Mortality in Sheep Flocks after grazing on Bt Cotton fields,
Warangal District, Andhra Pradesh
Report of the Preliminary Assessment
April, 2006

Background

Over the years there is a steep decline in availability of grazing lands in Warangal district with increased cultivation of commercial crops. On secession of rainy season, usually the sheep and goat are allowed to graze on left over fields after harvesting of crops. This year several reports appeared in media on steep rise in sheep and goat deaths after grazing in Bt cotton fields in Warangal district. During 2005 similar reports appeared and complaints have been lodged with Joint Director Agriculture by few NGOs. No action has been taken.

This year again shepherds of Warangal district reported that there was high mortality in their flocks between February – March 2006, after grazing on harvested Bt cotton fields. Some shepherds reported this incidence to the animal husbandry department, and requested them to confirm whether the deaths in their flocks were due to grazing on Bt cotton fields. Based on the complaints a fact finding team has been constituted by AP Shepherds Union (Andhra Pradesh Gorrelu Mekhala Pempakam Darula Sangham). The team consisted of of five members two from Anthra, an NGO working on livestock issues, a veterinary scientist, Dr. Ramesh and a field researcher, Mr. Apparao, along with Mr. Jamalaiah, Secretary, Andhra Pradesh Shepherds Union and two scientists from Centre for Sustainable Agriculture working on Bt cotton issues, Mr. S. Ramprasad, and Mr. G. Rajashekar. The team traveled in three mandals in Warangal district on 22 April, 2006 and met several shepherds and farmers.

The villages visited were Ippagudem (Station Ghanapur Mandal), Valeru, and Unkkucherla (Dharmasagaram mandal) and Maadipalli (Hasanparthi mandal).

Ippagudem village, Ghanapur mandal

Village has 100 households belonging to the shepherd community. Forty shepherds and ten farmers attended the group meeting when the team visited. According to them the deaths began after their sheep grazed on Bt-cotton leaves/bolls. The sheep grazed on the fields which belonged to the shepherds and other farmers. This is the first time some of the shepherds/farmers cultivated Bt- cotton hybrid. Many sheep were not grazed on the Bt cotton fields last year, as they went on migration .This year most of the shepherds cultivated Bt-Cotton with the intention that they can get more yield and profit. According to them they grazed their fields between end January and March. **The mortality started to occur within a week of continuously grazing on Bt cotton crops-residue.** The sheep grazed on the leaves (tender leaves) and pods of the Bt cotton plant residue in the fields. Mr J. Parmesh (20) suffered diarrhea after consuming the affected sheep's meat.

The major symptoms as reported by the shepherds were:

1. Sheep became dull/ depressed after 2-3 days post grazing
2. Cough with nasal discharge
3. Reddish and erosive lesions in the mouth
4. Bloat
5. Blackish diarrhea
6. Sometimes red coloured urine
7. death within 5-7 days of grazing on the Bt cotton fields

Age affected: Within the flock the young lambs aged 3-4 months, as also the adults in the age group of 1.5 -2 years were affected.

Shepherds transported their sheep to the government veterinary hospital in Warangal, so that a post-mortem could be performed by the government veterinarians. Some shepherds had also conducted their own post-mortems on the dead sheep (as is often the practice of shepherds across Andhra Pradesh). They observed black patches in the intestine and enlarged bile duct and black patches on the liver. The shepherds said that the Assistant Director, Animal Health Centre, Warangal, told them that these deaths appeared to be due to grazing of Bt-cotton fields as she has earlier seen such cases. The case history of all such deaths shows grazing in bt cotton commonly. She prescribed some medicines for the sick sheep. However, very few sheep responded and most died.

A shepherd of the hamlet village, Akkapalli reported that he had cultivated Bt- cotton the previous year and allowed his sheep to graze on it, which resulted in mortality in his flock during that period. This year while he cultivated Bt- cotton, he did not allow his sheep to graze on Bt cotton fields, due to the experience of last year, and his sheep did not die.

Of 2601 sheep that belonged to the 42 shepherds, 651 sheep died, which implies a crude mortality rate of 25%. (see table 1 below)

Table 1: Mortality of sheep in Ippagudam village

S.no	Shepherds name	Total Nos	Mortality since January, 2006
1	kotha venkatiah	105	25
2	D.komariah	100	24
3	P.Laxmarao	100	20
4	paramesh	150	16
5	kota mallaiah	44	20
6	G.venkatiah	130	34
7	marri venkatiah	70	16
8	jakkula chukkiah	50	20
9	mandha gattiah	150	30
10	g.bucchiah	60	10
11	veerboina ramulu	50	20
12	chinnaboina komariah	40	10
13	mandha gattiah	40	5
14	m.uppaliah	60	15
15	merru bithiah	50	10
16	Varala raju	120	8
17	mari komariah	40	10
18	G.komariah	40	10
19	G.somaiah	80	30
20	Kathila yelliah	40	10
21	bottla lingiah	24	10
22	Kothula ramulu	90	30
23	vundari sambaraju	45	12
24	K.lingiah	20	10
25	K.narsaih	80	15
26	t.gattiah	40	10
27	k.sariah	50	15
28	B.parasuram	50	10
29	K.sambaiah	70	20
30	G.venkatiah	40	15
31	K.ailaih	80	15
32	K.eswariah	40	10
33	Karriah	100	20
34	Jaggiah	30	10
35	satiah	8	25
36	Gattiah	80	20
37	B.bucchiah	30	10
38	K.raju	30	10
39	A.komariah	80	20
40	B.lingaiah	40	10

