J. Agric. Sci. Mansoura Univ., 33 (12): 9205 - 9216, 2008

EVALUATION OF SOME CHEMICAL AND MECHANICAL METHODS TO CONTROL RODENT POPULATION UNDER FIELD CONDITIONS IN UPPER EGYPT AREA.

Metwaly, A.M.[1]; K.H. Abdel-Gawad[2]; M.A. Ahmed[1] and H.S.K. Ahmed[1]

1- Agric. Zoology and Nematology Dept., Fac.of Agric., AL-Azher Univ., Egypt.

2- Agric. Zoology, Plant Protection Dept., Fac.of Agric., Assiut Univ., Egypt.

ABSTRACT

The rodent infestation in pods of broad bean, plant/m^2 of wheat as well as cobs/m^2 of maize and sorghum at different sampling dates and distances in both chemical and mechanical control methods were discussed.

It is obvious from the obtained results that control of rodents in broad bean, wheat, maize and sorghum fields by mechanical means as well as application of Supercaid and Phosphide zinc either singly and in combination was very effective than non-application. Mechanical control by (handling destroying of burrows and erased the wasted materials) was more effective in controlling rodents than chemical methods. The mechanical control for rodents under the field condition was more effective than the mechanical methods. The mechanical method may be arranged according to their effectiveness, destroying of burrows and erased the wasted materials. The application of Phosphide zinc singly was the superior in controlling rodents, while Supercaid only had the lowest effect. Whereas, using both rodenticide together achieved a moderate effect.

INTRODUCTION

The control and management of rodent populations and their parasites associated with rodent diseases leads to reducing an infectious disease. Thus, great efforts should be done to develop rodent control programs. Control methods not only fulfill the requirement of protecting crops, but also in a safe efficient and economic manner. The chemical control of rodents has been practiced for more than three decades. The use of anticoagulant rodenticides began from 45 years ago. Previously the use of acute toxicant had been relatively less effective, due to poison shyness, behavioral resistance and the lack of specificity. On the other hand, the chronic poisons (anticoagulants) exhibited more selectivity and un-developing poison shyness. Although many rodent species developed resistance to some anticoagulants such as Warfarin, the efficacy of anticoagulant rodenticide should be checked periodically (Ahmed, 2007).

Al-Wakeel (2000) indicated that single dose anticoagulant Brodifacoum and Bromadiolone gave higher effect against R. norvegicus causing 90.7 and 95.3% population reduction, respectively comparing with 90.6 and 88.9 to for Chlorophacinone and Diphacinone multi dose anticoagulant. On the other hand, A. cahirinus showed anticoagulant tolerance either for single or multi-dose anticoagulant as Brodifacoum and

Bromadiolone, who reduced mice population with 71.6 and 68.3%. While Chlorophacinone and Diphacinone showed a lower affect causing 62.2 and 63.9% reduction. Farghal *et al.*, (2000) studied the toxicity of three anticoagulants i.e. Farobid, Caid and Supercaid under field. Farobid gave complete control to A. niloticus in habited tomato field after 20 days of treatment. Supercaid reduced 77.3% of A. niloticus population in sugarcane field after 20 days of treatment. Caid gave 59% reduction in A. niloticus inhabited sugarcane and Lucerne populations after 20 days of treatment. The acute rodenticide, Quintox reduced 70% of A. niloticus population in corn field after 20 days of treatments. Storm completely eradicated R. norvegicus after six days offering poisoned baits. Wood (2001) mentioned that anticoagulants from methods which was developed to control rats species responsible for damage in oil palm, Rattus timanicus and rice, R. argentiventer such as the use of the Bromadiolone and Flocoumafen. El-Mallah (2004) reported that rodent control experiment was carried out, using an anticoagulant rodenticide (Racumin, 0.375% Coumatetralyl) to reduce infestation in the poultry farm location during the summer. There methods were used to estimate rodent populations before and after rodenticide application. Evaluation ranks for the three methods of population estimation, depending on the similarity in population reduction percentage were: food consumption (93.36%), foot prints (94.65%) then trapping method (75%). Abdel-Galil (2005) found that Zinc phosphide 1.5% bait gave good control against rodents in houses and fields with population reduction 55 and 52%, respectively. Also, he found that the single dose anti coagulants Bromadiolone 0.005% exhibited a higher effect against rodents with rate 80% population reduction, while Comatetralyl 0.375% as multi dose gave 70% population reduction in houses. Whereas, the same poisons when applied against the roof rat, rodents gave 70% and 66.66% population reduction for Bromadiolone 0.005% and Coumatetralyl 0.375% in fields, respectively.

