academicJournals

Vol. 8(49), pp. 6608-6614, 19 December, 2013
DOI: 10.5897/AJAR2013.7948
ISSN 1991-637X ©2013 Academic Journals
http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Full Length Research Paper

Limiting the rose-ringed parakeet (*Psittacula krameri*) damage on guava (*Psidium guajava*) and mango (*Mangifera indica)* with an ultrasonic sound player in a farmland of Faislabad, Pakistan

Hammad Ahmad Khan*, Muhammad Javed, Ammara Tahir and Madeeha Kanwal

Department of Zoology and Fisheries, University of Agriculture, Faisalabad, Pakistan 38040.

Accepted 21 November, 2013

This paper provides information regarding the damage of rose-ringed parakeet (*Psittacula krameri*: Scopoli*)* on guava (*Psidium guajava* L.) and mango (*Mangifera indica* L.) with an ultrasonic sound player in an urban garden of Faisalabad. The rose-ringed parakeet, with the status of a serious vertebrate pest throughout the region of Central Punjab, Pakistan, with the availability of suitable roosts and nests on various trees, damages and destroys both cultivated and fruit crops and incurs in substantial damage to farmers and commercial fruit growers. There was also a marked reduction in the numbers of parakeet visitations on the two fruits in the presence of the acoustic player. Seemingly, the roosts of the rose-ringed parakeet occur closely to the food sources and as such, lower levels of energy budgets are required to manifest with frequent visitations from and to their roosts throughout the day, inflicting damage and economic losses to them. Therefore, it seems plausible to use similar bird repellents on a variety of crops to reduce the bird depredatory attacks to improve on economic losses and augment the crop quality and production in the productive agro-ecosystems of Punjab, Pakistan.

Key words: Rose-ringed parakeet, guava, fruit orchards, sound player, management.

INTRODUCTION

Worldwide bird damage to various food crops has been reported to cause substantial economic losses (De Grazio, 1978; Bruggers et al., 1981; Manikowski, 1984; Tracy et al., 2007). Being a major crop pest, the rose-ringed parakeet has become naturalized in many parts of the world in its native range (Forshaw, 1989; Juniper, 1998). Populations of this parrot have significantly increased in England, with alarmingly more than 2,500 individuals, per roost (Butler, 2003). The rose-ringed parakeet (*Psittacula krameri*), also popularly called as the green or ringed parrot, belongs to the family 'psittacidae' and order 'psittaciformes'. Due to its wide feeding niche, it is regarded as one of the most destructive vertebrate pests, particularly in the region of Punjab, Pakistan. It affects the farm crops and horticultural practices and sporadically the stored grains in good proportions (Khan et al., 2011; Ahmad et al., 2012). Of the four recognized subspecies viz. *P. k. borealis*, *P. k. manillensis*, *P. k.*

*Corresponding author. E-mail: druafhammad@yahoo.com

neumann and *P. k. parvirostris*, the earlier two, are in abundance throughout South East Asia, mostly in Pakistan and India, while that of the large Indian parakeet (*P. k. eupatria*), has only been rarely reported from Pakistan (Ali and Ripley, 1969; Whistler, 1986; Roberts, 1991; Forshaw, 2006).

Of the orchards, mango, guava and citrus are economically important as they not only provide nutritious food, but their export to Asia and Europe, fetch lucrative income (Shafi et al., 1986). One of the major inhibiting factors for lower fruit production in Pakistan is due to an intensive damage by the rose-ringed parakeets, particularly in the unguarded crop conditions (Khan and Beg, 1998; Iqbal et al., 2001). Farmer's frequent choice for the multiple cropping practices over a relatively small area of 12 ha, throughout the region of Punjab, for convenience, augments in severe damage by the parakeets, crows, sparrows, mynas and staling besides, the small and large mammals (Akande, 1986; Khan and Hussain, 1990; Roberts, 1991; Iqbal et al., 2001).

By far, the ringed parakeets appear to be more tenacious, as they not only spoil the food sources, but also cause substantial economic losses to local farmers and the stakeholders, establishing their roosts and nests among suitable old and tall trees, located closer to the crops (Khan and Beg, 1998; Strubbe and Mathysen, 2009). It is worth pointing out here that many of their roosts become permanent and are in their use year after years, along side the canal irrigation, road side avenues, urban gardens and the undisturbed habitats of the college and university campuses (Khan, 2002). Butler (2003) reported that roosts of the rose-ringed parakeet are considered broader and stable than that of any other global roosting bird. Potential economic impacts of *P. krameri* on agriculture, conservation concerns, and mixed public opinion regarding the species have highlighted the need to expand effective and human management options (Lambert et al., 2010). Richness for parakeet species densities have been recorded higher for both harvested sunflower and corn fields than for the small-grain and soybean fields, and the application of broad spectrum herbicides with enhanced harvesting effectiveness of crops have reduced the accessibility of weed seeds and waste grains for game and non-game wildlife (Rao and Shivanaryanan, 1981; Galle et al., 2009).

