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Leveraging the Critical Incident Technique to Identify the Detrimental Effect of *Cuscuta reflexa* Roxb. on Dairy Animals

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ABSTRACT

The critical Incident technique was deployed to study the detrimental effect of *Cuscuta reflexa* on dairy animals. In the present study, the critical incidences were farmers' fields where *berseem* was infested with *Cuscuta reflexa* and farmers were feeding that contaminated *berseem* to dairy animals. Thus, face-to-face interaction was done with 13 farmers of *Malpur* and *Ganeshpur* village of Bareilly district for the same incidences in the years 2021 and 2022. Based on farmers' response it was observed that due to gradual feeding of *berseem* contaminated with *Cuscuta reflexa* on an average there was a reduction in milk yield of 5.35 L/day in 2021 and 3.35 L/day in 2022 of dairy animals. The annual economic loss was calculated as Rs. 27322/- in 2021 and Rs. 20048.57/- in 2022. The reduction in milk yield (68.67%) shares the maximum percentage of economic loss followed by replacement cost (25.38%), and then treatment cost (5.95%).

INTRODUCTION

Plant poisoning in dairy animals are always a major concern for a veterinarians as well as dairy farmers. There are numerous plants that adversely affect the health of dairy animals and the income of dairy farmers. During the field visit conducted, the researcher came across the twinning or climber parasite i.e. *Cuscuta reflexa* in the *berseem* field and observed that farmers were feeding the *berseem* infested with *Cuscuta reflexa* to their dairy animals. It was also observed that the dairy animals especially buffaloes were eating this feed may be due to its palatability. After the pilot study, it was found that *Cuscuta reflexa* was causing gradual milk yield reduction in dairy animals and due to the same reason; few farmers had sold their animals also. The *Cuscuta reflexa* makes a tangled mask covering the *berseem* (host) plant and it has very low levels of chlorophyll and can slightly photosynthesis, thus dependent on the host plant for nutrition. The *Cuscuta reflexa* belongs to Convolvulaceae family and it is popularly known as dodder in English. The local names of this plant are *akashbel, amarbel, parasari,* etc.

Literature studies also reported that the *Cuscuta reflexa* is having an adverse effect on dairy animals. The study conducted in Udhampur district of Jammu and Kashmir reported *Cuscuta reflexa* Roxb. causes uneasiness, vomiting, anorexia, abdominal pain, and purgation in livestock (Bhatia et al., 2014). Its intake by pregnant animals results in abortion. Another research in southern Aravalli hills of Rajasthan reported that plant juice causes depression with nausea, vomiting, and abortion. Tribals mix the plant with fodder to kill the enemy's livestock (Katewa et al., 2008). Similar finding was reported by C. Alagesaboopathi, 2012 in Salem District of Tamil Nadu (Alagesaboopathi, 2012). Thus, based on farmers' perception and literature supported findings that *Cuscuta reflexa* Roxb. is adversely affecting dairy animals. The first-ever attempt has been made to conduct the study with the objective "Leveraging the Critical Incident Technique to identify the detrimental effect of *Cuscuta reflexa* Roxb. on dairy animals". The first attempt has been made to calculate the economic losses i.e. reduction in milk yield, treatment cost, and replacement cost occurring due to feeding of *berseem* contaminated with *Cuscuta reflexa*. The critical incident technique was used to calculate the

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economic losses due to feeding of *berseem* contaminated with *Cuscuta reflexa* to dairy animals.

METHODOLOGY

The critical incident technique (CIT) was first described by John C. Flanagan in 1954 and it is a well established qualitative research tool used in many areas of the health sciences, including nursing (Kemppainen, 2003; Keatinge, 2002 & Chamber, 1988), medicine (Holmwood, 1997 & Altmaier et al., 1997), dentistry (Henzi et al., 2007) and their respective education systems.

CIT is a research tool that facilitates the investigation of significant occurrences (events, incidents, processes, or issues) identified by the respondent, the way they are managed, and the outcomes in terms of perceived effects (Chell, 1998). In another word, CIT is a set of procedures designed to systematically gather information concerning specific incidents (events or occurrences) that lead to either effective or ineffective behaviour concerning a particular activity (Swan, 1975). Many of the researchers opine that CIT is an exploratory method that is suitable when the purpose of research is to enhance knowledge of a phenomenon about which relatively little has been documented. The present investigation has made an attempt to analyze the economic losses occurring among farming community due to feeding of *berseem* infested with *Cuscuta reflexa*. In the study, critical incidents were characterized as farmers' *berseem* field in which *Cuscuta reflexa* appeared and they were feeding contaminated *berseem* to their dairy animals. Hence, only those farmers were selected for present investigation, where such cases had been reported. Following five basic steps of CIT: 1) identifying general aims; 2) planning; 3) collecting the data; 4) analyzing the data, and 5) interpretation and reporting of results, the present study was carried out.