El-Eraky *et al.*, (2000) recorded that the two mechanical control methods for controlling rodent pests were applied comparing with Quintox rodenticide. The mechanical control by laser-land operation has given great success. By this method a complete reduction in rodent active burrows achieved after 10 days as compared with 50.6% in Quintox rodenticide. The RT_{50} and RT_{90} values of Quintox indicate protection of date palm from rodent attack using pruning operation. In date palm trees pruning operation reduced the rodent infestation to zero and no paraized dates were observed, so it should be done annually. Abdel-Gawad (2001) recorded that the four mechanical control methods viz., laser-land leveling, deep irrigation, destroying burrows and traps were evaluated for their efficacy for rodent control in maize fields. Mechanical control methods achieved great success in rodent control as compared with the mechanical control methods. The percent of decrease in rodent population by using mechanical control methods ranged between 94.2% in the laser treatment method and 74.5% in the trap method with an average of 89.65%. In the chemical control method the decrease was 85.6% in anticoagulant treatment and 88.3% in Zinc phosphide method with an average of 86.9%.

MATERIALS AND METHODS

The current study was carried out at Al-Azhar University Experimental Farm in Assiut Governorate, Upper Egypt. This study was initiated to choice the best methods for controlling rodents under the field conditions withen 20 areas each area about half feddan. These areas were divided to four groups every one was 5 areas. The first group was cultivated with broad bean, the second was cultivated with wheat as a winter crops. On the other hand, the two other groups were cultivated with the summer crops, maize and sorghum.

Every group divided into 5 sub groups, the first one was treated by distribution 30 bait stations containing 50 g from (Super Caid 0.004%) mixed with crushed maize for ten days. The second was treated by distribution 30 bait stations containing 50 g from Zinc phosphide 3% mixed with crushed maize for the same period. The third one was treated by Super Caid 0.004% for 5 days and by Zinc phosphide for other five days. The fourth group was destroying the active burrows as the mechanical control methods. The last sub group was left without treatment as control. The effect method of the rodent control was estimated by using the decrease of the damage during the crop growth. Protection index (PI) in each method was calculated according to the equation of Inglis and Isaacson (1987) as follows:

Protection index (PI) = (MPDC –MPDT)/ MPDC

Where: MPDC= Mean percent of damage in untreated field (control).

MPDT= Mean percent of damage in treated field.

All the obtained data were statistically analyzed using Duncan's test for recognizing the significant among the tested treatments.

RESULTS AND DISCUSSION

1.Broad bean:

Data in Table (1) show the efficacy of mechanical and chemical control on the infestation of pods/m^2 of broad bean by rodent at different sampling dates and distances. The effect of mechanical and chemical control clearly showed that the infestation of pods/m^2 in broad bean by rodent was greatly varied among the means of control. The averages of infestation were varied from 11.41 pods/m^2 in untreated areas to 3.22 pods/m^2 for mechanical methods (handling destroying of burrows and erased the wasted materials). Application of Supercaid and Phosphide zinc singly or in combination as well as mechanical control was accompanied with reducing rodent infestation in pods of broad bean compared with the cheek treatment. Low rodent infestation of pods was observed in mechanical methods (3.22), Phosphide zinc treatment (5.91), Phosphide zinc+Supercaid treatment (7.15) and Supercaid treatment (9.14) in descending order. One can state that, the mechanical control for rodents by destroying burrow under the field condition was more effective than the chemical methods. The maximum infestation rate (11.41) was recorded in untreated area. Phosphide zinc was superior of other chemical agent. Using Phosphide zinc and Supercaid together failed to show

promising effect on protection of rodents compared to using Supercaid compound alone. Using Phosphide zinc alone was preferable than using it with Supercaid in checking the infestation of rodents in broad bean.

Table (1): The efficacy of mechanical and chemical control on the infestation of pods / m^2 of broad beans by rodents at different sampling dates and distances.