According to De Grazio (1978), worldwide avian damage to economically important crops not only brings about the damage, but also raises certain health and safety issues to man. Malhi (2000) suggested that the damage to seedlings and the mature stages of the sunflower crop is inflicted mainly by the house crow (*Corvus splendens* L.), and that of the *P. krameri*. Studies conducted by Gilsdorf et al. (2002) on sunflower crop in Ludhiana, India for a period of five months viz. November, December, January, February and March, pointed out that in the early sowing season, seemed more suitable for bird depredations. At this stage, induction of frightening and mechanical devices, augmented in reduced bird damage and, without any serious impact on the agro-ecosystems. Farmers have mostly been relying on traditional methods of control like sling shorts, beating of metallic drums and hurling voices to disperse the attacking birds on crops, and with a least success (Whistler, 1986; Roberts, 1991;Anderson et al. 2013). Ecological friendly means coupled with intermittent avicides, have been largely recommended in view of fast deteriorating environment, particularly to do away with the predicament of pest resistance among birds (Day et al 2003; Avery et al., 2002; 2005). For the present studies, it was hypothesized that, incorporation of distress sound player would considerably reduce the rose-ringed parakeet depredations for both the fruits in terms of their production and economics of a horticultural fruit farm in the study area.

MATERIALS AND METHODS

Study sites

Observations on using ultrasonic sound player to reduce rose-ringed parakeet (*Psittacula krameri*) depredations on both guava and mango were extended in agricultural farmland of Faisalabad, with latitude 31°25 north and longitude 73°04, of Central Punjab. This region is characterized by the dry and humid hot summer (42±5°C) in May through August and exceedingly cold winters (2±5°C) in December through February. Main agricultural and horticultural crops in this region comprise wheat, maize, rice, fodders, sugarcane, sorghum and millet; citrus, dates, guava, mango and mulberry. The region is canal irrigated with three main canals viz. Jhang branch, Gogera branch and Rakh branch, with their water tributaries, irrigate bulk of the crops along side the canal rest houses with more or less modest populations on their banks.

Present observations continued for a period of twelve weeks with an ultrasonic player placed inside the both orchards during May through July, 2011 of an orchard fruit farm at the University of Agriculture, Faisalabad, of Central Punjab province of Pakistan. Observations were extended in the evening and of a total 108 fruits each observed for damage, in the unprotected conditions, for guava, it was 108±14.97SE, and for mango, 108±15.31SE, numerically assessed through manual count methods throughout the studies, for both unprotected and protected conditions. For the protected conditions using ultrasonic sound player, it were 108±7.60 SE and 108±1.64 SE. A sufficiently large area of this campus has an enrich flora of mainly experimental crops throughout the year. As such, there appears no dearth of food for pest faunistics round the year. Occurrence of a variety of invertebrate and vertebrate pests occurs in fairly good numbers. Guava (*Psidium guajava* L.) has two crops in summer and winter, while the mango (*Mangifera indica* L.), comes about during late spring (April) till early fall (September). Guava and mango were sampled using the randomized sampling design, in square nine fruit orchard of the Institute of Horticultural Sciences, University of Agriculture, Faisalabad. Observations were recorded consecutively for three hours (with a 10 minute time intervals) in the evening for the unprotected phase, and again for the similar duration, in the protected conditions (with ultrasonic sound player). The sound player is a bird repellent has au audio play back sound of alarming noises of some fearsome animals, is equipped with a chargeable battery, to disperse attack of birds. It was placed in the middle of the field. Numbers of parakeet visits per stipulated time interval were recorded during the same durations on both fruits. Data

