

Management Strategies for Birds and Wild Animals in Organic Crop Production

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Abstract

The organic farming in real sense envisages a comprehensive management approach to improve the health of underlying productivity of the soil. On the other hand organic agriculture is a production system which avoids or largely excludes the use of synthetic compounded fertilisers, pesticides, growth regulators and livestock feed additives. It relies on crop rotation, crop residues, animal manure, legumes, green manure, off farming organic waste and aspects of biological pest control. The crop production in general affected through various insect pests, plant diseases, and weed plants to a greater extent in different stages of crop in anyway neither inorganic nor organic farming. In recent times, apart from the above pest and diseases, avian fauna mainly consisting of depredatory birds and mammals with special reference to rodents, wild boars, blue bull and monkeys started gaining pest status and in certain cases a huge damage is being encountered due to some of these vertebrate pests. Among them, depredatory birds and wild boar has become regular menace for farmers in major crops resulting into enormous crop damages. The present study focused to evaluate various cost-effective management strategies to minimize the damage caused by vertebrate pests and also to minimize man-animal conflict in agricultural landscape.

Keywords: Organic crop production, birds, wild animals,

1. Introduction

The concept of organic farming is not clear to many persons (Palaniappan and Annadurai 1999). Many people think that traditional agriculture, sustainable agriculture and Jaivik Krishi etc, are organic farming. Some people are of the idea that the use of organic manures and natural methods of plant protection instead of using synthetic fertilisers or pesticides are organic farming. But this is not true. The organic farming in real sense envisages a comprehensive management approach to improve the health of underlying productivity of the soil (Palaniappan and Annadurai, 1999). Earlier Lampkin et al. (1999) mentioned that organic agriculture is a production system which avoids or largely excludes the use of synthetic compounded fertilisers, pesticides, growth regulators and livestock feed additives. It relies on crop rotation, crop residues, animal manure, legumes, green manure, off farming organic waste and aspects of biological pest control (Bhattacharyya, 2004). But the most recognised definition of organic farming is: The term "organic" is best thought of as referring not to the type of inputs used, but to the concept of the farm as an organism, in which all the components -the soil minerals, organic matter, microorganisms, insects, plants, animal and humans - interact to create coherent, self-regulating and stable whole. Reliance on external inputs,

whether chemical or organic, is reduced as far as possible. Organic farming is (w) holistic production system (Lampkin et al., 1999). The crop production in general affected through various insect pests, plant diseases, and weed plants to a greater extent in different stages of crop in anyway neither inorganic nor organic farming. In recent times, apart from the above pest and diseases, avian fauna mainly consisting of depredatory birds and mammals with special reference to rodents, wild boars, blue bull and monkeys started gaining pest status and in certain cases a huge damage is being encountered due to some of these vertebrate pests. Among them, depredatory birds and wild boar has become regular menace for farmers in major crops resulting into enormous crop damages (Rao, 2000). The present study focused to evaluate various cost-effective management strategies to minimize the damage caused by vertebrate pests and also to minimize man-animal conflict in agricultural landscape.

Several ITKs are being employed by the farming community to ward off depredatory birds and wild animals in different innovative ways. Some of such effective ways, practiced by local people were scientifically evaluated and validated for effectiveness and economic feasibility. Even though several traditional methods are in practice but their efficacy cannot match with the desired yields, this is mainly an account of



establishment of feeding patterns and fast acclimatization to the situations by pest species of both birds and animals. In this context, to reduce the crop losses, based on behavioural pattern of targeted birds and animals extensive field studies and trials were under taken by All India Network Project on Agricultural Ornithology in different agro ecological regions. Through intensive field research designed and developed cost effective, eco friendly and environmentally safe management methods across different agro climatic zones on various crops to reduce crop losses by depredatory birds and wild animals by AINP on Agricultural Ornithology (Rao, 2000; Rao, 2013). The following are the sum of such methods which are being recommended through AINP on Agricultural Ornithology.