Sampling date	Distance (m)															Grand avg. treatment						Grand avg.
	1.0 m					10.0 m					20.0 m											
	Treatment																					
	C	M	P	P+S	S	C	M	P	P+S	S	C	M	P	P+S	S	C	M	P	P+S	S	
Jan. 16	4.8 d-e	6.2 yz	6.2 yz	6.2 yz	6.2 yz	6.4 z-e	6.2 yz	6.2 yz	6.2 yz	6.2 yz	6.8 z	6.8 z	6.8 z	6.8 z	6.8 z	11.41 (a)	3.23 (d)	5.91 (c)	7.15 (c)	9.14 (b)		6.28 F
23	2.6 e-e	6.6 v-e	6.6 v-e	6.6 v-e	6.6 v-e	1.8 e-e	6.6 v-e	6.6 v-e	6.6 v-e	6.6 v-e	6.4 z-e	6.2 yz	6.2 yz	6.2 yz	6.2 yz							6.72 F
30	4.4 g-e	1.8 e-e	1.8 e-e	1.8 e-e	1.8 e-e	3.8 j-e	1.2 t-e	1.4 r-e	1.6 p-e	1.8 o-e	1.6 p-e	6.6 v-e	1.2 s-e	1.2 s-e	1.4 q-e							1.84 E
Feb. 6	7.2 c-e	3.8 j-e	3.4 l-e	3.6 k-e	4.8 g-e	5.8 g-e	2.8 o-e	2.6 n-e	2.8 l-e	2.8 l-e	3.4 j-e	1.4 r-e	2.8 n-e	2.2 m-e	2.8 k-e							3.21 E
13	12.8 a-d	4.8 g-e	5.8 e-e	5.4 e-e	10.8 a-d	10.8 a-d	2.2 n-e	3.8 k-e	3.8 k-e	5.4 e-e	6.8 e-e	1.8 o-e	2.4 m-e	2.6 m-e	3.8 k-e							5.32 D
20	10.8 a-d	5.2 e-e	7.2 c-e	8.6 c-e	14.8 a-d	16.2 a-d	4.6 g-e	6.4 e-e	8.8 c-e	11.8 a-e	11.4 a-e	2.8 l-e	3.6 j-e	5.4 f-e	6.8 e-e							8.67 C
27	22.4 a-d	6.8 e-e	10.8 a-e	13.8 a-e	17.6 a-d	17.8 a-d	5.8 f-e	8.4 c-e	10.8 a-e	14.8 a-d	14.8 a-e	3.6 k-e	5.6 e-e	8.8 c-e	10.8 a-e							11.19 B
Mar. 6	25.2 a-b	6.4 d-e	13.2 a-d	17.2 a-d	22.8 a-c	19.8 a-d	5.8 e-e	9.8 a-e	13.2 a-e	16.6 a-d	15.4 a-e	4.8 g-e	8.2 c-e	10.6 a-e	13.4 a-e							13.39 AB
13	25.6 a	6.8 d-e	17.8 a-d	20.8 a-c	23.6 a-c	19.4 a-d	6.8 e-e	12.6 a-e	14.2 a-e	17.4 a-d	15.6 a-e	4.8 g-e	9.4 b-e	11.8 a-e	14.6 a-e							14.57 A
20	25.6 a	6.8 d-e	17.8 a-d	20.8 a-c	23.6 a-c	19.4 a-d	6.8 e-e	12.6 a-e	14.2 a-e	17.4 a-d	15.6 a-e	4.8 g-e	9.4 b-e	11.8 a-e	14.6 a-e							14.57 A
Grand avg.	9.48 (A)					7.22 (B)					5.80 (C)											

C: non-treatment M: mechanical control P: phosphid zinc P+S: phosphid zinc + super caid S: super caid

(1) Means followed by the same small letter(s), do not significantly different at 0.05 level of probability.

(2) Means followed by the same capital letter(s), within the same column, do not significantly different at 0.05 level of probability.

(3) Means followed by the same capital letter (in parentheses), within the same row, do not significantly different at 0.05 level of probability.

(4) Means followed by the same small letter (in parentheses), do not significantly different at 0.05 level of probability.

Concerning the effect of different sampling dates on the rate of rodent infestation in broad bean, data clearly showed that rate of infestation was remarkably varied with differing sampling dates with delaying sampling date there was gradual increase in the rodent infestation of pods/m^2 of broad bean infestation rate was maximized at 13 to 20 March. In another words, the rodent infestation was raised with maturity progressed. The highest rodent infestation in the pods of broad bean was recorded in February (the average were 5.32, 8.67 and 11.19/m^2 in February 13, 20 and 27, respectively). The lowest infestation by rodents was recorded on January and (13-20 March) taking the samples on 13-20 March as well as 20-27 February had insignificant infestation by rodents. The infestation was observed through (13, 20 and 27 February) which the pods were in the doughy stage in both treated and untreated areas.

It is clear that infestation of broad bean pods by rodents was significantly varied among the three distances namely 1.0, 10.0 and 20.0

meters. From plants infestation rate was gradually increased with decreasing distances, the highest infestation rate was recorded on broad bean plants adjacent to rodent burrows at the ridge of field. The narrow distance i.e. 10 m recorded an intermediate value (i.e. 7.22/m^2 in the pods). The wide distance (20.0 m) gave the lowest infestation in the pods of broad bean by rodents (5.40/m^2). This trend is logical, since the rodent burrows population was increased with reducing the site of rodent burrows from crop fields.

Data in Table 2 showed the highest percentage of infestation was recorded in untreated area (11.41) followed by Phosphide zinc, Phosphide zinc + Supercaid and Supercaid (5.91, 7.15and 9.14), respectively. The lowest percentage was observed in the mechanical treatment (3.22). The highest protection index was recorded in mechanical control (0.71) followed by Phosphide zinc and Phosphide zinc + Supercaid (0.48 and 0.37) and the lowest one for Supercaid (0.20). These results are in agreement with data obtained by Abazaid (1997). Mechanical control gives good results for controlling rodents under the field conditions without environmental pollution.

