BIRD DAMAGE AND CONTROL STRATEGIES IN GRAIN SORGHUM PRODUCTION

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Abstract

Sorghum is a versatile crop that is grown worldwide for food, feed, fodder and biofuel. It thrives well in marginal environments where other cereal crops fail. However, its production is hindered by abiotic and biotic stress factors. Among them, birds are a serious pest and limit grain production from sorghum. Factors such as field sizes, fields near roosting sites, planting density, weed control, choice of variety and timing of farm operations influence the ability of the birds to damage the crop plants. Nonetheless, various methods have been employed to control birds including use of chemicals, repellents, bird scaring, lethal and non-lethal methods including host plant resistance. Among the control strategies host plant resistance can be an effective method due to presence of tannins in bitter sorghum types. Emphasis needs to be placed in breeding for bird resistance to improve crop production and productivity.

Key words: Birds, control strategies, sorghum

INTRODUCTION

Sorghum is one of the most important cereal grain grown worldwide. It ranks fifth after wheat, maize, rice and barley (FAO, 2011). In South Africa, it ranks third after maize and wheat. According to Vijayakumar et al. (2014) sorghum produced worldwide is 64.20 million tonnes with a cultivated area of 41 million hectares. Of this grain, about 26 million tonnes are produced in Africa. The four leading sorghum producers in Africa are Nigeria, Ethiopia, Burkina Faso and Niger. About 74% of sorghum in Africa is used for food (Acquaah, 2012). It is classified into two groups: wild and the cultivated types (Smith and Frederiksen, 2000; Ayana et al., 2002). The wild sorghum species include Sorghum halepense, S. propinquum, S. bicolor subspecies drummondii and S. bicolor subspecies verticilliflorum. The cultivated sorghum has been classified into five major races: bicolor, caudatum, durra, guinea and kafir, and 10 intermediate races based on panicle and spikelet characteristics (Dogget, 1988; Assar et al., 2005). In South Africa, both wild and domesticated sorghum species are present. Mann et al. (1983) reported that the South African sorghum race ‘Kafir’ might have arisen from introgression between domesticated and wild sorghum. Sorghum has great tolerance for drought and it thrives well where other cereals do not survive. However, sorghum is affected by biotic and abiotic stresses that hinder its production. Damage of
sorghum by bird infestation is a worldwide problem in grain production and productivity. These birds cause damage in sorghum fields more especially when the sorghum plants are at soft dough stage crushing the juice out of sorghum grains (Tipton et al., 1970). The bird species reported to attack sorghum include parrots, sparrows (Passer domes-ticus), Quelea quelea, crows, Volatina jacarina, Patagioena spicazuro, Aratinga leucophthalma and Columbina talpacoti (Priyavratha and Nakasimha, 1953; Melo and Cheschini, 2012). The birds can cause damage to crops and a loss to the farmers from sowing and planting till harvesting. The yield loss birds cause vary from 10 to 80% as they flock in large numbers. Much losses were observed during early flowering and late flowering of the sorghum varieties. The sparrows, baya weaver, and rose-ringed parakeets damaged sorghum plants accounting for 52% of the total damage (Kale et al., 2014). It is reported that Psittaculakrameri is the most common and destructive bird which inflicts huge damage to standing cereal crops, fruit orchard, and vegetable crops (Kushwaha and Roy, 2002). It is reported that the percentage damage in the yield is higher compared to that caused by the insect pests. Hence, it is vital to implement different strategies to control birds. This paper reviews methods of controlling birds from causing damage on sorghum crop.

FACTORS INFLUENCING BIRD DAMAGE IN GRAIN SORGHUM

Fields near to breeding or roosting sites: Fields near breeding or roosting sites are more susceptible to bird damage (FAO, 1991). The trees, bushes or reeds around the planted fields provides nesting place for birds. They increase vulnerability to bird pests as the birds will continuously feed on the crops close by. The fields next to streams or dams where crops are grown increases vulnerability to bird damage as they attract birds as source of water supply and also provide habitats for water birds such as geese. The fields are often damaged by the birds.

