Application of different methods for rodent control in Upper Egypt

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Abstract: Rodent damage a variety of agricultural crops throughout most regions of the world, in developing countries where the economy depends on agriculture, rodent infestation can pose a serious threat of not only reduced income but also widespread dangerous diseases. Damage range from negligible destruction of growing plants to total crops loss. Thus, great efforts should be done to develop rodent control programs. Control methods must not fulfill the requirement of protecting crops, but also in a safe efficient and economic manner. However, in this review three methods of rodent curative applied control were considered these methods are mechanical control, biological control and chemical control. The main objective of this review was to develop an effective strategy for implementation of rodent management programs in cultivated and newly reclaimed agro ecosystems in Egypt.

[Abd El-Aleem Saad Soliman Desoky. **Application of different methods for rodent control in Upper Egypt.** *Researcher* 2015;7(9):90-93]. (ISSN: 1553-9865). http://www.sciencepub.net/researcher. 11

Key words: rodent control programs, rodent management, mechanical control, biological control, chemical control

Introduction

Rodents are considered as one of the most important pests in Egypt. They cause great economic loss to farmers (damage the growing crops, stored products, poultry and animals farm); and to food manufactures by damaging the structure and fabric of buildings. Besides, they gnaw through almost any object in their ways to obtain food and shelter, Abdel-Gawad and Maher Ali (1982).

Rodenticide application, causing rapid and large-scale population reduction, continues to be an important tool in rodent damage management (Abazaid, 1990 & 1997). These reductions, however, are short-term and there is a growing concern with the environmental hazards and safety issues associated with rodenticide use. Great strides have been made to better understand the nature of rodent populations, why damage occurs, how damage can be predicted and reduced by non-lethal approaches (physical, chemical, behavioral, and cultural), and how to apply ecologically based rodent management strategies (e.g., Singleton *et al.,* 1999). The general equipment, methods, and strategies used to manage rodents, including rodenticides, have been presented in detail by Buckle and Smith (1994) and Hygnstrom *et al.,* (1994). Many new approaches (use of disease agents and fertility control) have proven ineffective or ill-conceived for vertebrates in the preliminary testing phases.

All rodents require food, shelter, and water. The shelter provides protection from predators, inclement weather, and a favorable place to bear and rear their young. Although rodents require water, those water requirements vary greatly by species. Because rodent food and cover (i.e., vegetation) can be influenced by human activities, there has been considerable development of strategies to reduce populations and damage by manipulating vegetation (e.g., Barras and Seamans 2002).

1- Mechanical control

Most publications concerned with the Mechanical control of the common rodents was done by several authors such as

Maher Ali (1972) in Assiut Governorate of Egypt reported that in case of large food stores, it is highly advisable to destroy all vegetations (weeds) in order to deter any rodents foraging in the surrounding area from approaching close to the building.

Maher Ali and Abdel-Gawad (1982) in Assiut Governorate of Egypt, studied that the application of anticoagulants and zinc phosphide for the control of the Nile grass rat *A.niloticus* (Desm.) was compared with burning of weeds harboring rodents. It was found that anticoagulants are superior to the other two methods; the burning of weeds comes next.

El-Eraky *et al.*, (2000) in Assiut Governorate of Egypt found that mechanical control by laser-land operation has given great success. By this method a complete reduction in rodent active burrows was achieved after 10 days as compared with 50.6% in Qunitox rodenticides respectively. Abdel-Gawad (2001a) in Assuit Governorate of Egypt, studied that two common rodenticides, super caide0.004% and zinc phosphide 5% and four mechanical viz., laser-land leveling, deep irrigation, destroying burrows and traps were evaluated for their efficacy for rodent control in maize fields. The results showed mechanical control methods achieved great success in rodent control as compared with the chemical control was ranged between 94.2% in the laser treatment method and 74.5% in the trap method with an average of 89.65% and 94.6% in handing destroy method..