Table (2): Protection index (PI) of pods / m^2 of broad beans at different sampling dates by using mechanical and chemical control.

Sampling date	Treatment				
	M	P	P+S	S	C
Jan. 1 6	0.13	0.13	0.13	0.13	0.46
23	0.5	0.5	0.53	0.6	1.5
30	1.3	1.5	1.5	1.7	3.3
Feb. 6	2.13	2.7	2.9	3.2	5.2
13	2.7	3.5	3.9	6.7	9.9
20	4.2	5.7	7.3	10.6	15.5
27	4.9	8.3	10.9	13.9	18.0
Mar. 6	5.4	10.4	13.7	17.6	19.8
13	5.5	13.2	15.3	18.5	20.2
20	5.3	13.2	15.3	18.5	20.2
Mean	3.22	5.91	7.15	9.14	11.41
PI	0.71	0.48	0.37	0.19	

mechanical control P: phosphide zinc P+S: phosphide zinc + super Caid S: super CaidC: non-treatment

2. Wheat:

The efficacy of mechanical and chemical control on the infestation of plants/m^2 of wheat by rodents at different sampling dates and distances is shown in Table (3). It is clear that infestation of plants/m^2 of wheat by rodents was greatly affected by the application of mechanical and chemical control of rodent. Averages of rodent infestation in wheat plant/m^2 were ranged from 8.28 in untreated area to 3.33/m^2 in treatment controlling of rodent infestation by mechanical methods (the destroying burrows and erased the wasted materials). Phosphide zinc, Supercaid and Phosphide zinc + Supercaid significantly were followed by reducing infestation of plants rather than the control treatment. The effectiveness at these means in controlling rodents could be arranged as follows in ascending order, using Supercaid (7.47),

Phosphide zinc + Supercaid (5.59), Phosphide zinc (4.71) and mechanical control (3.33).

Application of Supercaid gave the highest infestation compared to the other agents. The lowest rodent infestation (3.33) was recorded on areas controlled by using mechanical control. Combined application of Phosphide zinc + Supercaid gave good control of rodents than using Supercaid alone, but not than using phosphide zinc alone. In untreated area, the maximum rodent infestation (8.28) was recorded. Infestation did not alter significantly by using (destroying burrows and erased the wasted materials) as using Phosphide zinc + Supercaid as using phosphide zinc.

Table (3): The efficacy of mechanical and chemical control on the infestation of plants / m^2 of wheat by rodents at different sampling dates and distances.

Sampling date	Distance (m)															(4)Grand avg. treatment					(3)Grand avg.
	1.0 m					10.0 m					20.0 m										
	Treatment																				
	C	M	P	P+S	S	C	M	P	P+S	S	C	M	P	P+S	S	C	M	P	P+S	S	
Apr. 1	(1)3.0 g-j (4)	1.8 m-o	1.6 k-o	2.2 j-o	1.8 g-o	2.4 k-o	0.8 m	1.4 l-o	1.4 l-o	2.2 k-o	1.8 l-o	0.4 o	1.8 m-o	1.2 m-o	1.8 l-o						1.69 D
8	4.2 e-o	1.4 l-o	2.8 k-o	3.8 f-o	4.0 e-o	3.8 j-o	1.2 m-o	1.6 l-o	2.2 k-o	3.8 j-o	2.6 k-o	0.6 m	1.4 m-o	2.8 l-o	2.4 k-o						2.31 D
15	6.0 c-o	2.4 j-o	2.6 l-o	3.8 e-o	5.8 c-o	4.2 g-o	1.6 l-o	1.8 k-o	2.6 j-o	4.2 e-o	3.6 j-o	1.2 m-o	1.8 l-o	2.4 k-o	3.4 g-o						3.16 CD
22	5.2 c-m	3.2 f-o	3.8 e-o	4.6 e-o	5.8 c-m	6.0 e-o	2.4 j-o	2.6 j-o	3.8 g-o	5.8 c-o	5.0 e-o	1.6 k-o	2.2 k-o	2.8 k-o	4.6 e-o						4.43 C
29	13.0 b-g	5.4 f-o	6.8 c-o	12.0 b-j	12.6 a-j	7.6 e-o	2.6 j-o	4.2 e-o	6.8 d-o	7.2 e-o	6.4 e-o	2.2 k-o	3.2 h-o	4.2 g-o	6.8 e-o						6.68 B
May. 6	18.8 a-c	6.8 c-o	13.4 a-g	13.2 a-h	17.2 a-d	10.2 b-o	3.2 f-o	5.4 e-o	7.8 d-o	8.8 c-o	8.6 c-o	3.2 g-o	5.8 e-o	4.8 e-o	7.6 e-o						8.83 AB
13	20.4 ab	10.8 a-f	14.8 a-f	14.2 a-e	17.8 a-c	11.8 a-o	4.8 e-o	6.2 e-o	7.4 e-o	9.4 c-o	10.2 c-o	4.8 e-o	5.4 e-o	5.2 e-o	8.8 e-o						9.87 A
20	20.8 a	10.6 a-f	14.8 a-f	14.4 a-e	18.8 a-c	11.4 a-o	5.2 e-o	6.2 e-o	7.4 e-o	9.4 c-o	10.2 c-o	4.8 e-o	5.4 e-o	5.4 e-o	8.2 e-o						10.04 A
(2)Grand avg.	8.71 (A)					4.90 (B)					4.83 (B)					8.28 (a)	3.33 (c)	4.71 (bc)	5.59 (b)	7.47 (a)	

