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Conservation of Indian peafowl in agricultural landscape

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Abstract

Indian peafowl *Pavo cristatus* Linn – Indian's national bird is protected under Schedule-1 of Indian Wildlife Protection Act. The non-availability/scarcity of their primary habitat has compelled them to enter into agricultural landscape to which they are well adapted. However, the threat of agricultural activities to birds for their better survival (i.e non-target effect of pesticide) needs to be addressed. A study on Indian peafowl was conducted to quantify the conflicts and threats with birds in agriculture by using indicator parameters like population size, crop damage and pesticide poisoning etc. in part of central Gujarat region during 2007 to 2010. An experiment was conducted to avoid the threat posed by pesticides.

The roost site population size at various locations ranged from 52 to 100 birds. During daytime, the peafowl were mainly distributed in non-cropped area; hedges, scrubland, haystacks, stubbles fields, building & structure and manure heap (78.71 % in monsoon and 80.92 % in winter) within agricultural field. Farmers don't perceive the peafowl damage as economic loss to them and there was no conflict of interest between birds and farmers. The experiments were set to managing the birds by restricting their movement in crop field to resolve the developing conflict among peafowl and farmer. In fact, we did not come across the field crop damaged by peafowl. However, the peafowl mortality due to non-target effect of pesticide application is a serious concern. To avoid the peafowl causality in pesticide treated crop fields, bird's movement in treated field should be restricted. Tying of jute string in and around the field was tested to evaluate its effect on peafowl movement and was found effective. It is advocated to educate the farmers for eco-friendly plant protection practices to conserve the biodiversity in agricultural landscape.

Keywords: Indian peafowl *Pavo cristatus*, agricultural landscape, crop damage, peafowl-farmer conflict, pesticide poisoning, peafowl conservation

Introduction

Indian peafowl *Pavo cristatus* Linn is our national bird and is protected under schedule-1 of Indian wildlife protection act ^[1]. This species has an extremely large range, is native to Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka and exotic to Australia; Bahamas; New Zealand and United States ^[2]. Indian peafowl is patchily distributed all over Indian territory ^[3-5]. The global population size has not been quantified, but the species is reported to be common to locally very common. Their preferred habitat is open meadow in or around scrub and deciduous forest. They have developed dependency upon local human population for food and protection provided by people due to several religious sentiments ^[6]. Being omnivorous species, it feeds on all sorts of grains, seedlings, shoots of plants etc. as well as insects and small reptiles. Intensive agriculture has improved agricultural productivity and where perennial patchy distribution of food resources attract birds (peafowl) and aggregate in crop fields ^[7]. They often forage on valuable crop and cause heavy damage, especially on germinating seeds, necessitating re-sowing. Hence, economic loss to the farmers is very high, particularly when land holding is small. Usually, farmers protect their valuable crop from other pest with pesticides. But they don't use pesticides against depredatory birds. Often they accidentally become victim of pesticide poisoning as peafowl forage on treated field or seed. There is conflict of farmer peafowl interest to maximize benefit from the crop field. This conflict is increasing day by day and affecting directly on survival of the species in agricultural landscape. Therefore, it is necessary to evolve conservation and management strategy for protecting birds from adverse effect of agriculture practices. Keeping this in view, experiments were planned to quantify the peafowl-farmer conflict and find the solutions for the pertinent problem. Population of the birds and their distribution pattern in crop fields, farmer's

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perception of damage to their crop fields and managing the birds by restricting their movement in crop field were studied and reported here.

Material and Methods

Study site

The present study was carried out in the Anand and Kheda districts of central Gujarat (22.30⁰ to 22.51⁰ N latitudes and 72.32⁰ to 72.49⁰ E longitudes), phase-wise during year 2007-10. The region is known for high density of trees at farm hedge and perennial agriculture where crops are grown throughout the year. This situation favours peafowl to reside within agricultural landscape. The peafowl population and its distribution and mortality in agricultural landscape were studied in year 2007. The study on damage perception by farmer in year 2008 and management of birds in crop fields in year 2010 was carried out, to reduce peafowl exposure to pesticide treated crop fields.

Peafowl population and distribution in agricultural landscape

The survey of peafowl population and its distribution in selected villages (i.e. Punaj, Nadhanpur, Khareti, Chikhalia, Untkhari, Dhunadhara Nes, Jhangirpura and Aklavadi) were carried out in agricultural landscape of central Gujarat during Monsoon and Winter season of year 2007, selected villages of central Gujarat region were surveyed for peafowl population and its distribution in agricultural landscape^[8]. The peafowl population was counted by night roost count method in month of May 2007. All the peafowl on arrival at roost were counted from 18:00 hrs to- 20:00 hrs.