2. Eco Friendly Bird Management Methods

2.1. Seed treatment during sowing

Seed treatment with copper oxychloride 3 g kg⁻¹ seed will reduces the damage caused by birds after sowing and also the percent composition of depredatory birds reduced to extent of 54-72%.

2.2. Reflective ribbons

Reflective ribbon is a polyester film with a shining metallic coating with red on one side and silver on the other. It is prepared by cutting along continuous polyester sheet in to strips of 1.5 cm width. Such strips, preferably 15 to 20 m long, are fixed parallel to the crop at 0.5 m height above the crop and at 5 m intervals using bamboo poles and strings. For better reflection, the ribbon should be fixed in north to south direction. During sunshine the reflection of sunlight and humming noise produced by the wind scares the birds from the field. The installation of reflective ribbon on sunflower crop resulted an yield of 1635.5 kg ha⁻¹ (*Kharif*) and 1264 kg ha⁻¹ (*Rabi*) when compared to controls 1281 kg ha⁻¹ (*Kharif*) and 756 kg ha⁻¹ (*Rabi*). The percent increase of yield over control is 12.15% during *Kharif* and 23.85% during *Rabi* (Table 1).

2.3. Screen Crop

Thick planting of sorghum (fodder crop) as well as of maize significantly reduced parakeet damage to minimize crop grown for grain production. By using this technique experimental plot yielded 1764 kg ha⁻¹ during *kharif* and 1605 kg ha⁻¹ during *Rabi* against controls 1195 kg ha⁻¹ during *kharif* and 1207 kg ha⁻¹ during *rabi*. The yields showed percent increase to the extent of 19.2% during *kharif* and 13.58% during *rabi* over controls (Table 1).

2.4. Fixing of coconut rope around the field

During sowing stage, coconut rope is fixed parallel to the crop at 1 ft height above the ground at 5 m intervals in the entire field using bamboo poles reduces peafowl entry to the extent of 85% and reduces seed damage.

2.5. Reflective paper plates

The paper plates are arranged on the stalk behind the flower

such that the reflective surface faces outside. So that the sun rays will be reflected back, this prevents the birds' vision and approaching the crop. The installation of reflective paper plates on sunflower crop resulted a yield increase of 1555 kg ha⁻¹ (*Kharif*) and 1309 kg ha⁻¹ (*Rabi*) when compared to controls 1097 kg ha⁻¹ (*Kharif*) and 422 kg ha⁻¹ (*Rabi*) (Table 1). The percent increase of yield over control is 17.27% during *Kharif* and 47.99% during *Rabi*.

2.6. Wrapping

Covering maize cobs by wrapping adjacent green leaves around them reduced the damage to a negligible level by parakeets and crows, which were the major problem birds. Being hidden camouflaged, the wrapped cobs escape detection by birds and thus the crop is protected. This method does not have negative impact on the grain yield. All cobs need not be covered. Since parakeet damage is restricted to peripheral rows, covering of 50% cobs at random on outer 3 rows of the field is sufficient to effectively reduce bird damage. Wrapping of Maize cobs by adjacent green leaves yielded 1418.3 kg ha⁻¹ (*Kharif*) and 1352.8 kg ha⁻¹ against control 837 kg ha⁻¹ (*Kharif*) and 756 kg ha⁻¹ (*Rabi*). The increased yields over control were observed to the extent of 25.77% during *Kharif* and 26.71% during *Rabi* (Table 1).

2.7. Spraying of egg solution

Spraying of egg solution@ 25 ml l⁻¹ of water was very effective in control of bird damage in Safflower, Maize, Sunflower, Sorghum, Bajra, and other food crops. In sunflower and sorghum, among the treatments egg solution @20 ml l⁻¹ showed higher yields, in sunflower during *kharif* 950.7 kg ha⁻¹ and 1391 kg ha⁻¹ during *Rabi* against control 438 kg ha⁻¹ (*Kharif*) and 738 kg ha⁻¹ (*Rabi*). The percent yield showed an increase of 36.92% during *kharif* and 28.82% during *rabi* over controls (Table 1).

