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REPELLENCY POTENTIAL AND PROTECTION INDEX OF SOME PESTICIDES AGAINST HOUSE SPARROW, *Passer domesticus* (L.) IN WHEAT CROP

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Abstract: Two **s**chedules of spray programme were tested for protecting wheat spikes from bird attack and reduce damage. In one-spray programme schedule, the protection indices (PI%) were calculated after different post-treatment intervals from pesticide applications. PI% of different application rates of the tested pesticides (pirimicarb, fenitrothion, malathion, flusilazole and diniconazole) indicated that the repellency performance at ripening stages of wheat was differed according to the chemical type and concentration of the repellents. The highest protection performance was exhibited by using the recommended rate of the tested pesticide, where PI% of 63.96, 37.66, 38.05, 41.24 and 42.55 % were obtained with pirimicarb, fenitrothion, malathion, flusilazole and diniconazole, respectively. In the two-spray programme schedule, protection performance of wheat spikes from house sparrow attak was also differed according to the chemical structure, rate of application and post-treatment intervals. Significant differences were observed between insecticide and fungicide compounds. The highest protection indices for wheat spikes were 74.33%, 51.53% and 51.06% when treated by pirimicarb, diniconazole and flusilazole, respectively, using the recommended rates for pest control. PI% were 48.09%, 46.68% and 44.68% for fenitrothion, pirimicarb and malathion, respectively, when fenitrothion and malathion were used at the recommended rates. While pirimicarb was used in a rate less than that of recommended for insect pest control. The differences between one and two-spray programme schedules; repellency potential; protection acheivement after different post-treatment intervals and the rates of pesticide application were discussed.

Key words: Repellency**,** Pesticides, wheat crop, *Passer domesticus*, house sparrow.

Introduction

Bird damage to crops, particularly cereal grains, is a serious problem allover the world. The house sparrow, *Passer domesticus niloticus* (L.) is the most familiar bird species.

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Sparrows frequently commensal with man and common in Egyptian villages, towns and cities. It has been viewed both as a pest (of agriculture and in the fouling of buildings) and as a desirable enhancement of the human environment.

In Egypt, the house sparrow, is considered one of the most important agricultural pests in cultivated areas. House sparrow birds consume many crops especially cereal grains such as wheat and sorghum as well as broad bean, sunflower, and grapes (Khattab, 1993 and Omar, 2005).

Bird repellents to protect seeds are a potentially impotent of integrated vertebrate pest management strategies (Avery *et al.*, 1993). This study was carried out during the ripening stages of wheat. The trial was aimed to evaluate the effectiveness of different application rates of recommended pesticides, for controlling some wheat pests, as repellent compounds. Two schedules of spray programme were performed to protect wheat spikes from birds attack and reduce birds damage.

Materials and Methods

Repellency potential and crop protection index (Pl%):

The study was executed at the Experimental Farm of Faculty of Agriculture., Assiut University, during the growing season of 2002/2003. The experiment included the chemical control of house sparrow, *P. domesticus niloticus* at the ripening stages of wheat plants (variety of Sids 7), cultivated on Nov., 20th by using broadcasting planting method. An area of about half feddan was divided into plots, each of 1/400 feddan. The experiment was arranged in split-split plot design, with planting method as a main plot treatment, chemical treatment as a sub plot, and spray program as a sub-sub plot treatment. Five pesticides (3 insecticides + 2 fungicides) were tested, to evaluate their repellency effects on house sparrow birds. Each chemical compound was investigated at three rates of concentrations:

- Pirimicarb (IUPAC), 50% DG was used at the rate of 10.4, 20.8 and 31.2g*/100 L. water

- Fenitrothion (IUPAC)50% EC was used at the rate of 66.6, 133.3 and 200cm3*/100L.water

-Malathion (IUPAC), 57% EC was used at the rate of 50, 100 and 150 cm3*/100L.water

-Flusilazole (IUPAC), 40% EC was used at the rate of 6.25, 12.5 and 18.75cm3*/100L.water

-Diniconazole (IUPAC), 5% EC was used at the rate of 11.6, 23.3 and 35 cm3*/100L.water

Full coverage of the wheat spikes with pesticides was secured by the use of a knapsack sprayer fitted with one nozzle. Check treatment was sprayed with water only, each treatment was replicated 4 times and tested in two programmes of pesticide applications as follows:

Programme number	Date of application		No.of application
	First	Second	
1	Apr., 1st	—	1
2	Apr., 1st	Apr., 15th	2

Sampling and counting:

The damage assessment and protection index (PI), in all experimental plots (treated and untreated spikes), were used as a criteria to evaluate the effectiveness of the tested pesticides and application programmes on repellency potential and protection of wheat spikes, against house sparrow attack. Protection index (PI) was calculated by the equation adopted by Inglis and Isscson., 1987 as follows:

$$\text{Protection Index (PI)} = \frac{A-B}{A} \times 100$$

where: (A) = mean damage percentage in untreated plots.