To document the distribution pattern of birds in region, about 1 km² area of each study sites was scanned for presence of peafowls with aid of binocular during 6:00 to 9:30 hrs at weekly intervals in July and December 2007. On sighting of peafowl, time of sighting, number of birds and their activity and habitat characteristic were recorded.

Peafowl farmer conflict

Perceptions of peafowl damage

The survey on farmer's perception of peafowl damage to crop was conducted during the year 2008. Villages were selected on the basis of report from local people that it holds sizable population of peafowl, capable to damage crop. Respondents were selected through simple sampling procedure. List of farm owners around peafowl roost sites at different village was prepared and out of each list, 10 cultivators were selected at random. We developed a questionnaire to use for survey of 50 farmers chosen whose farm was located around roosting site of peafowl. All prospective respondents were advised by researcher and local leader about the nature and aims of the survey. Subsequently, 50 farmers were interviewed in person. At interview, each farmer was informed of the confidentiality of his/her reply, and then asked a series of identical questions. The interview normally lasted about 20 minutes. Each survey began with questions on farmer demography. The next questions sought to determine how farmers perceived current and past peafowl population, peafowl visitation to crop fields, crop damage by peafowl in their crops, and other individuals suffered the damage by peafowl to their crop fields.

Peafowl mortality

The study on mortality was conducted at Jhangirpura village of Anand district of Gujarat in 2007-08. Total area of the site is 50 ha mainly under cultivation of agriculture having mango plantation and other wild tree at farm boundary. Estimated peafowl population at site was 52 birds. The area was scanned at weekly interval to document incidences of peafowl causality. On finding of carcasses, paralyzed or sick bird, or mutilated body part, we inquired the locale to collect further details about the incidence. The affected birds were taken to aviary for treatment and further analysis for cause of adverse effect. Further, published and own field observation reports on mortality of peafowl were collected and analyzed.

Management of Peafowl

The experiment to restrict birds on pesticide treated site was conducted to manage non-target effects of pesticide on peafowl. To test effectiveness of various jute strings as physical barriers to prevent bird entry into the artificial feeding sites, experiments were conducted at Aklavadi and Jhangirpura of Anand district, Gujarat during monsoon season of 2009 and 2010, respectively. Experiment was designed by placing plots of 25 sq. m on routes of roost site and water hole. Plots received different treatments to scare and restrict the movement of birds in the plot were: 1) Treated plot where Jute string tied in and around the plot and 2) control where plot was kept open without any hurdle to access. In treated plot, jute string was tied at 15 cm and 30 cm height above the ground at plot boundary and at 30 cm height above ground inside the treated plot in zig-zag manner. In both plots, bait (grains) was offered for 8 days before applying the treatments to habituate birds at site. In bait, 500 gm each of Bajra, Sorghum and Maize were mixed and offered by broadcasting in treatment plots at 06:30 and 17:30 hrs for 8 days. Instantaneous sampling at interval of 5 minute for one hour duration was made from inside of a hide located at 100 distances. Birds visiting treatment plot were recorded for one hour after 10 minutes from offering the grains. Mean number of birds per interval, observed in treatment plot were considered for comparing effectiveness of the treatments.

Results

Peafowl population and its distribution

Peafowl population

Roost site count of peafowl at different sites was ranged from 52 to 200 birds. Most of the sites (Punaj, Nadhanpur, Khareti, Untkhari, Dhunadhara) were having peafowl population of 100 birds and above. While at Nes, Jhangirpura, Aklavadi, and Chikhalia, population below 100 birds was recorded. Recorded population at different sites was quite capable to inflict damage to crop fields.

Table 1: Roosting population of Indian peafowl at various locations in Anand district during year 2007

Place	Tahsil	Roost Population
Punaj	Matar	130
Nadhanpur	Matar	200
Khareti	Matar	152
Chikhalia	Khambhat	67
Untkhari	Umreth	200
Dhunadhara	Thasra	103
Nes	Thasra	63
Jhangirpura	Anand	52
Aklavadi	Anand	72

Peafowl distribution

Distribution pattern revealed that the birds mainly distributed in non-cropped area in both season, monsoon (78.71%) and winter (80.92%) within agricultural landscape (Fig. 1 and 2;

Hedges, Scrubland, Haystacks, Stubbles fields, Building & structure and Manure heap). About 20% birds' were distributed in crop fields. Presence of peafowl in those crops has not inflicted in economic loss to the farmers.