Under *identifying general aims*, it has been observed that *Cuscuta reflexa* was present in the *berseem* field and it was very difficult for farmers to separate it from the *berseem*. Owing to prevailing high cost of wheat straw, they were feeding the *berseem* contaminated with *Cuscuta reflexa* plant. It has been observed based on dairy farmers' response that there was a reduction in milk yield of buffalo due to feeding of *berseem* contaminated with *Cuscuta reflexa*. Also, the literature suggested that *Cuscuta reflexa* Roxb. causes uneasiness, vomiting, anorexia, abdominal pain, and purgation in livestock. Its intake by pregnant animals results in abortion (Bhatia et al., 2014). Therefore, an attempt has been made to study the poisonous effect of *Cuscuta reflexa* Roxb. on dairy animals as perceived by farmers.

During the planning stage, the following aspects were addressed. Firstly, "the situations to be observed" in which the villages having an infestation of *Cuscuta reflexa* in *berseem* were identified. Then the dairy farmers were identified whose *berseem* field was infested with *Cuscuta reflexa* by the help of a resource person. Those identified farmers were interviewed about the detrimental effect of *Cuscuta reflexa* feeding to their dairy animals. The question regarding when *Cuscuta reflexa* appeared in *berseem field*, how long they were feeding the *berseem* infested with *Cuscuta reflexa*, why they were feeding and what else they were feeding etc. asked during the investigation. Further, visit to every farmer's *berseem* field infested with *Cuscuta reflexa* was also conducted to confirm the situation. Secondly, "the observer" i.e. experts who were working on the poisonous plants for dairy animals, were the scientists from the extension education division and pharmacology division in the study. Thirdly, "the method of data collection" under which personal interview method along with experts' consultation has been made for collecting the data as done earlier by Mishra (2022).

In step 3, *collecting the data*, the semi- structured interview schedule was prepared with the help of an expert team and then administered to the farmers as used by other researchers (Shamna, 2022). The face-to-face interaction was done to collect the data from dairy farmers regarding the effect of *berseem* infested with *Cuscuta reflexa* feeding on dairy animals. The data collection was done in the years 2021 as well as 2022 to cross-check the effect of feeding *berseem* contaminated with *Cuscuta reflexa* to dairy animals. Two villages of Bareilly district i.e. *Malpur* and *Ganeshpur* were identified where *berseem* contaminated with *Cuscuta reflexa* was found and farmers were feeding the same to dairy animals. From *Ganeshpur* village, 3 dairy farmers were affected and from *Malpur* village, 10 dairy farmers were affected. Hence, 13 dairy farmers were studied to identify the poisonous effect of *Cuscuta reflexa* Roxb. on dairy animals as perceived by farmers. This study is the first ever to calculate the economic losses occurring to farmers due to feeding *berseem* contaminated with *Cuscuta reflexa* at field. Step 4, *analyzing the data* and step 5, *interpretation and reporting the results* have been explained under results and discussion section.

RESULTS AND DISCUSSION

Analyzing the data

The data on the social profile of dairy farmers were collected and compiled. It was found that on an average the dairy farmers were 44 years old with 20 years of experience in dairy farming. Although, on an average, their educational qualification was poor with 5-6 members in the family. In the year 2021, 10 dairy farmers and 11 dairy animals were affected due to the feeding of *berseem* contaminated with *Cuscuta reflexa*. It has been observed that buffalo were mainly affected as in this region buffalo rearing was more preferred than the cow. The calf and heifer had not shown many symptoms except diarrhoea in a few cases. Based on farmers' perception, it has been found that due to continuous feeding of *berseem* contaminated with *Cuscuta reflexa*, there was a gradual reduction in milk yield of buffalo. It has also been perceived that some of the farmers had replaced their buffalo because of reduced milk yield. Extra expenditure on treatment costs was also involved.

The average lactation order and lactating stage of incidences faced by dairy animals were 3.25 (numbers) and 2.9 (months) respectively. The average months of pregnancy observed was 1.4 months among incidences faced by buffaloes. Before feeding the *berseem* contaminated with *Cuscuta reflexa*, the average milk yield of buffalo was 8.3 l/day whereas after feeding the contaminated *berseem* the milk yield reduced to 3.35 l/day. Thus, due to continuous feeding of *berseem* contaminated with *Cuscuta reflexa* for two months (March & April) there was a reduction in milk yield of 5.35 l/day. The change in milk yield between before

Table 1. Detrimental effect of *Cuscuta reflexa* ingestion on milk yield of Buffalo during 2021