C: untreated M : mechanical control P : phosphid zinc P+S: phosphid zinc + super caid S: super caid

(1) Means followed by the same small letter(s), do not significantly different at 0.05 level of probability.

(2) Means followed by the same capital letter(s), within the same column, do not significantly different at 0.05 level of probability.

(3) Means followed by the same capital letter (in parentheses), within the same row do not significantly different at 0.05 level of probability.

(4) Means followed by the same small letter(s) (in parentheses), do not significantly different at 0.05 level of probability.

In wheat field, it is advised to control rodents by mechanical control continuously, There was significant different between untreated area and mechanical control as well as Phosphide zinc and Supercaid. Rodent infestation in untreated and treated of wheat crop was significantly affected by varying sampling dates. There was a gradual increase in rodent infestation in wheat plants with harvest progress. The maximum values (10.04) were recorded on 20 May. Averages were 1.69, 2.31, 3.16, 4.43, 6.68, 8.83, 9.87 and 10.04 when samples were taken at April 1, 8, 15, 22, 29 and May 6, 13 and 20, respectively. Values did not significantly differ between April 1, 8 and

15. The truth that feeding of rodent depends on the ripening stage of crops especially wheat could explain the present results.

As shown in Table (4) rodent infestation of wheat plants was gradually decreased with increasing distance values from 1.0 to 20 m. The highest value (8.71) was recorded on wheat plants adjacent to rodent burrows at the ridge of the field. The lowest rodent infestation (4.03) was recorded at 20 m distance. The highest percentage of infestation was recorded in untreated area (8.28) followed by Phosphide zinc, Phosphide zinc + Supercaid and Supercaid (4.71, 5.59 and 7.47). The lowest percentage was observed in mechanical treatment (3.33). The protection index was (0.60, 0.43, 0.32 and 0.10) for mechanical method, Phosphide zinc, Phosphide zinc + Supercaid and Supercaid, respectively.

3. Maize:

The rate of rodent infestation in maize in response to mechanical and chemical control at different sampling dates and distances is given in Table (5). It is evident from the obtained data that varying methods of controlling rodents in the field was accompanied with changing infestation of ears of maize plants. Averages of rodent infestation areas to 9.66 ears /m^2 in (destroying burrows and erased the wasted materials) treatment mechanical and chemical control means significantly checked rodent infestation compared to non-treatment. Mechanical control of rodent gave the best control (9.66) followed by using Phosphide zinc (10.07) and using both Phosphide zinc + Supercaid (12.04) using Supercaid only ranked the last position in this respect. Controlling rodent infestation by using Phosphide zinc was very effective than using Supercaid. It is necessary for avoid rodent damage in maize plants by using mechanical agent namely (destroying burrows and erased the wasted materials) as using bait namely Phosphide zinc meaning less difference on rodent infestation was detected between using mechanical control and Phosphide zinc.

Table (4): Protection index (PI) of plants / m^2 of wheat at different sampling dates by using mechanical and chemical control.

Sampling date	Treatment				
	M	P	P+S	S	C
Apr. 1	0.7	1.3	1.7	2.3	2.4
8	1.1	1.7	2.4	3.13	3.3
15	1.7	2.1	2.9	4.5	4.6
22	2.4	2.9	3.7	6.4	6.7
29	3.4	4.7	7.7	8.6	9.0
May. 6	4.4	7.9	8.3	11.2	12.3
13	6.3	8.5	8.9	11.7	13.9
20	6.6	8.5	9.1	11.9	14.1
Mean	3.33	4.71	5.59	7.47	8.28
PI	0.60	0.43	0.32	0.1	

mechanical control P: phosphide zinc P+S: phosphide zinc + super Caid
S: super Caid C: non-treatment

Table (5): The efficacy of mechanical and chemical control on the infestation of ears / m^2 of maize by rodents at different sampling dates and distances.