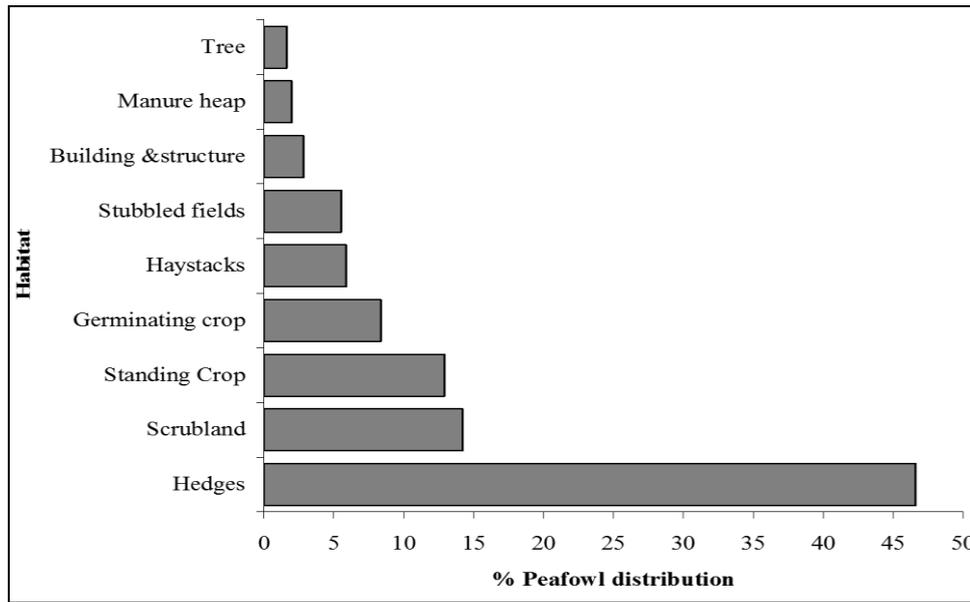


Fig 1: Distribution of peafowl in agricultural fields in monsoon season 2007

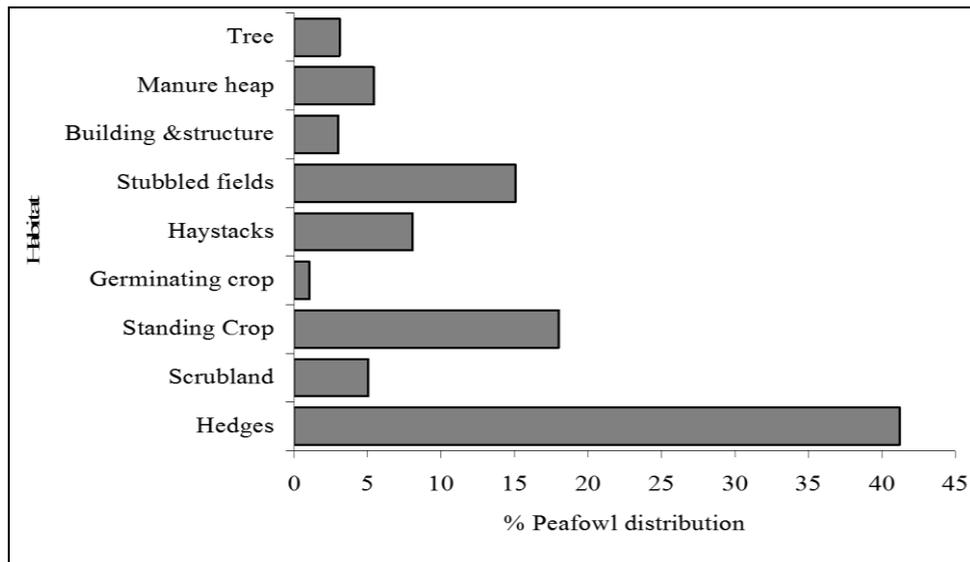


Fig 2: Distribution of peafowl in agricultural landscape in winter season year 2007.