2.8. Pyrotechnic

This is a sound producing device which works continuously for a whole day with 1 kg of calcium carbide and water. One-hectare areas can be covered with this method and it is found effective in reducing crop losses by birds. Care must be taken about the frequency of firing and change of positions and directions to avoid bird getting habituated.

2.9. Bio-acoustics

The acoustic equipment can also effectively drive birds away. It consists of 1 stereo tape recorder with 30 w amplifier, 2 speakers and one 12 v battery. Pre-recorded tapes of distress calls of birds are played. The operation of the equipment should be done from a distance of about 100 meters and the speakers should be kept in bushy spots near the field area. Depending on the intensity of bird activity, the frequency of play should be setup at regular time intervals. Broadcasting of such distress calls of depredatory birds keeps the birds away from maize fields and also other crops. This method is very effective in orchards and small acreage crops. Installation of



Table 1: Showing the efficacy of various methods to protect the crop from depredatory birds and wild boar

Sl. No	Treatment	Crop	Protection against	Kharif (Yield kg ha ⁻¹)			Rabi (Yield kg ha ⁻¹)		
				Treat-ment	Con-trol	% yield in-crease	Treat-ment	Con-trol	% yield in-crease
1.	Reflective ribbons	Sunflower	Depredatory birds	1635	1281	12.15	1265	756	23.85
2.	Reflective paper plates	Sunflower	Depredatory birds	1555	1097	17.27	1309	422	47.99
3.	Wrapping	Maize	Depredatory birds	1418	837	25.77	1353	756	26.71
4.	Spraying of egg solution	Sunflower	Depredatory birds	951	438	36.92	1391	738	28.82
5.	Screen crop	Sunflower	Depredatory birds	1764	1195	19.2	1605	1207	13.58
6.	Bio-acoustics	Sunflower	Depredatory birds	1540	593	44.40	1390	340	56.02
7.	Four rows of Safflower around the crop	Ground nut	Wild boar	1875	457	60.81	1313	862	19.28
8.	Four rows of castor around the crop	Maize	Wild boar	5524	1133	66.0	4616	1640	46.11
9.	Barbed wire fence	Maize	Wild boar	1049	786	14.33	1781	908	31.14
10.	Circular razor fence	Maize	Wild boar	2267	823	46.73	1196	780	19.59
11.	Chain link fence	Maize	Wild boar	1066	786	15.13	1069	780	14.71

this equipment in sunflower resulted in higher yield 1540.0 kg ha⁻¹ against control 593.0 kg ha⁻¹ against control 593 kg ha⁻¹ (*Kharif*) and 340 kg ha⁻¹ (*Rabi*). The percent increase of yield over control is 44.40% during *Kharif* and 56.02% during *Rabi* (Table 1).

2.10. Habitat manipulation

Creating continuous disturbances to the nesting sites of the depredatory breeding birds in and around the cropped areas that will force the birds to leave breeding grounds and shift to another area. For parakeets in addition to manual destruction of nests, closing the entrance of the nests proved effective reducing their population. Planting of some fruit bearing trees like Manila tamarind (*Pithecolobium dulce*), Flame of the forest (*Butea monosperma*) Mulberry (*Morus alba*) and Toothbrush Tree (*Salvadora persica*) in and around cropped areas attract many granivorous birds during fruiting period and reduces the impact at vulnerable stage of the crop.

3. Traditional bird management method

3.1. Machan

A machan is erected amidst the maize crop. A semicircular mat made of bamboo splits is put on the machan to prepare a small hut for the shelter which is locally called *dhagla*. Sometimes, instead of semicircular mat, an umbrella type structure made of leaves of *Butea monosperma* and bamboo sticks (locally called *dengcha*) is placed on machan. Loud calls are made from the *machan* to keep away the birds. Stones are thrown by locally made equipment called *gophana* (sling) to drive away birds. By using this technique the extent of damage

through birds can be reduced to 5-10%

3.2. Flagged bamboos and flagged leader shots

pieces of plastics and coloured clothes are tied on bamboo sticks which are erected amidst the crop in the field to keep away the birds. Sometimes these are placed at the periphery only. When the crop reaches the milky stage, flags of cloth are tied on leader shoots of some of the tall trees. This method is effective in controlling bird damage up to 8-12%