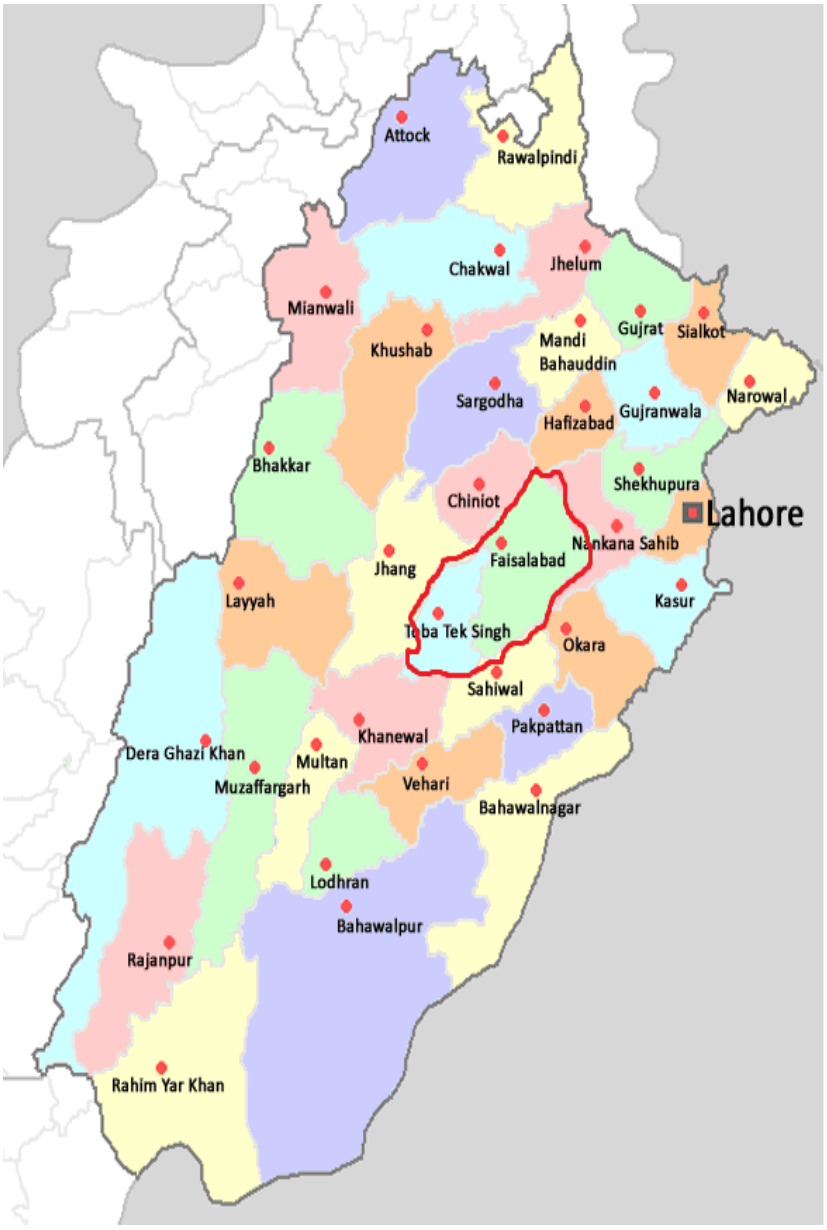

Figure 1. Map of the Punjab Province, Pakistan.

obtained was statistically analyzed with one way Analysis of Variance (ANOVA) for a comparison of means for the unprotected and protected situations with correlation drift for the fruit damage under both conditions (Figures 1 and 2).

RESULTS AND DISCUSSION

From the present data, it was evident that both the fruits were extensively damaged by the rose-ringed parakeet in an unprotected phase. However, there remained a considerable decline in the damage proportions in the presence of distress sound player (Table 1) in both of them which also impacted on the mean damage for guava and mango, and that there was a strong impact of the playback of loud and intermittent noise produced by fearsome animals (Table 2), and kept the attacking parakeets at a bay from both fruits (Figures 3 and 4). There was also a fairly strong correlation between the numbers of parakeet visitations and fruits in the orchard. Depredations were augmented without any shielding impact from that of the sound player (Table 3) and high values of coefficient of regression R^2, 0.997 and 0.999 (Figures 5 and 6). In another study conducted at the same facility (Ahmad et al., 2011, 2012), frequency of parakeet visitations for unprotected conditions for maize and sunflower also remained highly significant, and comparable findings to these, regarding the pestiferous