HH (no.)	Age (yrs)	Exp (years)	Education (Class)	Family size (Nos.)	Incidence cases (Nos.)	Lactation order (Nos.)	Lactating stage (month)	Pregnancy status (months)	Effect on milk yield (L)		Reduction in milk volume (L)	Economic milk loss @ 40 (Rs/day)
									Before feeding	After feeding		
1.	48	22	8	6	1	4	3	1	9	5	4	160
2.	51	20	7	7	1	3	4	2	7	3.5	3.5	140
3.	42	22	2	6	1	2	5	1	7	2	5	200
4.	35	15	2	6	Nil	Nil	0	0	Nil	Nil	Nil	Nil
5.	55	20	0	8	1	4	1	0	10	5	5	200
6.	40	18	8	4	1	2	2	0	8	2.5	5.5	220
7.	38	12	7	5	1	5	3	0	9	6	3	120
8.	58	32	12	7	1	3	4	2	14	3	11	440
9.	45	25	5	5	2	4	2	0	6	2	8	320
10.	32	12	2	4	1	1	2	0	5	2	3	120
11.	55	23	8	6	1	4.5	3	1	8	2.5	5.5	220
12.	38	18	5	6	Nil	Nil	0	0	Nil	Nil	Nil	Nil
13.	40	21	8	5	Nil	Nil	0	0	Nil	Nil	Nil	Nil
Average	44.38	20	5.69	5.76	11	3.25	2.9	1.4	8.3	3.35	5.35	214

Table 2. Detrimental effect of *Cuscuta reflexa* ingestion on milk yield of Buffalo during 2022

HH No.	Cases of incidence	Lactating Stage (month)	Pregnancy status (Nos.)	Effect on milk yield (L)		Reduction in milk volume (L)	Economic milk loss @ 40 (Rs/day)	Remark on incidences faced
				Before feeding	After feeding			
1.	1	4	0	5	0	5	200	Repeated
2.	Nil	0	0	Nil	Nil	Nil	Nil	Replaced but not fed
3.	1	4	1	6	2	4	160	Replaced and fed
4.	1	5	0	8	4	4	160	Fed in 2022
5.	Nil	0	0	Nil	Nil	Nil	Nil	Not fed in 2022
6.	Nil	0	0	Nil	Nil	Nil	Nil	Not fed in 2022
7.	Nil	0	0	Nil	Nil	Nil	Nil	Not fed in 2022
8.	Nil	0	0	Nil	Nil	Nil	Nil	Replaced but not fed in 2022
9.	Nil	0	0	Nil	Nil	Nil	Nil	Replaced but not fed in 2022
10.	1	1	0	5	3	2	80	Replaced and continued feeding
11.	2	4	1	8	2.5	5.5	440	Repeated
12.	1	2	0	6	2	4	160	Fed in 2022
13.	2	3	1	6	3	3	240	Fed in 2022
Overall Average	9	3.28	1	6.28	2.75	3.92	205.71	

feeding and after feeding was calculated with the help of paired t-test and it was found that there is significant reduction in milk yield due to feeding of *berseem* contaminated with *Cuscuta reflexa* with t value 4.63 ($p<0.001$) as seen in table no. 3. Therefore, the average economic loss due to the *berseem* contaminated with *Cuscuta reflexa* at the rate of Rs. 40 per litre was Rs. 214 every day.

From Table 2, it can be inferred that 9 dairy animals faced the incidences of *berseem* contaminated with *Cuscuta reflexa* in the year 2022. In 2021, a total of 10 incidences were seen at the farmers' household level whereas, in 2022, 7 farmers' households were found affected. It has been observed that 5 households had replaced their dairy animal due to the reduced milk yield. Among 5 households, three didn't feed *berseem* contaminated with *Cuscuta reflexa* next year after replacing the animal but two households continued. Although, 4 households had been observed feeding *berseem* contaminated with *Cuscuta reflexa* both the years 2021 and 2022. The reason may be a lack of awareness about the *Cuscuta reflexa* and the high cost of wheat straw.

The average lactating stage and pregnancy status of incidences faced by dairy animals were 3.28 (numbers) and 1 month respectively in the year 2022. Before feeding the *berseem* contaminated with *Cuscuta reflexa*, the average milk yield of buffalo was around 6.28 l/day whereas after feeding the contaminated *berseem* the milk yield was reduced to 2.75 l/day. Thus, due to continuous feeding of *berseem* contaminated with *Cuscuta reflexa* for two months (March & April) there was a reduction in milk yield of 3.92 l/day. A significant difference in milk yield between before feeding and after feeding was found at paired t-test 3.46 ($p<0.002$) as seen in table no.3. Therefore, the average economic milk loss due to the *berseem* contaminated with *Cuscuta reflexa* at the rate of Rs 40 per litre of milk was Rs. 205.71 every day.