3.3. Pitcher-effigy (Scare crows)

Pitcher-effigies (locally called *byawana* or *taoon*) are prepared by the farmers with locally available material. An old pitcher (terracotta vessel), having black outer surface due to use in kitchen for cooking purpose, is kept upside down on a vertically erected wooden pole of a man's height to symbolize the head of a man having black hair. Sometimes head is made by black cloth also. Then, a horizontal stick is tied to the vertical pole to resemble arms raised to shoulder level. An old shirt (kurta) is put on the wooden structure to make an effigy of a man working in field. This method can reduce the bird damage up to 10%

3.4. Use of owl rests

Cushion owl-rests: A coiled mass of *Tectona grandis* leaves is wrapped at one end of a bamboo stick. Dozens of such sticks are erected in the field keeping the leaf mass upward. At night, owls are attracted to these perches and prey on night dwelling rats. This method is generally used in fields of wheat and gram. *Pole owl-rests*: Poles of bamboo culms, 0.5 to 1.5 m long, are erected amidst gram, wheat and barley crops to provide perching stations to the owlets during night to



minimize rodents damage to the extent of 15%

3.5. Hanging Crows

A hung dead crow is said to be very effective in repelling crows. This method is equally effective in houses as well as in fields. This method will deter the birds up to 10-15%

3.6. Calls made by 'ghunku'

'Ghunku' is a simple device made by locally available material. An earthen pitcher used in persian wheel (to draw water from wells, locally called ged) is taken and a piece of goat skin having a hole in its centre is tied to the mouth of the pitcher. A tall feather of peacock is inserted in the hole and a knot is made at its lower end. This apparatus is held between the feet and then a massage like action is made on the feather with the thumb and the first finger. To make the action easy, few oil drops are also applied on the feather. A loud call is generated by this apparatus which is said to be effective in frightening nocturnal animals. This is also used during day-time to keep away birds. By this method the bird damage can be minimized to the extent of 7-13%

3.7. Halas

This method is mainly practised by *Saharias*. A string is tied loosely around or across the fields. Leaves of *Tectona grandis* are tied to the string in a series. This festoon of leaves is connected by another string at the mid-point. A man sitting on a machan pulls the string in jerky motions and dry, hanging leaves produce a typical buzz like sound which keeps away the birds and other animals. This indigenous device is called *halan* (i.e., something which moves). Many variations of this system can be seen in the state. Sometimes bells instead of leaves are also used. Sometimes, single leaf *halan* (locally called *jalra*) made by bamboo pole and striated *Tectona grandis* leaf are also erected amidst the crop to keep away rodents and birds.

3.8. Drum beating

Drums are beaten from some elevated places or machans to keep away the flocks of grain eating birds. This method is said to be effective against the raid of locusts also.

3.9. Use of feathery grass inflorescence

Just after sowing of wheat and gram, feathery inflorescence of *Saccharum bengalense* are erected at random in the fields. This method is said to be effective to keep away the grain eating birds.

3.10. Use of white-washed stones

In southern Rajasthan, white-washed stones are put in a series at the periphery of gram and wheat fields to keep away the Sarus Cranes, Grey Partridges, Hares, etc.

3.11. Methods to protect harvested crop

Generally the harvested stems of jowar and bajra are bundled and then piled in a conical shaped heap, keeping all the ear ends upwards. These conical heaps are locally called chhauras. Spiny bushes of *Zizyphus nummularia* are cut and placed on

the top of the heap to keep away the bird flocks.

