INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2000/02–1-2–74–76

Significance of Additives to Enhance Poison Baits Acceptance against Field Rats in Rice Paddy in Central Punjab, Pakistan

HAMMAD AHMAD KHAN, ANJUM SOHAIL† AND SHAHID YAZDANI
Departments of Zoology and Fisheries and †Entomology, University of Agriculture, Faisalabad-38040, Pakistan

ABSTRACT

Field trials on four field rodents *viz.*, *Bandicota bengalensis, Millardia meltada*, *Mus musculus* and *Nesokia indica* were conducted to control their populations in rice crop by improving poison bait acceptance using the additives *viz.*, minced meat, egg-yolk, egg-shell and yeast. Poison baits; brodifacoum, bromoadiolone (0.005%) and zinc phosphide (2%) were employed as rodenticides. Egg-shell ranked first in the preference over the other additives and non-additive poison baits. Additive poisoning with brodefacoum reduced the population of *Mus musculus* to 92.4%, with bromadiolone 89.7% and with zinc phosphide 94.7%. Similarly, for *Bandicota bengalensis,* a reduction of 91.5% with brodefacoum, 92.0% with bromadiolone and 94.7% with zinc phosphide was recorded, while for both *Nesokia indica* and *Millardia meltada*, the respective decrease was 87.5, 90.5, 94.2, and 88.7, 85.7 and 94.7% was reported. Two baitings, one at flowering and other at maturity stage of the crop gave a tiller reduction damage to 94.0% with brodefacoum, 92.0% with bromadiolone and 91.5% with zinc phosphide. It was concluded that the two baitings, one at the flowering stage, and the other at maturity stage may be employed to obtain a robust production.

Key Words: Additives; Bait; Rice; Brodifacoum; Bromadiolone; Zinc- phosphide

INTRODUCTION

Rice is an important cash crop of Pakistan, as such the area for its cultivation has enhanced steadily. However, Pakistan is still ranked amongest the low yield countries in the world (Fulk, 1977). Rice is highly susceptible to the attack by field rodents *viz.*, *Bandicota bengalensis, Millarida meltada, Mus musculus* and *Nesokia indica* (Khan *et al.,* 1988). An average reduction in paddy rice was estimated to be 18% within an area of 40-45% in Sheikupura (Akhtar, 1988). Use of a variety of poisons has been a principal method for rodent control as it is inexpensive and effective. The success of this programme is however, based on the type of poisons and their formulations (Fulk *et al*., 1980). The present study was, thus aimed at knowing the poison bait acceptance coupled with the addition of certain additives in Central Punjab to reduce the rodent infestation in paddy rice crop.

MATERIALS AND METHODS

The study area was randomly divided in to four equal sized blocks (three treatment and one control). Treatment blocks were treated with brodifacoum, bromadiolone and zinc phosphide. Zinc phosphide, an acute poison, brodifacoum and bromadilone, anticoagulants, were employed as rodenticides. For the baits, broken rice and wheat flour were used as the base of the bait. White egg shell, egg yolk, yeast powder and minced meat were used as the additives. The brodifacoum formulation 0.005%, was prepared with a mixture of broken rice, wheat flour, additive and poison with a ratio of 44.5:45.5:2.7. For an approximate evaluation, poison bait formulated by mixing broken rice, wheat flour, additive and a poison in a ratio 48:46:2:4, and a poison bait without additive in a ratio 47.5:48.4:2.4, whereas, non-additive bait was prepared in a ratio:48:4:47:8:3:2.

Bait procedure. Experiments were conducted at two growth stages *viz.*, flowering stage (seven weeks after transplantation) and a maturity stage (10 weeks after transplantation). In every treatment block, four baiting stations were formed at equal distance (250 m) from each other. Each bait station comprised of four additive poison baits and a reference bait (without additives) and were placed separately in earthen cups on the dikes and fixed in the soil. At every baiting station, bait weighing 100 g was offered to the rodents and was replenished with a fresh bait daily for a period of five days. Weighing of the baits was accomplished with a "weighing balance" after a 24 hour interval, and the quantity of the bait consumed was recorded. The location of feeding cups was changed daily to avoid any position preferences. The percentage reduction in the rat activity was assessed by the measurement of the tracking tiles and tiller damage (Mathur & Prakash, 1987). Pre-treatment and post-treatment activity of rodents was documented by placing forty tracking tiles/block and each measuring 30 x 30 cm with the bait station by following the Cowan and Townsend (1994) method, taking three transects in every block for three nights. Half part of the tracking tiles was painted with the printing ink to find any record of the footprints of the

three rodent species. After three days, tiles were recorded to be positive and represented the percentage proportion of all the placed tiles in the field. For the tiller damage assessment, a total of forty samples were selected from all four blocks. All the three rat species were identified due to the presence of their footprints on the tracking tiles.