Peafowl- farmer conflict

Perceptions of peafowl damage

The study on perception of peafowl damage to crop resulted that 76% of respondent supported that 'peafowl usually forage in crops fields' (Table 2). Forty two per cent respondents supported that 'peafowls damage to the crop while foraging in crop field'. Only 4% of respondents had supported that peafowls cause economic damage to crop' which shows that foraging on crop by peafowl does not inflict economic loss to

farmer. None of the respondent had seen or heard about the economic damage by peafowl to crop at study site. The results revealed that farmers don't perceive economic loss to them due to damage caused by peafowl while foraging in agricultural crops. The perception of farmers for peafowl damage to crop while foraging (supported by 42% respondent) were higher than actual damage observed by farmer at the field.

Table 2: Distribution of respondents according to their response (n=50)

Query	Number of farmers supported	Percentage
Peafowl usually forage in crop fields	38	76
While foraging in crop field, peafowl damage to crop	21	42
Due to peafowl in crop field, farmer suffer economic loss	2	4
Specify the name of the farmers who suffered economic loss due to peafowl damage to crop	0	0

Peafowl mortality

Anand Agricultural University campus and surrounding area (about 0.5 sq. km) were monitored for the peafowl population and mortality during year 2007-08. The total population of 52 was estimated by night roost count in the month of May 2007 and subsequently incidences of mortality were recorded through enquiring the people regularly. Total 18 birds were reported died due to paralysis and unconsciousness (probably due to pesticide poisoning). The distribution of death report were 2 in month of July 2007, 4 in December 2007, 7 in January 2008 and 6 in March 2008. The gut content recovered from two dead peacock collected from Jahangirpura (Anand) were analyzed in which Profenophos residues were detected. On incidence day, Profenophos was applied on the lucerne crop to control the sucking pest. While foraging on lucerne, peafowl consumed contaminated Lucerne as diet and affected. The peafowl were found unconscious, and paralyzed with difficulty in respiration on consumption of the contaminated food. They succumbed to death one by one within 12 hours of consumption of contaminated Lucerne. The 18 peafowl were

died within a span of year from the present locality where total population was 52 birds. Almost 30 % population died within year is a serious concern.

Published and own field observation reports on mortality of peafowl were collected and analyzed. The result revealed that total 457 peafowl death was reported within last 7 years, mostly due to the pesticide poisoning (Table 3). Mortality pattern of peafowl over year revealed that highest mortality was observed in month of July (26.26%), May (25.38%), January (13.13%) and March (12.47%) (Fig 3a, 3b), with maximum incidences of mortality were 6 in December, 5 in January, 4 in July and 3 in March. The result suggests that mortality of peafowl was distributed all over the year, without any seasonal effect. It suggests that massive mortality of peafowl occurring all over India is not due to heat stress. Besides, most of the published reports had mentioned the death symptoms and consequent evidences suggest that pesticide poisoning was the main reason for such high mortality of peafowl.