The different parameters considered for calculation of economic losses due to feeding of berseem contaminated with Cuscuta reflexa were milk yield reduction, treatment cost and replacement cost for those who replaced their animal due to the same incidence. Thus, in the year 2021, the economic loss due to reduced milk yield was Rs. 15252, due to treatment cost was Rs. 1570, and replacement

Table 3. Effect on milk yield of dairy animals due to feeding of *berseem* contaminated with *Cuscuta reflexa* by t-test

Particular	Milk yield	Mean	Variance	Pearson correlation	Paired t test value
2021	Before feeding	6.384	17.92	0.785	4.63 (p< 0.001)
	After feeding	2.576	3.78		
2022	Before feeding	3.38	11.42	0.868	3.46 (p<0.001)
	After feeding	1.26	2.27		

cost was Rs. 21000. Therefore, the total annual economic loss for the year 2021 was Rs. 27322 as seen in Table 4. However, the total annual economic loss in the year 2022 was Rs. 20048.57 which includes reduced milk yield (Rs. 18,777.14) and treatment cost (Rs. 1271.42) due to berseem contaminated with *Cuscuta reflexa.*

Interpretation and reporting the results

During the field visit of documentation of toxic plants for dairy animals as perceived by farmers, it has been observed that in the *Malpur* and *Ganeshpur* village of Bareilly district, the *berseem* field was found infested with *Cuscuta reflexa*. After a pilot study, it was observed that the farmers' were feeding the *berseem* contaminated with *Cuscuta reflexa* which had resulted in gradual milk yield loss and in a few cases the animals could not recover, and thus, farmers replaced their animals. Thus, the critical incident technique was used to study the detrimental effect of *Cuscuta reflexa* on dairy animals. In the present study, the critical incident was selected farmers who were feeding the *berseem* infested with *Cuscuta reflexa*. The data was collected from the selected farmers for two years 2021 and 2022. Through deep interaction and field study, it has been found that the farmers due to lack of awareness and due to the high cost of wheat straw, they were feeding contaminated *berseem* to dairy animals. Thus, the annual economic loss for the year 2021 was Rs. 27322 and for the year 2022 was Rs. 20048.57. The gross economic loss for both the years (2021 & 2022) was Rs. 47370.57. The reduction in milk yield (68.67%) shares the maximum percentage of economic loss followed by replacement cost (25.38%) and then treatment cost (5.95%) as seen from Table 5. The study conducted in Haryana revealed that the total investment made on dairy animal, the major proportion was covered by investment on feed and fodder, followed by concentrates and labours (Ghalawat, 2022).

Table 5. Major determinant of economic losses due to feeding contaminated *berseem* to dairy animal

S.No.	Determinant	Average cost	Share (%)
1	Milk yield loss	21843.07	68.67
2	Replacement cost	8076.92	25.38
3	Treatment cost	1892.30	5.95
	Total	31812.30	

CONCLUSION

There are numerous poisonous plants that if ingested by dairy animals may affect their health adversely depending upon the amount consumed and toxicity of the plants. It was observed that *berseem* was infested with *Cuscuta reflexa* and farmers were feeding that contaminated *berseem* to dairy animals which cause the reduction in milk yield and affecting farmers' pocket ultimately. Hence, awareness regarding *Cuscuta reflexa* poisoning among dairy farmers should be created to prevent the adverse effect of *Cuscuta reflexa* on the health of dairy animals. It may be suggested that farmers should ensure the feed and fodder should be free from any toxic component which may harm the animal.

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Table 4. Gross economic loss incurred during both the years (2021 & 2022)

Household number	Economic milk loss (Rs)		Replacement cost (Rs)	Treatment cost (Rs)		Annual economic loss (Rs) 2021	Annual economic loss (Rs) 2022	Gross Economic loss (Rs)
	2021	2022		2021	2022			
1	9920	12400	Nil	500	1000	10420	13400	23820
2	8680	Nil	20000	2000	Nil	30680	Nil	30680
3	12400	9920	15000	1000	1500	28400	11420	39820
4	Nil	9920	Nil	Nil	500	Nil	10420	10420
5	12400	Nil	Nil	2000	Nil	14400	Nil	14400
6	13640	Nil	Nil	2000	Nil	15640	Nil	15640
7	7440	Nil	Nil	1500	Nil	8940	Nil	8940
8	27280	Nil	38000	4000	Nil	69280	Nil	69280
9	39680	Nil	20000	500	Nil	60180	Nil	60180
10	7440	4960	12000	1500	1500	20940	6460	27400
11	13640	54560	Nil	700	800	14340	55360	69700
12	Nil	9920	Nil	Nil	1100	Nil	11020	11020
13	Nil	29760	Nil	Nil	2500	Nil	32260	32260
Average	15252	18777.14	21000	1570	1271.42	27322	20048.57	47370.57

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