(B) = mean damage percentage in treated plots.

The post-treatment assessment was made after 3, 7, 15, 20, 24 and 30 days from the date of spray for the first application programme, and after 3, 7 and 15 day from the date of spray for the second one (2 sprays). These counts represent the initial, the actual and the residual effects of the tested pesticides.

1.2.3. Statistical analysis:

Data of the protection index (PI) were statistically analyzed using split-split plot design with four replications. Means were compared according to Duncan's Multiple Range test, at 0.05 level of probability

Results and Discussion

One-spray programme schedules:

The protection indices (PI%) were calculated after different post-treatment intervals (i.e., 3-, 7-, 15-, 20-, 24-, and 30-day) from pesticide applications in one-spray programme (Apr. 1st). Protection indices after 3-day and after 7-day represent the initial and the actual effect, respect-ively. While PI% after the rest intervals represent the residual effect of the pesticides as bird repellents (Table 1 and Fig.1).

Concerning the protection indices (PI%) of the different application rates of the tested pesticides regardless of post-treatment intervals, statistical analysis of data (Table 1) indicated that the repellency performance at ripening stages of wheat was differed according to the chemical type and concentration of the repellents.

Results in Table 1 and Figure.1 revealed significant differences among the concentrations of each pesticide. The highest protection performance was exhibited by using the recommended rate of each pesticide for controlling the pests. The protection indices (PI%) of the tested pesticides were: 63.96%, 37.66%, 38.05%, 41.24% and 42.55% for pirimicarb, fenitrothion, malathion, flusilazole and diniconazole, respectively, in the rate of 31.2 g., 200 cm^3, 150 cm^3, 18.75 cm^3 and 35 cm^3/100 lit.

It is interesting to note that application of pirimicarb at a relatively low rate (20.8 g/100 lit. water) was accomplished a protection index of 37.77%, which insignificantly different from those of malathion and fenitrothion at the recommended rate mentioned above. Moreover, spraying wheat plants during ripening stages by malathion with a rate of 50 cm^3/100 lit. water or by fenitrothion at a rate of 66.6 cm^3/100 lit. gave significant protection performance with PI% of 18.32% and 13.26%, respectively.The repellency effects were enhanced with increasing of pesticide concentrations and more protection potential and less wheat spikes damage were pronounced. The protection indices at different post-treatment intervals indicated that the highest protection index (49.96%) was achieved after 3-day post-treatment interval (initial effect), followed by 7-day post-treatment interval (actual effect, 45.10%). A quick declination in the protection performance was recorded after 15-day post-treatment and, after 20-day post-treatment interval, the protection index (23.62%) became around half the initial effect (49.96%).

Generally, data presented in Table 1 manifested that the protection index of the two tested fungicides (flusilazole and diniconazole) reduced to their halves for most of tested application rates, after 20-day of post-treatment intervals. Whereas, those for the three tested insecticides were reached after 15- or 20-day post-treatment intervals, except for pirimicarb (in a rate of 31.2 gm/100 lit. water) and malathion (in a rate of 100 cm^3/100 lit. water), which reached their halves after more than 24-day post-treatment intervals. The obtained results of the interaction effects emphasis the importance of expanding periods of protection performance by one more pesticide application after 15-20 days post-treatment interval of the first application (Table 1). Furthermore, the results of the interaction effects reveal superior performance of all tested pesticides, as bird repellents, after 3-day and 7-day post-treatment intervals (initial and actual effects) when applied at the recommended rates from both insecticides and fungicides for controlling insect pests and plant pathogen. The protection index ranged between 63.3%-89.1% and 65.27%-66.83% after 3-day post-treatment intervals (initial effect). While, it ranged 49.37%-80.53% and 61.37%-65.8% after 7-day post-treatment intervals (actual effect), for the tested insecticides and fungicides, respectively (Table 1). Also, the results, generally,

indicated the significant differences between pirimicarb and the rest tested pesticides, after 15 and 20-day post treatment interval.