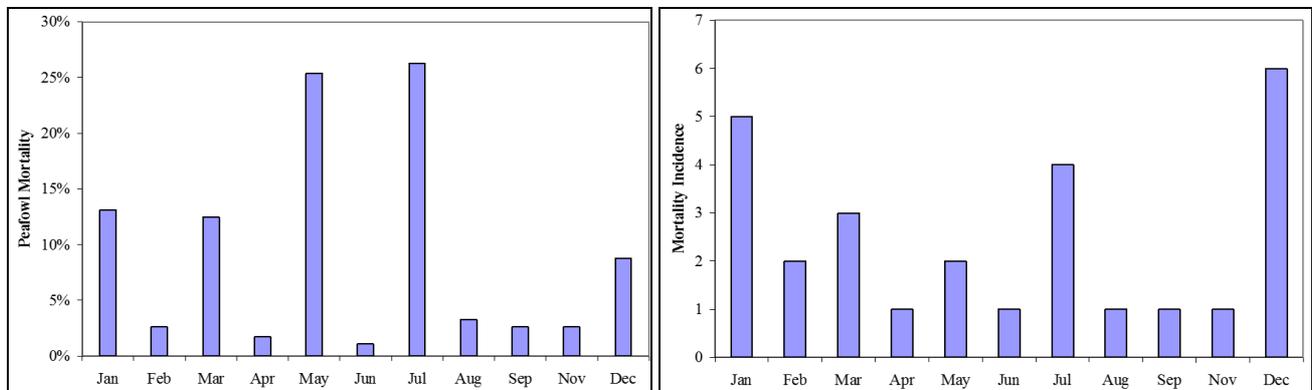


Fig 3: Mortality pattern of Peafowl over year

Table 3: Peafowl mortality reported by Times of India

Date of Incidence	Publication	Place	Total
Grand Total			457
19-03-08	The Economic Times	Mirzapur, UP	50
08-03-08	Times Of India, Ahmedabad	Odhav Jeevdaya Panjarapol	1
04-03-08	Field Observation	Jahangirpura, Anand	6
22-02-08	Times Of India, Lucknow	Allahabad district	6
29-01-08	Times Of India, Pune	Chainpur, Kanpur (UP)	2
28-01-08	Times Of India, Lucknow	Chainpur, Kanpur (UP)	25
11-01-08	Field Observation	Jahangirpura, Anand	7
29-12-07	Times Of India, Chandigarh	Lodhwana, Ludhiana district	11
21-12-07	Field Observation	Jahangirpura, Anand	4
17-12-07	Sandesh, Baroda	Tribhovan Foundation, Anand	3
25-07-07	Times Of India, Mangalore	Gadgag Wildlife Sanctuary, Shirahatti	13
06-07-07	Field Observation	Jahangirpura, Anand	2
17-05-07	Times Of India, Ahmedabad	Morena	100
03-12-05	Times Of India, Chandigarh	Maloud, Ludhiana	2
01-07-05	Times Of India, Mangalore	Gadgag Wildlife Sanctuary, Pallikoppa	25
03-11-04	Gujarat Samachar Ahmedabad	Dakor	12
01-09-04	Times Of India, Mangalore	Gadgag Wildlife Sanctuary, Ingalagi and Yeragatti	12
13-06-04	Saurashtra Samachar	Indore	5
31-05-04	Gujarat Samachar, Ahmedabad	Mosampura, Dehgam	16
03-04-04	Times Of India, Ahmedabad	Bhavnagar	8
25-12-03	Gujarat Samachar, Ahmedabad	Vanana, Jasdan	10
28-12-02	Sandesh, Ahmedabad	Bhajit, Alvar	10
08-07-02	TheTribune, Chandigadh	Morena	80
15-02-02	Rediff News	Delhi Rural	6
16-01-02	Gujarat Samachar, Ahmedabad	Kankaroli-MP Border	15
02-08-01	Times Of India, Ahmedabad	Danta-Ambaji	15
05-01-00	Rediff News	Jambughoda	11

Twenty peafowl died due to incidental mortality occurred at Kasor village. Detail investigation was carried out to find possible reason behind such mortality. We had collected sown wheat grain samples from field from where dead peacocks were reported foraging last. Wheat grains were analyzed by AINP on Pesticide Residue laboratory, Anand; however, report on pesticide residue was nil. Bird tissue was sent to Forensic laboratory, Ahmedabad by Forest Department which reported nil residues. Other birds species died and affected where Spotted Dove, (*Spilopelia chinensis*) babbler (*Turdoides* Spp.) Shikra (*Accipiter badius*) and Black Kite (*Milvus migrans*) etc. Kite and Shikra recovered after medication and were released back to nature.

Management of Peafowl

The experiment to restrict birds on pesticide treated site was conducted to manage non-target effects of pesticide on peafowl. Their movement was restricted using jute string revealed that mean number of peafowl observed in restricted plot was significantly lower than it was observed in open plot ($P < 0.005$), it was 0.00 at Aklavadi and 0.41 birds at Jhangirpura in restricted plot while in open plot it was recorded 3.60 at Aklavadi and 1.21 birds at Jahangirpura) at both sites, Aklavadi and Jhangirpura (Table 2). The result has indicated that jute string tied surrounding treated site was effective to prevent the peafowl to enter the site. It is recommended to farmers/managers, to avoid non-target effect of pesticides to peafowl, tie jute string in and around field to prevent entry and restrict movement of peafowl in pesticide treated crop field. Parallel two strings should be tied firmly, one above the other, one at 30 cm and other at 50 cm height above ground with the help of wooden stakes (Figure 3)

Table 2: Mean number of Peafowl per five minute recorded in experimental plot

Parameter	Anklavadi area		Jhangirpura area	
	Open plot	Restricted plot	Open plot	Restricted plot
Mean	3.60	0.00	1.21	0.41
Variance	6.97	0.00	0.93	0.08
df	14		14	
t Stat	5.28		3.27	
P(T<=t) one-tail	0.00		0.00	
t Critical one-tail	1.76		1.76	