41	B.sooriah	15	3
42	k.mallaih	40	8
	total **Mortality Rate**	**2601** **25.02 %**	**651**

Table 2: The economics of Bt – cotton vs Non-bt variety as reported by the farming shepherds

Per acre	**Bt-cotton**	**Non -Bt variety**
Investment	**Rs.9000** (Seed per kg –Rs.1850 Pesticides, fertilisers etc.)	**Rs.5000** (seed Rs.500and other expenses)
Outcome	10 quintals @Rs.1800 =**Rs18,000**	8 quintals @ Rs.1800 =**14,400**
Netprofit	**9,000**	**9500**

On the way to Dharmasagaram mandal, we spoke to a shepherd Shri Kochla Malliah, who has 100 sheep. He too had grazed his sheep on the harvested Bt-cotton crop. 5 of his sheep died. He also reported that sheep had died in adjoining villages Molakagudam, Kunipatti and Kondaparthi .

Valeru village, Dharmasagaram mandal

Twenty nine shepherds participated in the meeting . Sheep mortality occurred during February - March 06 due to grazing on Bt-cotton fields. They described the identical symptoms as the shepherds in the previous village. Here again the sheep of age group 1-2 years were most severely affected and showed highest mortality. **Of 2168 sheep owned by the 29 shepherds, 549 sheep died, which makes it a crude mortality rate of 25%.**

There is large scale cultivation of Bt cotton in this season, the cotton yield obtained in early pickings was very less, farmers applied inorganic fertilizers and irrigated their fields in anticipation of second flush. There was good vegetative growth but less number of bolls. Farmers lost their hope in the crop and leased the fields for grazing to go for next crop. This resulted in large scale grazing in Bt cotton fields and resultant sheep deaths. Farmers buried the dead sheep in mass graves in fear to avoid further spread of the epidemic(!!?). There were no takers for the meat of the dead sheep, and the local business was also effected.

Table 3 : Mortality in Valeru village

S.no	**Shepherds name**	**Total Nos**	**Mortality since January, 2006**
1	D.komariah	100	24

2	N.peddagattiah	60	14
3	s.kanakiah	70	14
4	s.komariah	60	14
5	n.lingiah	50	20
6	N.vemkatiah	40	9
7	N.chandriah	30	7
8	N.malliah	40	12
9	N.venkatiah	50	16
10	J.lingiah	60	10
11	S.komariah	30	15
12	Laudi thallasorriya	60	6
13	lingareddy	24	8
14	J.rajiah	100	30
15	J.komariah	150	35
16	sothrappu venkatiah	100	20
17	J.rajiah	80	7
18	Jirru komariah	90	30
19	a.venkataiah	150	50
20	yerragolla kankaraiah	80	40
21	sothrappu yadiah	100	30
22	P.gattiah	50	15
23	Gatta komariah	50	10
24	serruveni kankariah	150	30
25	sothrappu komariah	50	10
26	adharu peddagattiah	200	40
27	N.chinnagattiah	54	15
28	a.gattiah	20	8
29	Chettapuri gattiah	70	10
	Total	**2168**	**549**
	Mortality rate	**25.32 %**	

Unkkucherla village, Dharmasagaram mandal

We could not have a group meeting in this village, but spoke to some individual shepherds. The sheep population is nearly 1000 in this village. We came to know that nearly 150 adult sheep and 70 lambs, had died due to grazing of cotton fields during the month of February - march. Death occurred within 4 days of grazing the Bt crop residue in the field.

Maadipalli village, Asanparthi mandal

In this village too, we could not have a meeting with the shepherds. There are 20 households rearing sheep with an average population of 3000 sheep. In this village nearly 400 died due to grazing of Bt- cotton field in and the mortality occurred in the second week of February and continued through to march. Despite having reported the matter to

the local VAS, no government veterinarian visited their flocks to assess the problem. So then they took their animals to Warangal, so that a post-mortem could be conducted. The Assistant Director, Animal health centre, conducted the post-mortem. She advised them that they should stop grazing their sheep on the Bt cotton fields. She said that the deaths could be due to grazing on the Bt cotton fields and she prescribed some medicines to the affected flocks.

Visit to the Office of the Joint Director, Animal Husbandry Department, Warangal

The Joint Director was not in office on that day, but we met the Assistant Director, Animal Health centre, who had in fact conducted the post-mortems and advised the shepherds. We asked her about her observations and the set of actions taken thus far, from the department side.