Sampling date	Distance (m)															Grand avg. treatment					Grand avg.
	1.0 m					10.0 m					20.0 m										
	Treatment																				
	C	M	P	P+S	S	C	M	P	P+S	S	C	M	P	P+S	S	C	M	P	P+S	S	
Sep. 15	12.6	8.4	8.7	9.9	11.1	10.9	8.1	8.7	10.1	10.8	10.5	7.8	7.8	8.8	9.4	16.15	9.66	10.07	12.04	14.03	9.58
22	19.7	9.4	9.8	10.9	13.5	12.8	8.6	9.1	11.1	12	11.4	7.8	8.3	9.3	10.6						10.96
29	20.4	10	11	13.9	16.7	14.2	8.9	9.7	11.6	13.2	12.9	8.2	8.6	10.6	12.1						12.16
Oct. 6	20.7	11.5	11.9	14.8	17.5	15.5	10.5	10.6	12.6	14.5	12.9	9.2	9.6	11.1	12.6						13.05
13	22.9	12.1	12.5	15.2	19.1	19.2	10.5	10.9	13.9	16.5	15.3	9.6	9.6	11.1	13						14.1
20	23.5	12.4	13.2	15.8	19.4	19.2	11	11.4	14.3	16.9	15.9	9.6	9.9	11.6	13.5						14.51
Grand avg.	14.29					12.26					10.62										

C: untreated M: mechanical control P: phosphid zinc P+S: phosphid zinc + super caid S: super caid

In general, it was observed that there were differences between mechanical control and non-treatment as well as Phosphide zinc + Supercaid and using Supercaid. Infestation of ears/m^2 of maize was varied among all dates of samples. Advancing maturity stage was followed by increasing infestation of ears/m^2 and the values were maximized 20 October (14.5). Taking samples on 15, 22, 29 September, 6, 13 and 20 October resulted in infested 9.58, 10.76, 12.16, 13.05, 14.10 and 14.51 ears/m^2 of maize, respectively. No differences on infestation by rodent in maize were obtained between the following two dates of samples between 15 and 22 March, between 22 and 29 March, between 29 March and 6 October and between 13 and 20 March. The great infestation on maize with rodents was greatly associated with stage of maturity. Distance between burrows of rodents and the maize plants significantly governed the infestation and the damage caused by rodents. The adjacent plants to the burrows gave the highest value (14.29). Values were tended to decrease with increasing distance between burrows and plants from 1.0 to 20 m. the lowest infestation of ears in maize plants (10.62) was observed at the distance of 20 m. These results are in agreement with data obtained by Abazaid (1997) and Abdel-Gawad (2001).

Data in (Table 6) shows the highest percentage of infestation was recorded in untreated area (16.15), followed by Phosphide zinc, Phosphide zinc + Supercaid and Supercaid (10.07, 12.04 and 14.03), respectively. While, the lowest percent was observed in mechanical treatment (9.66). The highest protection index was recorded in mechanical control (0.40) followed by Phosphide zinc and Phosphide zinc + Supercaid (0.38and 0.25) and the lowest one for Supercaid (0.13).

Table (6): Protection index (PI) of ears / m^2 of maize at different sampling dates by using mechanical and chemical control.

Sampling date	Treatment				
	M	P	P+S	S	C
Sep. 15	8.1	8.4	9.6	10.43	11.3
22	8.6	9.06	10.4	10.03	14.6
29	9.03	9.8	12.03	14.0	15.8
Oct. 6	10.4	10.7	12.8	14.9	16.4
13	10.73	11.0	13.4	16.2	19.3
20	11.0	11.5	14.0	16.6	19.5
Mean	9.66	10.07	12.04	14.03	19.15
PI	0.40	0.38	0.25	0.13	

M: mechanical control P: phosphide zinc P+S: phosphide zinc + super Caid S: super Caid C: non-treatment

4.Sorghum:

Data concerning the efficacy of mechanical and chemical control on the infestation of panicle/m^2 of sorghum by rodents are given in Table (7). It is clear from the obtained data that mechanical and chemical control of rodent reduced the infestation of panicle/m^2 of sorghum compared to untreated treatment. The highest infestation was recorded on untreated areas. It was ranged from 9.61 in untreated to 5.62 panicle/m^2 in mechanical control treatment. The lowest value (5.62) was recorded when rodents were controlled by (destroying burrows and erased the wasted materials). The promising effect of these agents for controlling rodents could be arranged as follows in descending order, mechanical control (destroying burrows and erased the wasted materials) (5.62), using Phosphide zinc (6.03), using Phosphide zinc + Supercaid (6.24) and using Supercaid (7.16). Supercaid came in the last position in this respect. Using Phosphide zinc, was preferable than Supercaid in controlling the damage of rodents in sorghum. Application of Phosphide zinc plus Supercaid was not superior than the application of each alone in controlling rodents. Infestation rate when such two chemical compound were applied together was 6.24, while were 6.03 and 7.16 panicle/m^2 when Phosphide zinc and Supercaid were applied alone, respectively. Infestation did not change significantly among the three agents of control i.e. mechanical control, using Phosphide zinc and Phosphide zinc + Supercaid. The best promising two agents for controlling rodents in sorghum field were mechanical control and using Phosphide zinc.