Field size: Huge crop fields have longer borders which are the zones preferentially attacked by the birds. Furthermore, large fields requires a large labour force for bird scaring which is challenging to have during peak periods (Manikowski and Da Camara-Smeet, 1979). Generally, the traditional scaring methods are more effective on small, privately owned fields than on large, agricultural schemes, or research stations.

Timing of farm operations: It influences the incidence of bird damage. Planting very late during summer predisposes the crop to damage by migrating birds of which at times may be arriving at the time of crop maturity (Treca, 1985). The damage is higher during dry season than wet season because of the lack of wild seeds (Ruelle and Bruggers, 1982). Bird damage also varies with growth stages of the sorghum crop. The crop is mostly vulnerable and damaged during milk to hard dough stage but invulnerable during vegetative growth. The damage is usually severe during maturation (Ruelle and Bruggers, 1982).

Crop establishment method: Seeds are highly vulnerable to bird attack when they are sown directly on to the soil. They are safe when are covered by the soil to protect them. Emerging seedlings are also vulnerable to bird attack. However, damage at this stage is not so common when granivorous migratory birds have flown to other countries or continents (Treca, 1977). In addition, farmers and researchers transplant sorghum, the damage can be greatly reduced by protecting planted seeds and seedlings with nets.

Planting density: Water birds are attracted to areas with plant densities much lower than in the immediate vicinity and can cause substantial damage to surrounding sorghum plants (Treca, 1977).

Choice of variety: also affects damage as the birds would prefer some varieties without awns and ignore the awned ones when the alternative food sources are sufficient. Some of the varieties have tannins and were found to be unfavoured by birds. Birds prefer light coloured seed varieties such as white, cream, and yellow varieties and ignores the brown more especially when the food is sufficient. During maturation the brown sorghum grain develops astrigence which imparts resistance against the birds (Burns, 1971). The tannins are more abundant phenolic compounds found in brown bird resistant sorghum varieties. Green
(1974) found that the grains of bird resistant sorghums have a high tannin content, and the pericarps that are tan or brown whereas pericarps of susceptible varieties are yellow, red, bronze or gold. The resistant varieties were favoured in areas where bird predation was a problem (McMillian et al., 1972). Often, bird predation restricts the farmer’s choice to brown, tannin-containing, bird resistant varieties.

Weed control: weedy fields attract birds as the birds prefer seeds of wild grass species. Weedy patches in the fields are associated with greater bird damage (Luder, 1985). Weed control reduces bird damage in the fields. The granivorous birds are attracted by weedy fields and leads to increased crop losses due to the effects of weed competition being compounded by the losses to birds.

Life cycle: The young Red-billed Queleabirds inflicts damage on the surrounding of the roosts whereas the matured birds will inflict damage further away. Feeding behaviour of different bird species varies with the time of the day and maturation stage of the crop (Bruggers, 1979). The presence of some birds in the field can also attract others (FAO, 2001).

CONTROL STRATEGIES OF BIRD DAMAGE IN GRAIN SORGHUM
The effectiveness of the control strategy varies with the bird species involved and optimum bird control strategy combines several techniques or can be used in random. Human operated scaring techniques were shown to be the most effective methods for reducing bird populations in the field.

Repellents: To reduce crop losses due to bird damage farmers employed various tactics including bird scaring techniques, devices and pesticides. For scaring tactic, the white cloth banging is used in paddy fields to scare the birds (Kiruba et al., 2006). Ergret causing damage to the paddy plants. On the other hand, farmers can use repellents for instance, visual repellents such as balloons, kites, plastic flagging and mylar streamers (FazlulHaque et al., 1985). Visual repellents are only effective for a short period of time. The auditory repellents such as sonic and ultrasonic frightening devices including electronic noise systems, synthetic bird calls and pyro-techniques were sometimes used in conjunction with exploders (Aubin, 1990). The systems can be effective against loafing and roosting birds. Further, bird populations can be reduced by destroying their nests around the field (Rodewald, 2001).