She replied that while it appeared to be deaths after grazing on Bt cotton fields, and it could be due to the effects of Bt toxin, we cannot arrive at a definitive conclusion, as farmer also spray different types of insecticides and pesticides on their crops, and this factor confounds the observations. She had conducted post-mortem on 3-4 sheep and observed black patches in the small intestines, enlarged bile duct and liver with discolouration, and accumulation of pericardial fluid. She reported that she had prescribed atropine and prednisolone/ dexamethasone as she suspected that it was due to toxicity. These drugs are standard routine drugs prescribed in cases of poisoning. She reported that there were no kits or other facilities available with the department to be able to arrive at a confirmatory diagnosis that the deaths were due to Bt toxin.

We asked to see the post-mortem results / reports, however the AD said she was not permitted to show us and give us a copy and we needed the permission of the Joint Director in this respect.

Discussion

The preliminary information gathered from meeting shepherds across 3 mandals, strongly suggests that the sheep mortality was due to a toxin, and most likely Bt toxin from the foliage. Shepherds from the various villages which are located at 20-25 kms distance from each another, reported an identical history of grazing on the Bt cotton fields continuously, course of manifestation of disease, symptoms and death within 5-7 days of grazing exclusively on Bt cotton plant residue – primarily young leaves and pods. The post-mortem symptoms as observed by the shepherds, suggest severe irritation of the intestines and associated organs (bile duct, liver) connected to the absorption and assimilation of food and processing of toxins. The post-mortem report of the government is awaited to corroborate the observations of the shepherds.

The symptoms reported by the shepherds, did not did not correlate to any of the other typical diseases that affect sheep during this period (common sheep diseases occurring during this season include sheep pox, enterotoxemia, occasionally pneumonia, peste du petits ruminants). The symptoms appear to be a generalized immune response to toxins or

organisms producing toxins in the gut of the animal and thus suggest death due to a phyto-toxin, most probably Bt toxin. Only further investigation will yield confirmatory results.

A review of secondary literature suggests that thus far there have been no reported incidences of mortality in sheep due to Bt toxin either in India or in other countries. The secondary literature on Bt cotton reports that the BT toxin is present in plant parts above the ground particularly in young leaves and flower pods. Recent reports also suggest that Bt toxin is present in the roots of the plant and that these released toxins into soils during plant growth and persist. Root breakage caused a significant increase in the release of Bt-toxin. Detectable levels of Bt toxin have been found in decomposing Bt –cotton leaf samples particularly high in fresh leaves, and then decline within 2 weeks of leaf breakdown. (www.deh.gov.aus).

Labs have demonstrated that the Cry1Ac prototoxin does bind to mice intestinal epithelium surface proteins and does induce insitu changes in electrophysiological properties and may cause diarrhoea and irritation of the intestines (Vasquez-Padron et. al., 2000). In vitro it has been shown to be cytotoxic to mammalian cell lines and also has been shown to generate immune responses in mice. (Vasquez et. al. 1999). Whether these can be directly correlated to sheep and other livestock with fermentation or prokaryote (bacteria) based digestive systems is left open but it does warrant further investigation, as in livestock diets rich in cellulose, which make the stomach environment more alkaline is a favourable environment for the toxin to survive in the active form, causing sufficient damage once it reaches the intestines. The toxin usually gets inactivated in acidic stomach pH but is highly stable in alkaline conditions; hence humans won't be effected much if they ingest it or if the toxin is taken in the oral route of entry through mouth and stomach.

Since the toxin may bind to intestinal proteins, there is a chance that if the sheep were exclusively eating the Bt crop matter, they would have in effect concentrated the toxin in their intestines due to the binding properties.

The report entitled "Back ground note on BT cotton cultivation in India", available at the http//envfor.nic.in, reports that toxicological studies were carried out on goats where they were fed Bt and non Bt cotton seed , and then cattle, poultry, buffaloes and fish where they were fed cotton seed meal, and there was no significant difference or toxic affect on the animals. The quantity of seed fed or age of the seed were not mentioned (as toxin content varies with time). **However no toxicology studies have been conducted in India on a situation of sheep continuously grazing on Bt cotton crops residues- fresh leaves and pods.** The toxicology studies need to simulate field conditions, as the phenomena of grazing on harvested crop residue continuously for a period of time, is a situation that predominates across India, post harvest. It is completely different from a controlled study of cotton seed feeding (we do not know for how many days). The toxin levels of cotton seed may be completely different from those of fresh leaves and pods. Here the sheep fed on fresh young leaves and pods, continuously where it suggests accumulation of the Bt toxin in the gut, resulting in death.

Recommendations

There is a strong need to carry out more in depth exhaustive investigation on the impact of Bt toxin on the local Indian livestock, as managed under our field conditions. The studies needs to be done by the Veterinary university before clearing the Biosafety tests.

There are diagnostic kits available from many companies for quantifying and detecting the Cry1Ac and other isoforms of prototoxin from Bacillus thurengensis either from the plants or even from animal tissue. There are kits available for general detection of the toxin itself in soil samples and plant material. These diagnostic kits need to be available at all the government veterinary hospitals/ agriculture department, so that they can be used immediately when disease reports come in, to confirm cause of death.

There should be a complete moratorium on BT cotton cultivation, until conclusive results are shown that the Bt toxin is completely harmless to our livestock, reared and managed under our field conditions.

The shepherds who suffered losses must be compensated.

References

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