Data concerning the effect of sampling dates on rodents infestation of sorghum clearly reveal that varying dates of samples was followed by differences on infestation of panicle of sorghum. With advancing maturity stage of sorghum infestation of panicle in sorghum tended to increase until reached the maximum value at 21 October. Samples taken in September 16, 23 and 30, October 7, 14 and 21 recorded 5.73, 5.99, 6.68, 7.18, 7.78 and 8.23 infestation values, respectively. No differences on infestation by rodents in sorghum were obtained between the following two dates of samples between 16 and 23 September, between 30 September and between September 30 and October 7. These results confirmed the good relationship between stage of panicle maturity and the extent of rodent infestation.

Table (7): The efficacy of mechanical and chemical control on the infestation of panicle / m^2 of sorghum by rodents at different sampling dates and distances.

Sampling date	Distance (m)															Grand avg. treatment					Grand avg.
	1.0 m					10.0 m					20.0 m										
	Treatment																				
	C	M	P	P+S	S	C	M	P	P+S	S	C	M	P	P+S	S	C	M	P	P+S	S	
Sep. 16	9.3	5.1	5.7	5.8	6.9	6.3	4.7	5.2	5.4	6.4	5.6	4.7	4.8	5.1	4.9	9.61	5.62	6.03	6.24	7.16	5.73
23	9.7	5.4	6.1	6.2	7.4	6.6	5.1	5.2	5.4	6.8	5.9	4.7	5.1	5.1	5.3						5.99
30	11	6.1	6.5	6.9	8.2	8.6	5.4	5.9	6.1	7.2	7	5	5.5	5.5	5.6						6.68
Oct. 7	12	6.5	6.9	7.2	8.8	9.9	5.8	6.2	6.4	7.8	8.1	5.1	5.5	5.5	5.9						7.18
14	14	6.9	7.5	7.9	9.2	11	5.8	6.2	6.7	8.5	9.5	5.7	5.8	6.1	5.9						7.78
21	15	7.1	7.8	7.9	9.2	13	6.4	6.9	7.1	8.5	11	5.7	5.8	6.1	6.2						8.23
Grand avg.	7.99					6.88					5.92										

C: untreated M: mechanical control P phosphid zinc P+S : phosphid zinc + super caid S: super caid

Distance between burrows of rodents and the sorghum plants significantly governed the infestation and the damage caused by rodents. The plants that adjacent to the rodent burrows gave the highest rodent infestation (7.99). Increasing distance between rodent burrows and sorghum plants from 1.0 to 20.0 m was followed by reduction and the rodents infestation. The lowest infestation of panicle by rodents in sorghum (5.92) was observed at the distance of 20 m. distance 10 m gave infestation value reached (6.88) panicle/m^2 of sorghum.

On the other side, data in Table (8) shows the highest percentage of infestation was recorded in untreated area (9.61) followed by Phosphide zinc, Phosphide zinc + Supercaid and Supercaid (6.03, 6.24 and 7.16, respectively). The protection index was (0.42, 0.37, 0.35 and 0.25) for mechanical control, Phosphide zinc, Phosphide zinc + Supercaid and Supercaid, respectively. In the mechanical method the destroying of burrows and erased the wasted materials may be reduce the all shelters of rodents and may be kill all rodents in the areas study. On the other side, the chemical method may be leaving some individuals after the treatment to return the population in this area.

Table (8): Protection index (PI) of panicle / m^2 of sorghum at different sampling dates by using mechanical and chemical control.

Sampling date	Treatment				
	M	P	P+S	S	C
Sep. 16	4.8	5.2	5.4	6.06	7.1
23	5.1	5.5	5.6	6.5	7.4
30	5.5	6.0	6.1	7.0	8.7
Oct. 7	5.8	6.2	6.4	7.5	10.1
14	6.1	6.5	6.9	7.9	11.4
21	6.4	6.8	7.1	8.0	13.0
Mean	5.62	6.03	6.24	7.16	9.61
PI	0.42	0.37	0.35	0.25	

M: mechanical control P: phosphide zinc P+S: phosphide zinc + super Caid S: super Caid C: untreated

Generally, the mechanical control for rodents under the field condition was more effective than the chemical methods. The mechanical method may be arranged according to their effectiveness, destroying of burrows and erased the wasted materials. These results are in agreement with data obtained by Abazaid (1997), Villa and Velasco (1994), El-Eraky *et al.*, (2000), and Abdel-Gawad (2001). Mechanical control gives good results for controlling rodents under the field conditions without environmental pollution.