Chemical control: Edwardson and Molyneux (1962) reported a complete protection of sorghum plants from the, red-winged blackbirds (Agelaiusphoeniceus), sparrows (Passerdomesticus) and boat-tailed grackles (Cassidixmexicanusmajor) when using a dust containing blood, bentonite, anthraquinone and red cement pigment. In addition, chemical repellents like trimethacarb, methiocarb, and curb were used to repel birds from the fields (Bruggers et al., 1986). Methiocarb (4 methylthio) 3,5-xylyl-N-methyl carbamate and Thiram were also used to control the birds in the field crops (Sandhu, 1987). Furthermore, poisonous chemicals were further applied to reduce bird populations (Bhatnagar, 1976). Many plant chemical defences against insect predators are well documented, and some of the material are repellent to birds. For instance, cucurbitacins are triterpenoid glycosides that occur in plants belonging to the Cucurbitaceae and Cruciferae families (Robinson, 1983). These substances deter insect feeding and repel birds (Mason and Turpin, 1990; Metcalf, 1985).

Plant characters: Growing sorghum cultivars having awns, large glumes and inverted heads can contribute in reducing losses caused by the birds especially when there is plenty of food around (Shiringani, 2005). Very compact heads with goose-necked peduncles can considerably reduce the amount of grains eaten by the birds. It becomes difficult for the birds to perch and feed on the grains. According to Priyavratha and Nakasimha (1953) the birds in their study preferred white and yellow grains than the red sorghums, loose panicles than compact, and types with open glumes than in those with glumes completely encasing the grains. Fields or nurseries can be protected with nets or wires, covering individual maturing heads with grass or cloth.

Host plant resistance: Host resistance of sorghum to birds seemed to be an effective control method. The sorghum that showed resistance to bird damage exhibited tannic acid and astringens than the susceptible hybrids and even at maturity (Tipton et al.,
Merwine (1963) reported a hybrid, RS 617 that has a bitter taste at milk or dough stage and confers resistance to birds. Bird resistance is associated with tannin compound found in varieties with brown nucellar layer (Harris, 1969). The bird damage on developing grain can result in near total crop loss. The key plant characters for resistance to birds are bitterness of the grains when green, large glumes, and pendent heads (Doggett, 1957). The tannins have bird repellent properties and they are present in the mature grain and lowers their palatability and nutritional quality to the consumers (Butler, 1981). They protect the grains against insects, birds, fungi and weathering (Waniska et al., 1989). Tannins have capacity to bind protein. The active tannin oligomers bind with the mucoproteins in the mouth of birds causing an astringent tactile response that is repellent to birds (Bullard and York, 1996).

Bird scaring: Bird scarers are usually positioned in the middle of the field where they can shout, throw rocks or plant stems, and crack whips or rattle cans as birds enter the field. Noise making objects such as cans are attached to lines of cords stretching from this central location throughout the field. The scarers cover a large area by tugging on the cord. Generally, the traditional protective methods such as manual bird scaring, flags, scarecrows can provide satisfactory relief but it is for small-scale farmers. If the fields are huge and the birds are too many then the methods become ineffective (de Mey et al., 2012). Bird scarers need to be effective throughout the daylight and patrol both centres and the edges of fields to create maximum disturbance to foraging seed eating birds (Hiron et al., 2015).

Lethal methods: Lethal methods are effective for a short term and are aimed at suppressing bird populations. They include nest destruction, treatment with avicides and use of flamethrowers or exploders. Avicides are chemicals lethal to certain bird species. Lethal control has been applied successfully and it reduces bird pests numbers in the vicinity. However, the success of this strategy varies with regions and the control method employed.

Non-lethal techniques: are techniques including agronomic practices such as vegetation management, good weed management, and choosing a variety with bird resistance characteristics such as presence of awns and large glumes.

CONCLUSION

Birds cause an extensive damage to cereal crops when the preferred seeds of wild grasses are unavailable. Various strategies have been employed to control bird pests including use of repellents, cultivars with awns, long glumes and goose-necked, chemical control and cultivars with bird-resistance characteristics. Controlling bird pests can help in maintaining crop yields and productivity. Breeding for resistance to bird damage can be of great help for current and future small and large-holder farmers for production of sorghum in large scale.

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REFERENCES

Mason, J.R and T. Turpin. 1990. Cucurbitacin-adulterated diet is avoided by captive European starlings. J. Wildl Manage., 54:672-676.