Each sample was one square meter quadrate in which all damaged and undamaged tillers were recorded. Percentage of the damaged tillers was calculated by the formula D (%)=100xTC/N where D is the percentage of damaged tillers done by rodents, while N is the total number of examined tillers in the crop. Damage reduction in treated blocks (treated) was compared with the treated (control) block to determine the efficacy of the poisons. Analysis of variance (ANOVA) was employed to find out the differences in the consumption of different baits. Duncan's New Multiple Range Test (DMR) was also used to document the variations between the groups**.**

RESULTS AND DISCUSSION

Bait consumption. Average daily consumption of the additive baits has been presented in Table I.

Table I. Average daily consumption of additive baits (brodifacoum, bromadiolone and zinc phosphide) rodenticides, compared with a non-additive bait in paddy rice

Bait additives	Average daily consumption (g)								
	Brodefacoum (0.005%)			Bromadiolone (0.005%)			Zinc hosphide		
	F	M	ACD	F	M	ACD	F	M	ACD
Egg shell	33.4	29.8	31.6a	72.4	27.5	49.9a	15.0	7.4	11.2a
Minced meat	33.8	27.5	30.6ab	67.4	11.5	39.4b	3.8	6.0	4.9bc
Egg yolk	22.5	19.7	21.1bc	58.7	8.8	33.8b	10.5	4.8	7.7ab
Yeast	25.0	11.5	18.2c	61.5	5.7	33.6b	2.8	5.5	4.1bc
Control (without additives)	24.7	5.5	15.1c	50.7	5.2	27.9b	3.8	3.7	3.7bc
Total	139.4	94.0	116.6	310.7	58.7	184.6	27.4	31.5	31.6

F = Flowering stage; M = Maturity stage; ACD = Average consumption per day; ($P < 0.05\%$)

It is evident from Table I that of the three rodenticides employed in tandem with the additives, egg shell on an average, proved to be the most intensively consumed bait additive by the three rodent species which was 31.6 g during the flowering stage, followed by the minced meat being 30.6 g, egg yolk 21.1 g, yeast 18.2 g, and for the control (without additives), it was 15.1 g. In the present study, the egg shell preference by rodents is in accordance with the laboratory trials conducted on field rats (Shafi *et al.,* 1991, 1992). Similarly, brodifacoum and bromadiolone bait with egg shell also proved to be effective in rodent control than the non-additive bait (Shafi *et al.,* 1992). It has been suggested that the texture of the egg shell marks an attractive taste for the rodents. For the zinc phosphide, more preference for the egg shell bait than the non-additive bait is significant as fundamentally, zinc phosphide causes an immense "bait-shyness" and posion abhorence (Prakash, 1976). It is important to point out here that with this an improved formulation with the zinc phosphide in tandem with an egg shell will prove beneficial to the farmers as it is one of the widely employed acute rodenticide against the control of rodent species. However, with lack of expertise, its grievous consequences cannot be done away with readily.

Table II. Rodent activity reduction in paddy-rice field with poison baits

Rodent species	Poison baits	Pre-treatment activity	Post-treatment activity	Reduction in rodent activity
Mus musculus	Brodefacoum (0.005%)	42.5a	4.2a	92.4a
	Bromadiolone (0.005%)	35.5b	3.5ab	89.7ab
	Zinc phosphide (2.0%)	34.2ab	1.5bc	94.7ab
		112.2	9.1	276.8
Bandicota bengalensis	Brodefacoum (0.005%)	40.4a	3.5b	91.5ab
	Bromadiolone (0.005%)	45.5a	4.8c	92.0ab
	Zinc phosphide (2.0%)	38.8b	2.5c	94.7bc
		124.7	10.8	278.2
Nesokia Indica	Brodefacoum (0.005%)	35.5a	4.4a	88.7aa
	Bromadiolone (0.005%)	32.5ab	5.7a	85.7ab
	Zinc phosphide (2.0%)	39.7a	2.5bc	94.5bc
		112.7	12.6	269.0
Millarida meltada	Brodefacoum (0.005%)	40.5a	4.4a	88.7aa
	Bromadiolone (0.005%)	32.5ab	5.7a	85.7ab
	Zinc phosphide (2.0%)	39.7a	2.5bc	94.5bc
		112.7	12.6	269.0

Rodent activity reduction. The rodent activity reduction with different baits has been presented in Table II.