It is also evident from the results (Table 1) that applied wheat spikes, during the ripening stages, by certain pesticides with rates less than that recommended for controlling wheat pests, may acquired adequate protection performance for a relatively long periods (15 or 20 days post-treatment intervals). These pesticides included pirimicarb (in a rate of 20.8 g/100 lit. water), followed by flusilazole and diniconazole (in rates of 12.5 cm^3 and 23.3 cm^3/ 100 lit. water, respectively), then pirimicarb (in a rate of 10.4 g./100 lit. water).

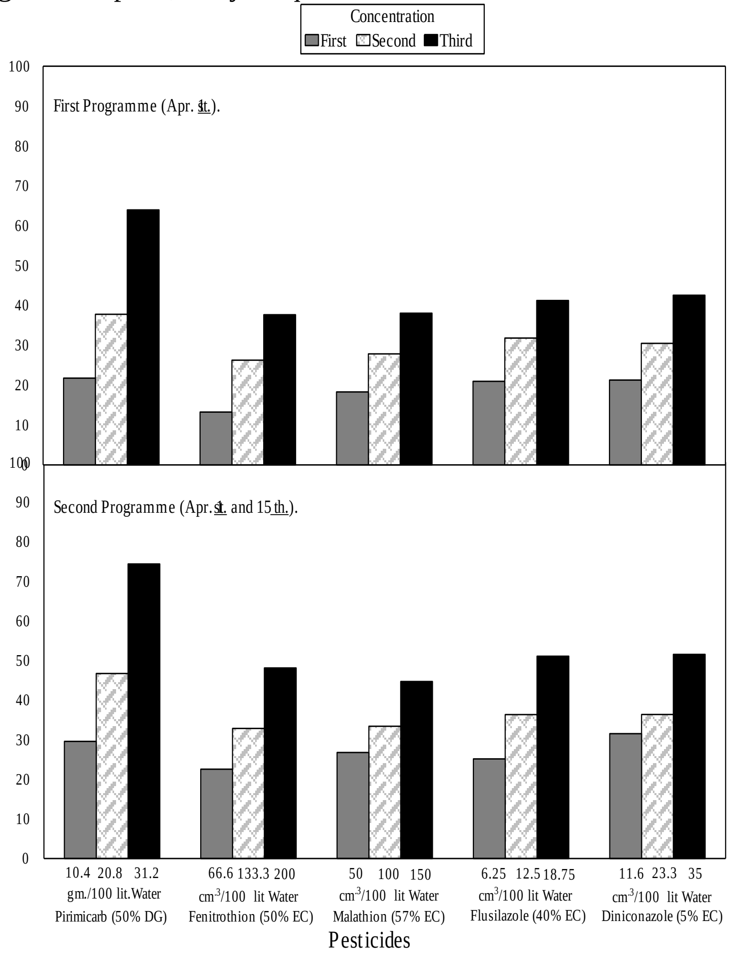

Fig.(1): Average protection index (PI%) of certain pesticide with different rates, in one-spray and two-spray programmes, during wheat ripening stages, regardless of different post-treatment intervals, Assiut Governorate, (2002/2003) season.