Ahmed (2006) in Assiut Governorate of Egypt, studied that mechanical control of rodents in broad bean, wheat, maize and sorghum fields by handling destroying of burrows and erased the wasted materials. It was more effective in controlling rodents than chemical methods. Baghdadi (2006) in Assiut Governorate of Egypt, found that the ploughing and brushing woods operation led to complete reduction in rodent numbers during the first five months of ploughing and brushing woods operation comparing with untreated area. Whereas, the number of rodent was increased gradually from May to November. Desoky (2013) found that Mechanical control methods achieved great success in rodent control as compared with chemical control. the percent of reduce in rodent active burrows population by using mechanical control methods ranged between 93.20% in deep irrigation, 87.20% in handing destroy and 52.60% in trap methods. This method is safe to the environment and higher than for reduce rodent population density.

Desoky *et al*., (2014a) found that The Nile grass rat, *Arvicanthis niloticus* was the dominant species considered in cultivated newly reclaimed lands. The highest reduction of rodent active burrows in control area was recorded in spring (52.21%), while the lowest was (20.63%) in autumn compared with the treated area by using the handling destroy of rodent active burrows, high reduction of rodent active burrows was recorded in spring (71.43%) the lowest was (49.20%) in autumn, Mechanical control of rodents by using the destruction of rodent active burrows achieved great success in rodent control under field conditions without environmental pollution and not costly.

2- Biological control

The rodent population in nature can be groaned by the Naturally Occurring Biological Control Agents (NOBA) such as pathogens, parasites and predators.

Most publications concerned with Biological control of the common rodents was done by several authors such as Hussain and Ahmad (1990) in Egypt, found that animals like cats, snakes and dogs were known to kill and eat rats under most field or go down conditions. Cats can catch a full grown rat, but adult rats were too large and aggressive and often injures the cat when a capture attempt was made cats therefore, generally confine their attention to mice and small immature rats. Dogs and snakes can kill rats but not in such effective quantities, as to result in rodent control. For dogs, cats and snakes, like all predators, only catch the rodents that were easily available.

Keshta (2003) in Shark El-Ewainat of Egypt, reported that wild animals were in wild cats *Felis sylvestrs*, sand fox *Vulpes ruepelli* and Arab wolf *Vulpes cana*. They encountered all over the year. The wild cat is diurnal. In general the efficiency average of the present predators against the distributed rodents in the tested area were arranged descendingly as follows. *Jaculus* sp 35.3%, *Gerbillus* sp 30.7%, *Meriones* sp 30.2%, *Mus* sp 25.2%. (Desoky *et al*., 2014 b) found that Cats (*Felis chaus nilotica*) as Naturally Occurring Biological Control Agent (NOBCA) were used in grain storages. The percentage of reduction during the presence was recorded as 90.91%. After 6 months the reduction % of the predator was 33.33%. The decreased in the efficiency of cats in reduction rodent population after six or seven months may be due to the predation prey efficiency of cats. Also, the feeding habits of the cats to prey upon variety of preys and switch their attention for one to other prey species according to the relative abundance. This switching behavior has two important effects, it allows the predator to survive when a particular prey species is low in numbers and it helps to keep it in check.

3.1. Chemical control (poison baits)

Most publications concerned with the chemical control of the common rodents was done by several authors such as: Abdel-Gawad and Farghal (1982) in the central hospital in Assiut of Egypt, found that *A. niloticus* was more susceptible to Warfarin (0.04%) than *R. norvegicus* in all maturity stages (early, medium and mature). Helal and Zedan (1982) in Assiut Governorate of Egypt, used Difenacoum at 0.005% against *R. norvegicus* and *R.r. alexandrinus*. They found that the LT_{50} and LT_{95} and values were 5.5 days and 21 days. Ali (1991) in Sohag Governorate of Egypt, studied efficacy of anticoagulant rodenticides using multiple feeding for 6 days under field condition. He found in multiple dose that Racumin and Matikus the highest percentage of rodents control success 98.5% and 95% consequently. Asran *et al.,* (1992) evaluated the efficacy of 6 anticoagulant rodenticides against Nile rat, *A. niloticus*. Results indicated that 0.005% Flocoummafen, 0.005% Brodifacoum anticoagulants were the most effective followed by 0.005% Diphacinone, 0.006% Chlorophacinone, 019% Sulpha quinoxaline, 0.005% Bromadiolone and 0.05% Warfarin. The reduction caused by the above mentioned six rodenticides was 91.2 %, 85.4%, 82.8%, 76.8% and 64.2%, respectively.