4. Eco Friendly Wild Animal Management Methods

4.1. Spraying of egg solution

By exploiting the habit of the wild boar using smell of the crop as criteria for identification, an extensive level of experiments were carried out to use spray of egg solution either on the border row of the crop or on the wet soil around the crop. The results has given a clear cut indication that spray of egg solution 20 ml l⁻¹ of water was capable of successfully making the natural odour of the crop and thereby reducing the wild boar damage. By using this method, wild boar entry into the crop fields can be reduced up to 65–85%

4.2. Four rows of Safflower around the crop

The practice of having 4–5 rows of safflower crop as border crop around ground nut found to be most promising in preventing the damage by wild boar. Safflower crop by being thorny in nature will cause great amount of inconvenience and damage to wild boar especially under situations when it is sown in closed spacing. In addition, safflower crop emits strong chemical odour effectively masking the odours emitted by ground nut crop. Due to this wild boar at the first instant will fail in locating the ground nut crop, secondly even if it is locates the thorns of the safflower plant causes mechanical injury or damage, thereby they will not try to enter into the ground nut field. This method was experimentally validated in different locations. The experimental plot yielded 1875 kg ha⁻¹ during *kharif* and 1312.37 kg ha⁻¹ during *rabi* against controls 457 kg ha⁻¹ during *kharif* and 862.5 kg ha⁻¹ during *rabi*. The percent increase of yield over control is 60.81% during *kharif* and 19.28% during *rabi* (Table 1).

4.3. Four rows of castor around the crop

This method is widely being popularized in maize crop by planting 4-5 rows of castor with close spacing around the maize crop. Wild boars being capable of identifying maize only through smell can't do so owing to the strong odour emitted by the castor successfully masking the odour emitted by the maize crop. Damage in castor by wild boar is also not possible due to the non palatable nature of the plants with high amount of alcholodies and glucosides. By using this technique experimental plot yielded 5524.45 kg ha during *Kharif* and 4615.6 kg ha during *rabi* against controls 1133 kg ha during *kharif* and 1640.6 kg ha during *rabi*. The yields showed percent increase to the extent of 66.0% during *kharif* and 46.11% during *rabi* (Table 1).

4.4. Planting of Karanda around the crop

Planting of karanda (*Carrissa carandus*) around the crop as bio fence does prevent effectively the entry of wild boars into the cropped area owing the thorny nature. Using karanda as a border crop gives enormous benefits to the farmer by giving value added products extract of medical important effective alternative to tamarind etc., in addition to fulfilling of basic



purpose of wild boar prevention.

4.5. Barbed wire fence

Erecting of barbed wire around the field in three rows with first row is at the height of 1 foot from the ground. This is highly effective in preventing wild boars from entering into the cropped area. Using of barbed wire fence as border against wild boar around maize crop yielded 1049 kg ha⁻¹ during *kharif* and 1781 kg ha⁻¹ during *rabi*, which is predominantly higher than the control 786 kg ha⁻¹ (*Kharif*) 908 kg ha⁻¹ (*Rabi*). The yields showed an increase of 14.33% during *kharif* and 31.14% during *rabi* over control (Table 1).

4.6. Circular blade wire fence

The iron wire fixed with sharp razor blades at regular distance is kept 1 ft away from the cropped area as border by farming circular rings. The blades caused serious damage to the wild boar which tries to enter into the field. This not only prevents the animal to enter into the field but also scares away other animals. The entangled animal makes alarm calls which deter away the other wild boars thereby saving the entire crop without any damage. Using of Circular blade wire fence as border against wild boar around maize crop yielded 2267 kg ha⁻¹ during *kharif* and 1195.8 kg ha⁻¹ during *rabi*, which is predominantly higher than the control 823 kg ha⁻¹ (*Kharif*) 780 kg ha⁻¹ (*Rabi*). The increased yields over control were observed to the extent of 46.73% during *kharif* and 19.59% during *Rabi* (Table 1).

4.7. Chain link fence

It is an easy most effective way of fixing a barrier which is more durable in nature. Chain link meshes of 3 feet height can be fixed around the crop by maintaining a distance of 1 ft away from the crop. Using of Chain link fence as border against wild boar around maize crop yielded 1066.3 kg ha⁻¹ during *Kharif* and 1069 kg ha⁻¹ during *Rabi*, which is predominantly higher than the control 786 kg ha⁻¹ (*Kharif*) 780 kg ha⁻¹ (*Rabi*). The percent increase of yield over control is 15.13 % during *Kharif* and 14.71% during *rabi* (Table 1).