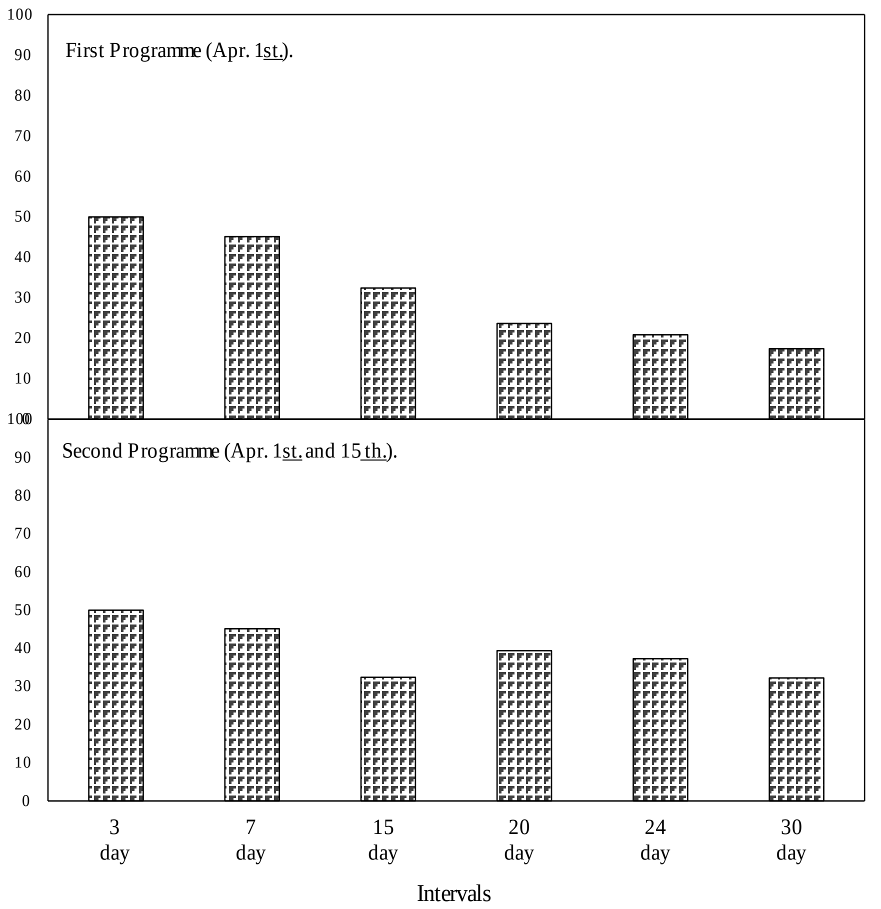

Fig.(2): Average protection index (PI%) at different post-treatment intervals, induced after application of one-spray and two-spray programmes, during wheat ripening stages, regardless of pesticide rates, Assiut Governorate, (2002/2003) season.

Finally, it can be concluded that it is profitable to treat wheat plants, during ripening stages, by the insecticide pirimicarb or one of the fungicides (flusilazole or diniconazole) in their recommended rates for controlling wheat pests to acquire adequate spikes protection performance from house sparrows attack, for a relatively long period (15 or 20 days post-treatment intervals). Also, the abovementioned three pesticides (pirimicarb, flusilazole and diniconazole) could be applied on wheat spikes effectively at rates less than that recommended for pest control to avoid air and land pollution.

Two-spray programme schedule:

The statistical analysis of data representing the protection indices (PI%) resulted from applying two-spray programme schedules, are presented in Table 2 and Figures. 1&2. The obtained results supported the former data regarding the tested rates of the different pesticide. Field repellency and subsequently protection performance of wheat spikes from house sparrow attack, were noticeably differed according to the chemical structures, rates of application and post-treatment intervals.

The protection indices after applications of two-spray programme schedule may be demonstrate the importance of the second application of pesticides for enhancing the protection potential and expanding the protection period to wheat spikes against attack of house sparrow.

Post- treatment intervals, data (Table 2 and Fig. 1) indicated that the highest protection index for wheat spikes (74.33%, 51.53% and 51.06%) were performed by applying the insecticide, pirimicarb and the two fungicides, diniconazole and flusilazole, with the recommended rates (i.e., 31.2 g., 35 cm^3 and 18.75 cm^3/ 100 lit. water), respectively.

Comparatively, from the results presented in Tables 1 and 2, it is of interest to note that the second applications of the tested pesticides (15-day later from the first one), enhanced the protection index of each application rate by different percentages. Increasing in the protection percentages ranged about 6%-11% and 5%-10% for the tested insecticides and fungicides, respectively. This emphasizes the necessity for more than one-spray programme for obtaining a profitable wheat spikes protection during ripening stage, against house sparrow attack. Evidently, the second application of the tested pesticide resulted in protecting the pattern of the repellent chemicals persistence, and so, the protection performance. The repellency effect of all tested pesticides was extended to 30-day post-treatment.

Generally, the results showed that higher rate of pesticide application resulted in higher repellency and protection performance to the wheat spikes during ripening stage. The differences among the pesticide achievement (repellency/protection) were significant through the experiment period. The excellent potential as avian repellent was accomplished when the insecticide, pirimicarb was sprayed with the recommended rate (31.2 g. /100 lit. water). The exhibited protection index after 3- and 7-day post-treatment interval (initial and actual effects) were 89.10% and

80.53% , respectively. While, after 15-day to 30-day post-treatment interval (residual effect) the protection indices ranged from 67.69% to 69.83%. This extension in the period of the residual effect was resulted from an excess application of the insecticide after 15-day from the first one.