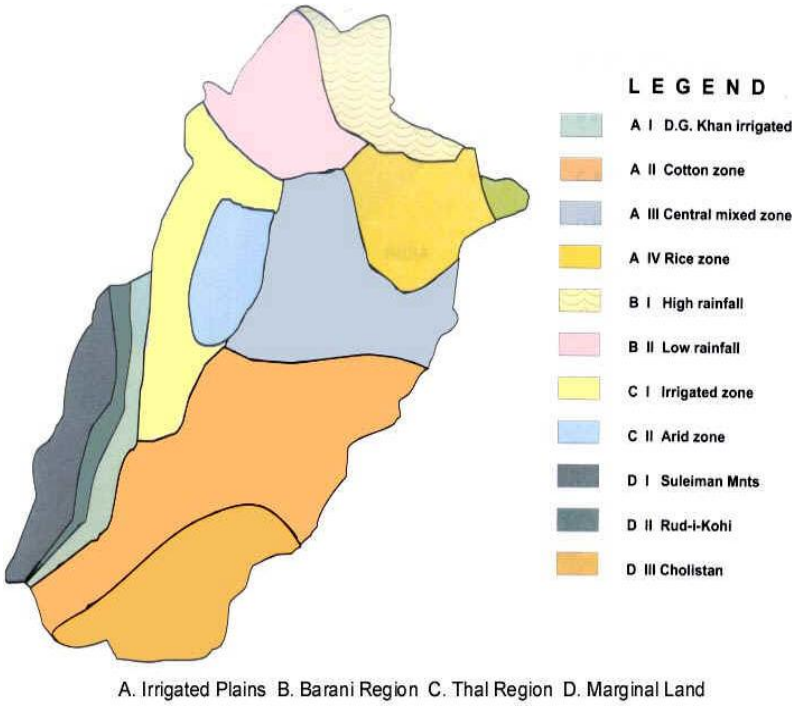

Figure 2. Major Ecological Regions of Punjab Province, Pakistan.

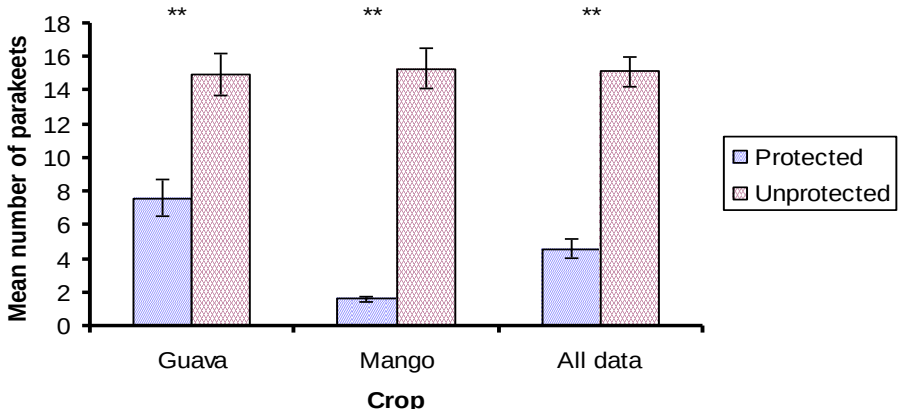

Figure 3. Mean number of rose-ringed parakeet visitations on guava and mango in an urban garden of Faisalabad. ** = Highly significant P<0.01 (Protected vs Unprotected).

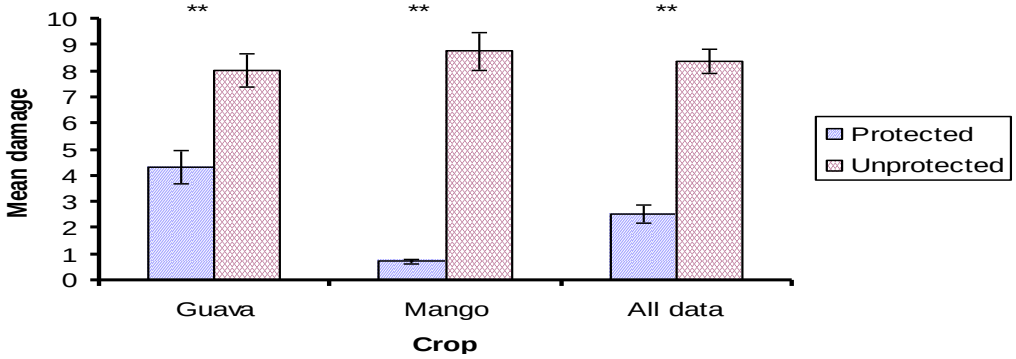

Figure 4. Damage recorded to fruits by the rose-ringed parakeet to guava and mango in a fruit farm of study area. ** = Highly significant P<0.01 (Protected vs Unprotected).