Farghal *et al*., (2000) in Qena Governorate studied the toxicity of three anticoagulant i.e. Farobaid, Caid and Supercaid against *A. niloticus* under field conditions, Farobaid gave complete control to *A. niloticus* inhabited tomato field after 20 days of treatment. The LT50 and LT95 values were 3.1 and 21 days. Supercaid reduced 77.3% of *A. niloticus* population in sugarcane field after 21days of treatment, with LT50 and LT95 values of 8.2 and 43 days. Caid gave 59% reduction in *A. niloticus* inhabited sugarcane after 20 days of treatment. The

LT50 and LT95 values were 16 and 100 days. The acute rodenticides, Quintox reduced 70% of *A. niloticus* population in corn field after 20 days of treatment. The LT50 and LT95 values of 10 and 82 days. Storm completely eradicated *R. norvegicus* after 6 days of offering poisoned baits. The LT50 and LT95 values were 4.4 –6.0 days in 1995 and 4.0 – 5.8 days in 1996. Abdel-Gawad (2001b) in Assiut Governorate of Egypt, studied the rodent control in the student buildings of Assiut University during ten successive years from 1991 to 2000. Zinc phosphide 3% was used through July as quick acting poison outside the buildings one time during the first year to reduce the high density of rodents and avoid to the bait shyness. The anticoagulant rodenticide, Retak (Difenacoum 0.005%) followed the treatment of zinc phosphide twice a year one during February and the other through July month, outside and inside the building. The results revealed that there were three species of rodent outside and inside the student buildings of Assiut University. The most prevalent rodents were *Rattus rattus alexandrinus* (Linn.) 42.6%, *Arvicanthis niloticus* (Desm.) 36.2%, *Rattus norvegicus* Berk, 21.2%. The reduction in rodent population after the treatment with zinc phosphide was 76.8% from the initial population. The decrease in rodent density during the years of study which treated with anticoagulant rodentcide was about 69.8% during 1994, 80.7% in 1995 and 1998. Using zinc phosphide treatment for one time followed by anticoagulant rodenticide twice a year and removing the garbage daily showed great effect on rodent population reduction in the university cities, and it may be useful in closed places such as hospitals and animal production farms. Ahmed (2006) in Assiut Governorate of Egypt, found that the application of phosphide zinc singly was the superior in controlling rodents, while supercaid only had lowest effect. Whereas, using both rodenticide together achieved a moderate effect. Baghdadi (2006) in Assiut Governorate of Egypt, observed that the females of *A.niloticus* were more tolerant to all rodenticides than males at different poisoned baits under laboratory conditions. The acceptance of rats to the poisoned bait considerably differed according to the type of bait. The Bromadilone carried on crushed maize has the most acceptance to rats, While Brodifacoum carried with sunflower was the lowest. On the other hand, time required to death differed according to the type of rodenticide and bait carrier. Brodifacoum carried with wheat was the most effective, while the lowest effective was recorded when Chlorophacinone with sorghum. Also, the effectiveness of rodenticides for mortality time was related to the concentration of the rodenticide. The Bromadilone 0.005% was more effective than Brodifacoum 0.004%.

3.2. Chemical control (fumigation)

Desoky (2011) Found that Aluminum phosphide is a new burrowing rodent fumigant in Upper Egypt. It reacts with water vapor to produce hydrogen phosphide gas. Hydrogen phosphide is a very toxic gas, however, several characteristics of the product and use pattern give most commercial formulations a low user hazard when used by trained applicators in accordance with label instructions. It is efficacious when used in many situations against several burrowing rodent species, but will not be effective in all situations.

Several factors to consider are burrow temperature, burrow humidity, burrow length and configuration, soil porosity, wind speed and direction, and species specific behavior characteristics. It is particularly desirable to use as a clean-up after a baiting program. Also, it can be used throughout most of the year. The user should read the label carefully to determine all endangered species precautions. Hydrogen phosphide has no secondary hazard although burrow dwelling non-target animals will probably be killed.

In conclusion, the recommended procedure for rodent control is applying aluminum phosphate followed by anticoagulants twice annually seems to be satisfactory to apply within active burrows. However, it is rather important to give all possible attention to environmental sanitation. At the same time, type of applied anticoagulant should be changed upon appearance signs of resistance of rodents under control to such product

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9/22/2015