5. Traditional Wild Animal Management Methods

5.1. Spraying of dung solution of local pigs

Territoriality is very high in wild boars which are being exploited under this method. The dung collected from local pigs will be made into solution and should be sprayed on soil to the width of 1 ft around the crop. This will confuse wild boars with a false assumption of entering into the territory of other pigs; there by their movement will be prevented to avoid territorial conflict. This method is effectively control the wild boar entry up to 50%

5.2. Human Hair as respiratory deterrent

Wild boar with poorly developed sight and hearing mechanism has to depend on its smell sensory mechanism only for movement as well as locating of food. In this process it moves

from one place to other place only by a way of sniffing on the ground there by getting guided in to the desired routes. Spreading of human hair collected from local barber shops is an affective and low cost traditional method being followed by farmers. Technically this indigenous method do have scientific logic which clearly suggest that the human hair in the movement routs of the wild boar gets sucked through nostrils causing severe respiratory irritation. Due to this the wild boar gets totally disturbed and loses its track by making distress calls, which will ward off other wild boars entering into the cropped area. Several farmers are extensively practicing this method in different crops and controlling the damage caused by wild boar to the extent of 65-90%

5.3. Fixing of used colored sarees

This method also is a farmer's innovation, which has a behavioural background as far as wild boar is concerned. By arranging used sarees of different colors around the crop will make wild boars to assume human presence in the area there by not preferring to enter into such areas. Even though, not feasible in all situations it has some marginal benefit in the areas of human movement. By using this, extent of damage by wild boar can be minimized to the level of 30-55%.

5.4. Burning of dried dung cakes

The dried cakes made of dung of local pigs are burnt by placing them in earthen pots. This will ensure slow generation and spread smoke during dusk time. The smoke coupled with smell of local pig dung helps in sensitizing wild boar about the inexistence presence of local pigs. As a result, to avoid territorial conflict, the wild boars don't prefer to move in such areas. By this method extent of damage by wild boar can be reduce up to 35-50%.

5.5. Creation of sounds and light through born fire

To scare away the wild boars from damaging their crops farmer's employee methods such as using fire crackers, making sounds through local drums, empty tins, making born fires and shouting. This type of methods proven to affective on community basis in protecting farmers fields from the wild boars.

5.6. Use of traditional local dogs for scaring away wild boars

In endemic areas of wild boar attacks farmers do follow using of trained dogs on a community basis to scare away the approaching wild boars. In selected cases this method proved to be affective and sustainable and controls the wild boar damage up to 30-50%.

5.7. Planting of thorny bushes and xerophytes around the crop

Different xerophytic species like Cacti sp *Euphorbia caducifolia*, *E. meriifolia* & *opentia* sp *Opuntia elatior*, *O. dillenii*, *Zizipus* sp *Ziziphus oenopolia*, *Z. mauritiana*, and agave sp *Agave americana*, *Caesalpinia cristata* can be planted on the bunds around the crop which will not allow the wild boars due to their thorny in nature. The wild boars after unsuccessful trail



of entry get injuries and making alarming calls, which makes the other animals to flee the scene. This method is very effective in minimizing the entry of wild boar into the crop area up to 60–75%.

5.8. Trenches method

Digging of 2 ft wide and 1½ feet deep trench around the cropped area at a distance 1 ft from the crop keeps away the wild boars from the field. This method also helps as an excellent source for water conservation in the rain fed areas despite being effective this method gives additional advantage of preventing the damage of the crop by insect pests which are migratory in nature from one field to other field. This method is very effective in dry land areas and minimizes wild boar entry to the extent of 50–70%

6. Conclusion

Ideally, a management strategy apart from considering the pest species concerned, the crops being protected and the way in which the method is applied interact with the one another. Effect of agro-chemicals and their ill effect on avifauna, wild animals and human health should be focused properly and priority should be given to the use of eco

friendly management methods like usage of bio-fencing and compounds of botanical origin as alternatives.

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