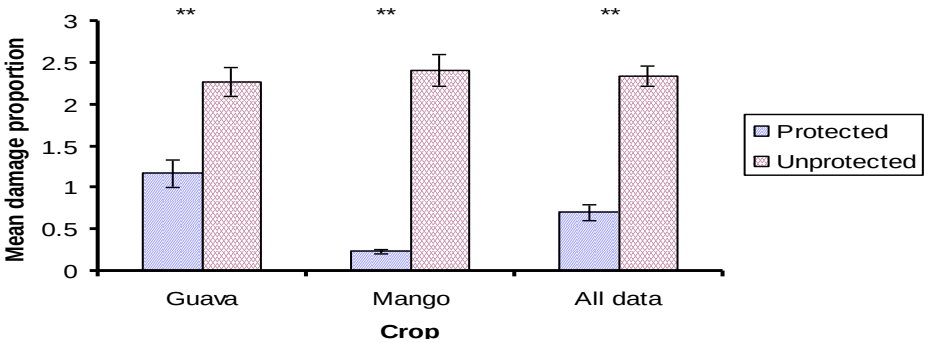

Figure 5. Mean damage recorded to fruit crops in the unprotected and protected conditions. ** = Highly significant P<0.01 (Protected vs Unprotected).

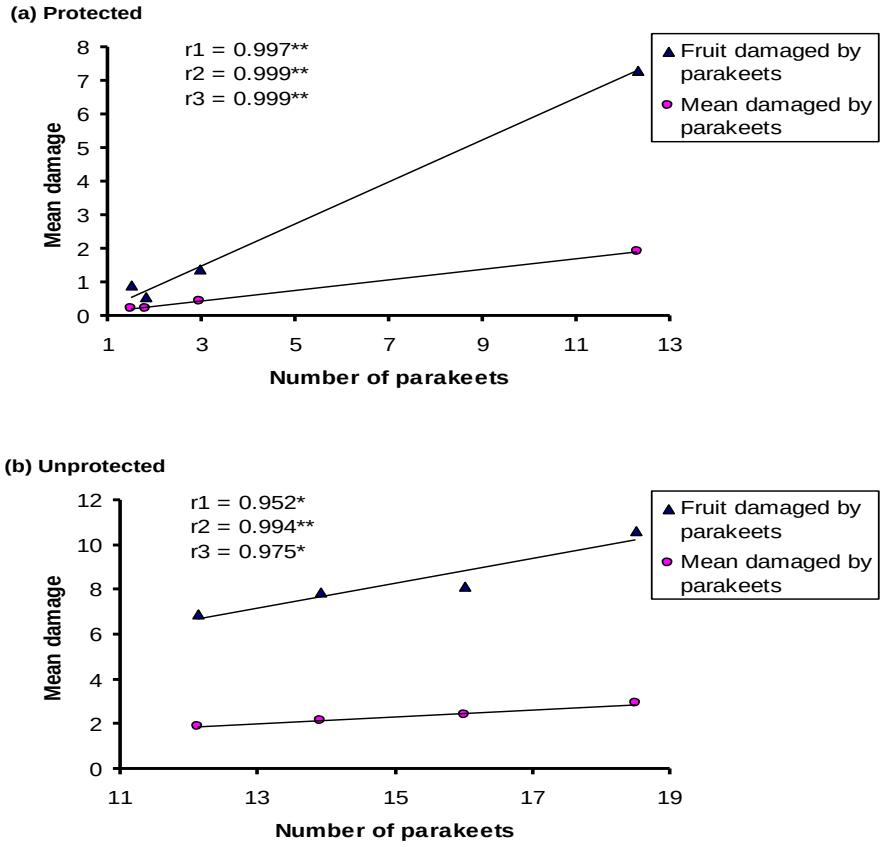

Figure 6. Mean correlation for unprotected and protected conditions of guava and mango in an orchard fruit farm. r1 = Correlation between Number of parakeets and fruit damaged by parakeets, r^2 = Correlation between Number of parakeets and mean damaged by parakeets, r3 = Correlation between mean damages and fruit damaged by parakeets.

implications of rose-ringed parakeets, have been also reported by (Anonymous, 2004a, b; Sushil and Kumar, 1994; Gupta et al., 1998).

