitrates and alkoloids
Bt cotton whole plant: were negative for saponin, nitrates, nitrites and alkoloids
Bt cotton leaves: were positive for nitrate or nitrite, and are negative for saponins and alkaloids

They do not mention about presence/ absence of Bt toxin in plant, which was a test specifically requested. However the results of the post mortem are yet to arrive. Finally a RTI was filed on June 18th 08, and on 18th July 2008, the IVRI-CADRAD sent a report dated 11.4.08, where the pathological exam indicated chronic hepatitis probably due to infectious nature, all toxicology tests are negative, tests for phosphine, nitrate/ nitrite, alkaloid, heavy metals, commonly used organochlorine/organophosphate are negative.

Crucially the IVRI- CADRAD in their PM report recorded that they cannot test for Bt toxins as

the facility for detection and estimation of Bt toxin was presently not available.

This admission of the premier veterinary research institute of the country, demonstrates sufficiently the complete inability of our top research institutions to engage in cutting-edge scientific work.

A Maze of Deception

It is indeed deeply disturbing that even after five years, there is absolutely no conclusive evidence of safety for animals, provided through the combined effort of state husbandry departments, research institutions at state and national level and regulatory authorities.

The GEAC is quoting bio-safety studies submitted by IVRI and AHD, and SVVU as proof that everything is safe. However IVRI in its report which it supposedly submitted to GEAC does not mention a word on BT- nor have they conducted studies on Sheep grazing on Bt cotton harvested fields. IVRI clearly says it has not done any studies on grazing of animals on Bt Cotton . When civil society organisations submitted samples from dead animals and plant material to IVRI, a per their guidelines, they report back to say they do not have the facility to test for Bt toxins. They also are silent on whether the cotton samples contain Bt toxin or not. Why so? If they are so competent on having tested for bio-safety how come they are unable to test for the presence/absence of the toxin in plants/ animals?

AHD , AP had sent the results of analyses of Bt cotton samples where they decide it has nothing to do with the toxin, because they find HCN, Nitrates/ nitrites, and without conducting any tests for the toxin. This is of course because they do not possess the facilities to carry out such tests. The very next year when the plant analyses are negative for HCN, Nitrate and Nitrites, GEAC uses the absence of testing for Bt , as proof that it is not Bt!

AHD, SVVU and IVRI conclude and recommend that more bio-safety tests have to be done which simulate the reality of grazing on harvested crops.

The Department of Veterinary Pharmacology and Toxicology, SVVU finally did carry out a study on 32 sheep from August 2007 for a period of 8 months and was titled “Studies on the toxicity of Bt cotton plants incorporated in the feed of small ruminants”. In October 2008, the department submitted their results to the university, where they concluded that in the present study the feeding of Bt cotton plants did not exert any fatalities and there was no adverse toxicity in the biological system of sheep.

The experimental design did not replicate the field reality in two critical respects:
i) The experimental groups that were exposed to Bt cotton were stall fed the plant, whereas in the field context, sheep graze on harvested crop.
ii) The second feature in their experiment is that the experimental sheep were being exposed to Bt cotton / or the BT protein for the first time in their entire life time. Under field conditions, it has been clearly documented that the response in sheep appears to be more pronounced in those animals which have had prior or previous exposure to Bt cotton which appears to elicit a morbid reaction from animals grazed on the crop.

In Conclusion

When it comes to actually engaging with the field situation, each institution is quite happy to pass on the buck to “NGOs”, who are finally held responsible for the inability of the National Research institutions for carrying out further tests. It is indeed a sad day, when National Institutions publicly admit that they are completely incompetent to carry out basic field-level research, and throw the ball back into the court of the very same NGOs whose scientists they have refused to take seriously.

In the final verdict, regrettably a majority of our premier national institutions and the larger public research and development system, have lost complete legitimacy, and are morally bankrupt. On what basis are we to believe and trust the research conducted in such institutions in light of this murky past?

There is urgent need to revamp our regulatory bodies, systems of investigation and put into place transparent and democratic research processes that are accountable to the wider public and the citizens of this country- be it the farmer or the urban consumer. Only then can we hope to really find some answers and solutions for the shepherds who continue to depend on harvested cotton fields, to feed their livestock during critical periods of the year. In this era of grave agrarian distress, farmers crucially depend on their sheep, goat, cattle for sustaining them, and it is our moral responsibility to provide answers and solutions to their very real and ongoing dilemmas.

References

1. a membership-based association of shepherds in AP
2. Anthra and Centre for Sustainable Agriculture
3. In August 2008 the VBRI reported that both samples sent for testing were negative for Blue tongue. They however do not provide diagnosis.
4. Haemorrhagic septicaemia (HS) vaccination in India provides only partial immunity to small ruminants as it protects against Pasteurella multocida which largely affects bovines. Sheep and goat are affected by Pasteurella haemolytica, for which there is no specific preventive vaccination in India.
5. Right to Information Act
6. GEAC-78th meeting minutes

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Lr Roc. No.14627/Epid/2006, Dated 20/09/06
Letter Roc. No. 3531/Epid/2006 Dated 9/5/2007
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• Assessment of the allergenicity of Bollgard cottonseed proteins relative to conventional cottonseed proteins
Performing laboratories - Monsanto company, St.louis
• Effect of feeding cottonseed produced from Bt cotton on feed intake, milk production and Composition in lactating water Buffalo in India
Study sponsor – Maharashtra hybrid Seeds Company Limited (MAHYCO), Mumbai
• Acute oral toxicity of Bacillus thuringiensis var. Kurstaki (Cry 1 AC) HD - 73 proteins in Albino Mice.
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• Comparison of Chicken performance when fed with diets containing Bt cotton , parental Non-Bt line or commercial cotton
Study sponsor – Maharashtra hybrid Seeds Company Limited (MAHYCO), Mumbai
• A 90 day feeding study with cotton seed in goat
Study monitor – Monsanto Enterprises Limited , Mumbai
• Evaluation of raw cotton seed meal derived from Bt-cotton seed as a feed ingredient for Indian cat fish, Magur (clarias batrachus) Performing Laboratory – Fish Nutrition and Physiology Division Central Institute of Fisheries Education

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F 3-1/2006-CAD and F 3-1/2006-CAD-239
Abstract of Project report: Toxicity of Bt cotton plants incorporated in the feed of small ruminants, pers comm..