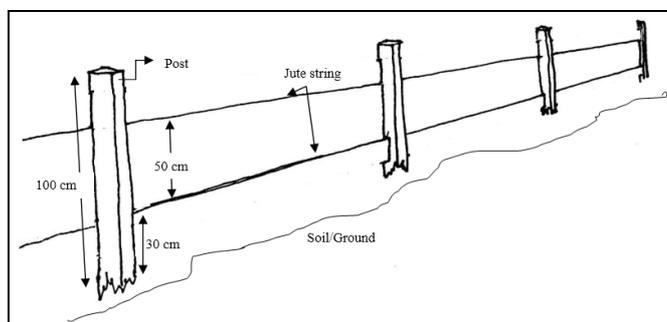


Fig 3: Fence designs to restrict peafowl enter in pesticide treated area.

Discussion

Population and its distribution

Estimated peafowl population over various sites ranged between 52-200 birds. The distributions of peafowl's were on non-cropped area of agricultural landscape. The bird's social

structure suggests that they never aggregate in large group, mostly peafowl move in small group of five or less birds [7]. Moreover feeding preference of peafowl for cultivated vs. wild resources is not available. Distribution of peafowl on non-cropped area suggests that they mostly feed on wild resources [5]. It can be concluded on the basis of social structure and feeding preference that peafowl is harmless to field crop because they generally don't assemble in large group and raid the crop. Resultantly we didn't come across such crop raiding during the study.

Peafowl-farmer conflict

About 42 % of respondent perceived that peafowl was damaging to their crop while foraging in crop field. Usually birds cause damage in agricultural crop while foraging in crop fields [9-13]. But perception of farmers about extent of damage to crop by birds is on higher side because farmer perceive the damage on the basis of birds presence, loss of grains/fruits at border row where usually bird do damage and size of the birds [10, 11, 14]. Farmers do not consider the peafowl as pest to crop fields and sentimentally allow the birds in fields. The diet and habitat preference study supported that peafowl don't pose threat to agricultural [15, 16]. Because of large body size among the other birds foraging in germinating seeds in recently sown crop, some farmer mistake peafowl as culprit for the damage caused to their field. Sometime as counter strategy against peafowl, farmers bait them by broadcasting pesticide treated grains in field deliberately (Times of India, Mangalore dated 26 July 2007). Many researchers has shown concern about threats to birds in agriculture area [15-17].

The details on peafowl mortality in Jhangirpura site revealed that pesticide applied against insect pest take toll of peafowl. Potential risk to pheasants foraging in treated crop recognized in several birds species; Ring-Necked Pheasant [18], Red-legged Partridges and Pheasants [19]. While foraging on pesticide treated plots by peafowl they intake pesticide which affect lethally or sub-lethally to them. Sometime sub-lethal affect of pesticide immobilize the birds and they become easy victim of predators (i.e. dogs). The peafowl became victim of non-targeted pesticide poisoning was common feature in agricultural area [20-24]. Direct conflict between farmer and peafowl is rare because peafowl (birds) were not considered as pest by the farmers. However peafowl was poisoned as non-target organism on entering pesticides treated fields.

Management of peafowl

The recent declines of farmland bird populations in many region of world including India were highlighted many researchers [25-27]. Over an issue of pesticide hazard to peafowl in agricultural landscape, majority of farmers approved that birds should not be penalized for economic benefit of human. But farmers don't know the trick to avoid the peafowl at pesticide treated sites. Experiment for managing birds in crop fields' by jute string tied in and around the field reported less number of birds in treatment plot. The jute string created obstacles to moving birds in the field and consequently birds disappeared from the site. Resultantly, less number of birds was recorded in the plot with jute string tied in and around the plot. Farmers can be advised to tie jute string as obstacle to restrict the movement of large birds in crop field. There are many examples of interventions in agricultural practices to conserve large mammals and birds [28].

Conclusion

The peafowl is our national birds and well distributed in agricultural landscape. The peafowl-farmer direct conflict is rare and not a real threat to bird. The pesticides applied for control of insect pest affected the birds (peafowl). The non-target effect of pesticide is major threat to peafowl population in agricultural landscape. To avoid such non-target effect to peafowl, it is suggested that birds' entry should be restricted on pesticide treated site by tying jute string in and around field. Also it is advisable to follow the good agricultural practice for cultivation of crop to minimize the non-target effect of pesticides to peafowl and other organism. It is suggested that farmer should be educated for eco-friendly practices of plant protection to avoid non-target effects and pesticide hazards to biodiversity.

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