Furthermore, the second potent pesticides tested as avian repellent, were the two fungicide compounds (diniconazole and flusilazole), applied with the recommended rates (i.e., 35 cm^3 and 18.75 cm^3 /100 lit. water). The differences in the protection index exhibited by the application of the two fungicides towards initial, actual and residual effects were insignificant, but significant between them and the insecticide, pirimicarb.

Ultimately, the forementioned results concerning repellency potential and crop protection indices (PI%) of certain pesticides against the house sparrow, *P. domesticus niloticus* attack, under field conditions, demonstrated different patterns of persistence/degradation behavior with each of the tested compounds. The efficiency or repellency effect and subsequently protection performance (damage/protection) of the tested pesticides, significantly, differed according to the concentration (rate), type and/or chemical structure and number of applications. Positive relation was recorded between pesticide number of application and enhancement of protection index, during the ripening stage of wheat.Certain rates of application of the tested pesticides exhibited superior protection performance in reducing wheat damage and in increasing wheat spikes protection against house sparrows attack. Generally, the more the number of pesticide application, the higher the protection index, and the less the damage of wheat spikes, and vice verca. This was pronounced, in general, with the tested pesticides: pirimicarb, fenitrothion, malathion, flusilazole and diniconazole.

In conclusion, the above-mentioned results, evidently, manifested that the chemical control approaches for the house sparrow, by using the foregoing compounds as avian repellents, must run at the beginning of the wheat ripening stages, especially, at dough ripe stage and mature ripe stage that are, drastically, attacked by the house sparrow birds.

The results respecting the fungicide (flusilazole) are in concordance with the findings of Gaber *et al*. (2001) who found that fenarimol and flusilazole were the most effective, as repellent compounds, in protecting grains of wheat and other field crops, against house sparrow birds, under field conditions.

The potentiality of pirimicarb (carbamate insecticide) and the two tested fungicides (diniconazole and flusilazole), as repellent compounds against the house sparrow birds, may be attributed to different physiological characteristics and biochemical mechanisms [e.g., merely distaste or some other sensory identification of the chemical, certain initial post-ingestional disturbance (nausea, lack of appetite, etc.)]. Schafer and Brunton (1971) reported that the reason that methiocarb (carbamate insecticide) and other chemicals repel birds is not well understood. Several decades ago repellents were believed to be merely distasteful substances. However, recent information indicated that taste may play a secondary role and that aversion to particular substance is caused primarily by the initial post-ingestional (nausea, lake of appetite, etc.) from eating varying amounts of that substance. Also, Schafer (1981) stated that a physiological effect caused by methiocarb (carbamate insecticide) is probably responsible for its repellency to birds. Birds can detect this effect and associate with the taste or some other sensory identification of the chemical.

The present results are partially agree with those of Bruggers (1979) who found that methiocarb could reduce bird damage to grain crops. It is probable that two or three applications are necessary to achieve damage reduction. Also, Khattab (1993), under field conditions, showed that the repellent potential of Nuvacron, Dimethoate and Marshal was significantly varied according to the type of chemical, species of crop and its stage in which the treatment was carried out in addition to habitat.

Many investigators in abroad and in Egypt, had reported the phenomenon of repellency action of some tested compounds against bird species. They elucidated that the effectiveness of any avian repellent compounds may varied according to numerous factors. These factors include the species of the treated crop, the crop particularity (its season and maturation process), the bird species (its numbers and season), the application rate, number of application, equipment, distribution of product, timing of application, and the irrigation systems. Until now, most of these bird pests were chemically controlled by using synthetic avicide such as repellent compounds or pesticides, which are relatively safe in use (Mott *et al.*, 1975; Pozzoli, 1988; El-Deeb, 1990; Metwally *et al.*, 1993; and Rizvi *et al.*, 2002).

Ultimately, the integrated bird management approach programmes differ according to the bird species, crop variety, stage and characteristics of the agro-ecosystem. To select the appropriate elements of IPM to alleviate bird damage, the cost-effectiveness, safety degradeability, applicability and environmental hazard should be taken into consideration.

References

Avery, M.L.; D.G. Decker; D.L. Fischer and T.R. Stafford. 1993. Response of captive black birds to a new insecticidal seed treatment. Ibid., 57 : 652-656.

Bruggers, R.L. 1979. Summary of methiocarb trials against pest birds in Senegal. Bowling Green Bird Control Seminar, 8:172-184.