An important aspect of this study was that the damage was apparently high in the evening with sufficiently large numbers of parakeet flocks inflicting the damage to both the fruits, to suffice their food requirements for spending the fasting night in their roost. In literature, similar results have also been described by (Dvir, 1985; Iqbal et al., 2001). Unquestionably, the wide feeding niche of the rose-ringed parakeet is mainly due to suitable ecological conditions here in the region of Central Punjab and,

Table 1. A Comparison between protected and unprotected conditions regarding number of rose- ringed parakeets (*Psittacula krameri*) visited.

Crops	Conditions	N	Mean	SD	SE	t-value	Prob.
Guava	Protected	108	7.620	11.186	1.076	-4.51**	0.000
	Unprotected	108	14.963	12.709	1.223		
Mango	Protected	108	1.639	1.743	0.168	-11.29**	0.000
	Unprotected	108	15.315	12.464	1.199		
All data	Protected	216	4.630	8.531	0.580	-10.17**	0.000
	Unprotected	216	15.139	12.559	0.855		

** Highly significant (P<0.01); SD = Standard deviation; SE = Standard error.

Table 2. A Comparison recorded between protected and unprotected conditions regarding number of damaged fruits.

Crops	Conditions	N	Mean	SD	SE	t-value	Prob.
Guava	Protected	108	4.343	6.715	0.646	-4.06**	0.000
	Unprotected	108	8.019	6.595	0.635		
Mango	Protected	108	0.731	1.056	0.102	-11.20	0.000
	Unprotected	108	8.769	7.381	0.710		
All data	Protected	216	2.537	5.125	0.349	-9.93	0.000
	Unprotected	216	8.394	6.993	0.476		

** Highly significant (P<0.01); SD = Standard deviation; SE = Standard error.

Table 3. An assessment between protected and unprotected conditions regarding mean damage.

Crops	Conditions	N	Mean	SD	SE	t-value	Prob.
Guava	Protected	108	1.172	1.756	0.169	-4.48**	0.000
	Unprotected	108	2.274	1.861	0.179		
Mango	Protected	108	0.236	0.259	0.025	-11.40**	0.000
	Unprotected	108	2.407	1.962	0.189		
All data	Protected	216	0.704	1.337	0.091	-10.32**	0.000
	Unprotected	216	2.341	1.909	0.130		

** Highly significant (P<0.01); SD = Standard deviation; SE = Standard error.

therefore, render it to be one of the worst vertebrate pests in the unguarded conditions, using certain trees as roosts and the hollows as nests (Shafi et al., 1986; Sarwar et al., 1989a, b; Khan and Beg, 1998). Throughout the region of Central Punjab, Pakistan, introduction of canal irrigation system to improve on agriculture more than a century ago, involved planting of trees along the canal rest houses of the main irrigating canals. Trees viz. *Salmalia malabarica*, *Dalbergia sissoo*, *Terminalia arjuna*, *Ficus benghalensis* and *Cedrella toona*, grown here, have become old and tall, providing many cavity nesting birds with safe roosts and nests, and therefore, augmenting their populations (Khan, 1999; Ahmad et al., 2011). Seemingly with a shorter distance from their roosts, damage traveled by the rose-ringed parakeet and some allied birds on the cultivated and non-cultivated crops, and orchard fruits, damage remains unparalleled, causing substantial economic losses (Butler, 2003; Sarwar et al., 1989a, b; Roberts, 1991).

Use of the traditional methods for crop management against the damage of birds, has failed to deliver the required dividends to the farmers and stakeholders (Dechant et al., 2003). Present studies also report on the ecologically effective management measures like the use of avian repellents to inhibit their depredations. The sound player with play back noises of fearsome creatures

helped to reduce the damage with minimized depredatory attacks on both guava and mango and that of an important oil-seed sunflower (Parwin, 1988) in the study site. This resulted in a better fruit crop production and also the least economic losses.

Conclusion

In the light of the present findings, it seems appropriate to incorporate few more such repellents viz. multi-mirror reflectors, reflecting ribbons, fire exploders and bird hawk eye rotators, to be tried under same conditions for varying crops, to substantially reduce the bird damage and also to gain maximum yields without exerting a fatal impact on the sustainability of the productive ecosystems. Similar eco-friendly management bird studies have remained wanting mainly due to the complexities involved in aerial mode of life. Present studies however, raise a useful anticipation regarding their efficient control using environmentally friendly methods, in contrast to the avicides to challenge the ecological safety issues.

ACKNOWLEDGEMENT

This work was financially supported by the funding from Agricultural Linkage Program, Pakistan Agricultural Research Council, Islamabad, Pakistan.

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