REFERENCES

Abazaid, A.A. (1997): Ecological and toxicological studies on rodents in Qena governorate (Upper Egypt). Ph. D. Thesis, Fac. Agric., Assiut Univ., pp. 96.

Abdel-Galil, Y. M.A. (2005): Comparative studies on rodenticides against some rodents. Ph. D. Thesis, Fac. Agric., Al-Azhar Univ. Egypt. pp. 158.

Abdel-Gawad, K.H. (2001): Evaluation of some chemical and mechanical methods to rodent population in maize fields. The 2nd Sci. Conf. of Agric. Sci. October 28-29, 2001, vol. (1): 421-429.

Al-Wakeel, A.E.M. (2000): Comparative studies for the control of rats and mice. M. Sc. Thesis, Fac. Agric., Al-Azhar Univ., pp. 90.

El-Eraky, S.A.; Abdel-Gawad, K.H.; Farghal, A.I. and Abazaid, A.A. (2000): Evaluation of some mechanical control measures to reduce rodent population in Upper Egypt. The 2nd Sci. Conf. of Agric. Sci., Assiut, October 28-30, 2000, Vol. (1): 519-521.

El-Mallah, S.M.A. (2004): Ecological studies on certain vertebrate pests and their losses in relation to cocomitant Acari with these pests in Sadat region. M. Sc. Thesis, Fac. Agric. Menofia Univ. Egypt. pp. 102.

Farghal, A.I.; El-Eraky, S.A.; Abdel-Gawad, K.H. and Abazaid, A.A. (2000): Laboratory and field evaluation of some rodenticides against rodent species in Upper Egypt. The 2nd Sci. Conf. of Agric. Sci., Assiut, October.

Inglis, I.R. and Isaacson, A.J. (1987): Development of a simple scooping device for wood-pigeons (*Columa palumbus*). Crop Protection 6(2): 104-108.

Villa, B. and Velasco, A. (1994): Integrated pest management of the rat *R. norvegicus* in poultry farms. Veterinaria Mexico. 25(3): 247-249.

Wood, B. (2001): Control in oil palms and rice fields. Pesticide. Out look. 12(2): 71-74.

مكافحة القوارض باستخدام بعض الطرق الميكانيكية والكيميائية تحت الظروف الحقلية فى مصر العليا

عبدالستار متولى[١]، خليفة عبدالجواد[٢]، مسعد عبدالحليم أحمد[١] و هشام سيد أحمد[١]

١- قسم الحيوان الزراعى والنيماتودا- كلية الزراعة- جامعة الأزهر- مصر

٢- قسم وقاية النباتات- كلية الزراعة- جامعة أسيوط- مصر

تم استخدام بعض الوسائل الميكانيكية والكيميائية فى أربعة محاصيل حقلية وهى الفول البلدى والقمح كمحاصيل شتوية والذرة الشامية والذرة الرفيعة كمحاصيل صيفية باستخدام أربعة مناطق من كل محصول لإجراء عمليات المكافحة . ففي المنطقة الأولى كانت المكافحة باستخدام بعض الطرق الميكانيكية (هدم الجحور وحرق المخلفات) والمنطقة الثانية استخدام فوسفيد زنك ٣ % والمنطقة الثالثة استخدم سوبر كايد ٠,٠٠٤ % والمنطقة الرابعة فوسفيد زنك + سوبر كايد – وتركت مساحة للمقارنة بدون معاملة مع استخدام نسبة الإصابة كمقياس لنجاح عملية المكافحة. وتم تقدير الإصابة فى كل محصول حتى نهاية الموسم

اظهرت النتائج من خلال الإصابة في كل محصول أن المكافحة الميكانيكية أكثر نجاحا وفاعلية من استخدام المكافحة الكيميائية فى كل المحاصيل الحقلية الأربعة وهذا ربما يؤدي إلى الاتجاه إلى المكافحة الميكانيكية لتجنب التلوث البيئي الناتج عن المكافحة الكيميائية أما بالنسبة لنوعية المبيدات فأوضحت النتائج أن فاعلية فوسفيد الزنك (كمبيد سريع المفعول) كانت اكثر نجاحاً من السوبر كايد (كمانع التجلط) . ولذلك ينصح باستخدام فوسفيد الزنك لإعطاء نتائج سريعة في حالة الأماكن التي لا يوجد بها إنتاج حيواني أو أشخاص يخشى من تسممهم في حالة استخدام فوسفيد الزنك في المكافحة.