El-Deeb, H.I. 1990. Effect of certain compounds as bird repellent to protect field crops under different conditions. Zagazig J. Agric. Res., 17: 1701- 1707.

Gabr, W.M.; S.H. El-Din; S.Y. El-Nabi and M.S. Ahmed. 2001. The avicidal performance of some pesticides against house sparrow, under laboratory and field conditions. Egypt J. Agric. Res., 79: 881-891.

Inglis, I.R. and A.J. Isscson. 1987. Development of a simple scaring device for wood-pigeons, *Colume palumbus*. Crop Protec., 6:104-108 .

Khattab, M.M. 1993. Biological ecological and toxicological studies on harmful birds of agriculture land of Sharkia Governorate. M.Sc. Thesis, Fac. Agric., Al-Azhar Univ., pp 192.

Metwally, H.E.; I.L.S.M. Fahmy; H.I. El-Deeb and S.M. Abd-El-All. 1993. The repellency potential and toxic effect of some pesticides against some common bird pest in Egypt. Bull., Fac. Agric, Univ. Cairo, 44 : 951- 966.

Mott, D.F.; J.L. Guarino; E.W. Schafer, Jr. and D.J. Cumminighan.1975.Methiocarb for preventing black bird damage to sprouting rice. Vertebr. Pest Cont., Calif., 8: 22-25.

Omar, M.M.A., 2005. Ecological and biological studies on some wild birds. MSc. Thesis, Fac. Agric., Al-Azhar Univ., Egypt, pp. 165.

Pozzoli, R.A. 1988. Use of repellent substances for reducing bird damage in cherries. Revista de la Facultad de Ciencias Agrarias, Universidad Nacional de Cuyo, 24: 69-78.

Rizvi, S.W.A.; A. Perevz and S.M. Ahmed, 2002. Evaluation of methiocarb 50%-WP as a taste repellent against the house sparrow (*Passer domesticus* L.). Turk. J. Zool., 26: 131-135.

Schafer, E.W.Jr., 1981. Bird control, chemical – nature, mode of action, and toxicity. CRC Handbook of Pest Management in Agriculture, 2: 599-610.

Schafer, E.W.Jr. and R.B. Brunton, 1971. Chemicals as bird repellent, two promising agents. J. Wildl. Manage., 35 : 569-572.

كفاءة بعض مبيدات الآفات فى طرد وحماية محصول القمح من هجوم عصفور النيل الدورى

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تم إختبار برنامجين للرش لحماية سنابل القمح من العصافير وتقليل ضررها. ففى برنامج رشة واحدة تم حساب نسبة الحماية عقب فترات زمنية مختلفة بعد المعاملة باستخدام معدلات مختلفه للمعاملة. والمعاملة بمبيدات البيريميكارب، الفينيتروثون، الملاثيون، الفلازيلازول، داينيكونازول قد دلت على أن التأثير الطارد فى طور نضج القمح قد اختلف تبعاً لنوع المبيد وتركيزه. وقد تم الحصول على أعلى نسبة حماية عند إستخدام المعدل الموصى باستخدامه حيث كانت نسبة الحماية 63.96 ، 37.66 ، 38.05 ، 41.24 ، 42.55% عند المعاملة بالبريميكارب، الفينيتروثيون، الملاثيون، الفلازيلازول، الداينيكونازول على التوالى. وفى برنامج رشتين إختلفت نسبة الحماية أيضاً تبعاً لنوع المبيد وتركيبه الكيميائى ومعدل الإستخدام والمدة عقب المعاملة. وكانت الإختلافات معنوية بين المبيدات الحشرية والأخرى الفطرية. وكانت أعلى نسبة حماية لسنابل القمح هى 74.33 ، 51.53 ، 51.06% عند المعاملة بالبيريميكارب، الداينيكونازول، الفلازيلازول على التوالى بإستخدام المعدلات الموصى بها لمكافحة الآفات .وقد كانت نسبة الحماية 48.09% ، 46.68% ، 44.68% للفينيتروثيون، البيريميكارب، الملاثيون على التوالى عند إستخدام الفينيتروثيون والملاثيون بالمعدل الموصى به بينما استخدم البيريميكارب بمعدل أقل من المعدل الموصى به لمكافحة الآفات. وقد تم مناقشة الإختلافات بين برنامج رشة واحدة وبرنامج الرشتين، وكفاءة الطرد ودرجة الحماية بعد فترات زمنية مختلفة و كذلك المعدلات المختلفة للمعاملة0