ReJeX-iT™AG-36, A POTENTIAL TOOL TO PROTECT SEEDS FROM BIRD DEPREDATION

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ABSTRACT: The ever increasing bird populations (e.g., Black birds, geese etc.) are known to cause considerable losses to agriculture. This problem has reached serious proportions for crops that are farmed on large tracts and are seeded by aerial application such as rice and canola. ReJeX-iT™AG-36, a non-toxic, biodegradable bird aversion formulation, derived from food grade ingredients, has been proven in pen tests and field trials to be effective as a seed treatment to prevent birds from eating the treated seeds. The product does not harm the seeds or the effected birds in any way, even if ingested; it just makes the seeds unpalatable to further feeding.

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Growing human requirements and multiplying bird populations in agricultural areas lead to increasing conflicts. Resolving these conflicts in an environmentally and socioeconomically sound way represents a challenge. Some of these conflicts can be resolved through the application of science with an ecological awareness for safety without harming either wildlife or humans.

Agricultural techniques are continually changing and the need to reduce costs has led to highly mechanized operations on ever expanding plots. This generates large and ideal food sources and new habitats for many opportunistic bird species. To change or alter the agricultural habitats to prevent bird damage is unrealistic. Seeds are the natural food for many of these bird species and as such most are very palatable and nutritional for them.

The bird problems with seeds fall into three categories: (a) sprouting seeds, (b) ripening seed heads, and (c) seeds treated with pesticides. The birds eat the seeds planted, especially by aerial seeding, requiring re-planting or resulting in a lower yield. Even seeding rice at 75 seeds/sqft (130 lbs/acre) does not guarantee that the desired optimal 20 seeds will be left to germinate and grow. Re-planting is not only costly, but also often times impossible and does not guarantee better results the second time around. Other birds, such as crows (Corvus brachyrhynchos) dig up the seeds (e.g., pine seeds) that are planted in a row, before they can germinate.

Ripening seed heads such as rice or hybrid seeds, some worth $ 6-9.00/lb (e.g., cabbage, kale, spinach seeds, etc.) are not only eaten but also shaken to the ground by a variety of birds, reducing the yield considerably. Seeds treated with fungicides and pesticides, which are toxic to birds cause unnecessary and unacceptable fatalities, not only of target birds, but also of other species.

Besides many mechanical devices of questionable effectiveness, various chemical products have been used in the past with good results to keep birds from eating seeds (e.g., rice, millet, sorghum, maize, corn, etc.), with products such as methiocarb (Besser 1973, Holler et al. 1992), thiram, copper oxalate, lindane, once available and registered by EPA (Mason and Clark 1992). Some also have been used to provide protection for ripening seeds. In the continued efforts to reduce toxic products from the market along with the requirements of the re-registration process and its associated costs, most of these products are gone from the marketplace. The list of registered products was quite long in 1986 (Eschen and Schafer 1986), but it has shrunk considerably since then (Table 1).

Other products such as DRC-1339, used under special registrations - such as for reducing bird damage to sprouting rice (Glahn and Wilson 1992) - are used strictly to kill the target species, where no other solutions are available.

The need for control agents (insecticides, fungicides, herbicides) on commercial agricultural seeds has not changed. There is a growing potential for ingestion of these agricultural chemicals by non-target avian species (Pawlina et al. 1993). Many non-lethal control methods have been identified in recent years, but none have made it to commercial use (Avery and Decker 1991, Mason and Turpin 1990).

Table 1. EPA registered bird repellents as of January 1993.

TRADE NAME	STRUCTURE	EPA REG. No.
* AVITROL	4-Aminopyridine	11649-
* THIRAM	Tetramethylthiuram disulfide	7501- 34704-
* TANGLEFOOT HOTFOOT 4-THE BIRDS	Polybutene	1621- 55943- 8254-
* MESREPEL	4-(Methylthio)-3,5-xylyl-methylcarbamate	34704-
* ROPEL	DNB/Thymol	45735-
* OUTDOOR ANIMAL REPELLENT	Allyl isothiocyanate	61966-

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Acceptable chemical control agents need to be effective, humane, cost effective, environmentally safe and completely disappear after their function is not required anymore. None of the presently registered products have all these properties. Most were developed from insecticides and fungicides (Schafer 1981) before these properties were required by society.

ReJeX-iT™MA (active ingredient methyl anthranilate (MA)) containing formulations make the food and water that are treated unpalatable to birds. They work as sensory repellents and mimic irritation in the mouth cavity and stomach of birds that try to ingest the treated seeds without causing adverse physiological reactions in the birds. This sensory repellent works because it affects the behavior while causing no actual harm to the bird. As a result, birds will avoid feeding in places where this repellant is present, and move to other feeding areas.

The effectiveness of MA as an avian repellent, if formulated properly and used in sufficient concentration has been proven repeatedly (Dolbeer et al. 1992, Dolbeer 1993, Belant et al. 1993). Depending on the application, maintaining a concentration that is effective and remains active long enough to produce cost-effective protection, can be quite a challenge. Properties that are desirable to the EPA (fast biodegradation, no residue formation, non-toxic) make it difficult to formulate into an active repellent with a sufficiently long lifetime. A balance had to be struck between protecting MA from natural degradation processes and insuring that the birds are exposed to the active ingredient. While MA is stable to hydrolysis in the range of pH 5.0-9.0, it photo-degrades to about 25-30% with strong sunlight, under the formation of trimers, which protect the remaining MA. Biodegradation, however, leads to complete removal of MA in less than three days, once the compound enters the water phase. No other degradation products besides CO_2 are identified.

Several problems allowing the use of MA as a repellent on sprouting seeds had to be overcome: (a) the seeds need to be coated with sufficient concentration to achieve an aversive reaction, (b) the product cannot interfere with germination, (c) the product has to last long enough to protect the seeds effectively, (d) the product has to be non-toxic and biodegrade after it has served its purpose, and (e) it has to be cost efficient and human friendly.

After many field trials for specific applications, ReJeX-iT™AG-36 bird aversion agent reflects the optimum balance between stability and effectiveness. In an initial field test in 1993, rice coated with ReJeX-iT™AG-36 was soaked for 24 hours and then seeded by plane into a field with very heavy pressure from red winged blackbirds (Agelaius phoeniceus). Initially the birds stayed away, returning in three days, after the rice had successfully germinated. Later analysis suggested complete biodegradation of the active

ingredient with the loss of protection. This observation was similar to the one gained in a blueberry field during summer where the product efficacy lasted about five days in hot and humid weather.

Several pen studies showed inconclusive results with blue colored canola seeds with house sparrows (Passer domesticus) (Pawlina et al. 1993). However, the bitter tasting canola seeds are not a favorite food for house sparrows which distorted the test results. Other granivorous bird species need to be studied that prefer canola seeds.

ReJeX-iT™AG-36 is an aqueous slurry with 14.5% active ingredient (MA), which is non-phytotoxic, and can be applied by spraying. Once dry it does not wash off during normal rainfall. The acute oral LD_{50} for rats is >5000 mg/kg. The grade of MA used shows no dermal irritation in rats and a LC_{50} >2000 mg/kg for rabbits and an acute oral LC_{50} >5620 ppm for mallards.

ReJeX-iT™AG-36 offers a humane and socially acceptable method for the non-lethal control of birds by diverting them, without harm. It can enhance many presently employed protection measures. With continuing cooperation from agriculture and animal damage control groups, many details for the most effective application to various crops will be resolved.

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