It is evident from Table II that for *Mus musculus*, the reduction in rodent activity with brodefacoum was 92.4%, with bromadiolone 89.7% and with zinc phosphide 94.7%. Similarly, for the remaining three rodent species, a decrease of 91.5, 92.0, 94.7; 87.5, 90.5, 94.2 and 88.7, 85.7 and 94.5% was recorded.

Tiller damage reduction. It is evident from Table III that two baitings one at flowering stage and the other at the maturity stage gave 94.0% with brodefacoum, whereas at the maturity stage it was 67.0%. For bromadiolone, it was 92.0% at the flowering stage, and 71.7% at the maturity stage, and for the zinc phosphide,

Table III. Tiller damage reduction after treatment with poison baits at flowering and maturity stages of rice paddy

Treatment	Tiller Damage (%)		Damage reduction (%)	
	F	M	F	M
Brodefacoum (0.005%)	40.0b	37.5a	94.0a	67.0b
Bromadiolone (0.005%)	4.7a	15.0bc	92.0a	71.7ab
Zinc phosphide (2.0%)	4.9a	24.0ab	91.5a	66.5ac
Total	13.6	76.5	277.5	205.2

F = Flowering stage; M = Maturity stage; P <0.05

it was 91.5% and 66.5% at the flowering and maturity stage, respectively.

Rice is the one of the main crops in Pakistan. It is vulnerable to the rodent attack during all stages of growth. However, initial harm to the tillers may result in a negligible yield loss as the compensatory growth fosters a fairly good recovery (Greaves *et al*., 1977). Tiller damage at the flowering stage results in only a partial yield loss compared to the losses incurred at the maturity stage which results in a total crop destruction (Guerrero, 1992).

The results obtained from the present study document that at both stage of the paddy crop, the frequency of baitings are significant to prevent it against the rodent damage. It may, therefore, be recommended that the two poison baitings, along with the egg shell additive should be used both at the flowering and the maturity stage of the rice crop to avert economic losses from these rodent species.

REFERENCES

Akhtar, N., 1988. An estimation of the rodent damage to paddy crop in Central Punjab. *Sarhad J. Agric.*, 12: 26–8.

Cowan, D.P. and M.T. Townsend, 1994. Field evaluation of rodenticides.Rodent pests and their control. Buckle, A.P. and R.H. Smith (eds.), pp: 450. *CAB International*, U.K.

Fulk, G.W., 1977. Food hoarding of *Bandicota bengalensis* in a rice field. *Mammalia*, 41: 539–41.

Fulk, G.W., A.C. Smiet and A.R. Khokar, 1980. Movements of *Bandicota* b*engalensis* and *Tatera indica* as revealed by radiotelemetry. *J. Bombay Natural Hist. Soc*., 76: 457–60.

Greaves, J.H., G.W. Fulk and A.A. Khan, 1977. Preliminary investigation into the rice rat problem in Lower Sindh, All India Rodent Seminar, Ahmadabad, India. *Proc. Rodent Damage,* May 20-23, 1977. pp: 24–8.

Guerrero, R.D., 1992. The effect of simulated rat tiller cutting on yield of Rice. *Trop. Pest Mangt*., 27: 116–20.

Khan, A.A., S. Ahmad and M.A. Chaudhry, 1988. Comparative evaluation of brodifacoum and bromadiolone against field rats in wheat and paddy crops. *Proc. Orgn. Pract. Vert. Pest Control,* 30th August to 3rd September, 1982. Eleventh Hall, Hampshire, England, pp: 359–79.

Mathur, R.P. and I. Prakash, 1987. Methods used in field evaluation of anticoagulants in India. *In: Vertebrate Pest Control and Management Materials, 4th Symposium ASTM STP 817,* Kaukeinen, D.F. (ed.), pp: 256–60. American Society for Testing and Materials, Philadelphia.

Prakash, I., 1976. Rodent pest management, principles and practice. Monograph No. 4, Central Arid Research Institute, Jodhpur, pp: 1–28.

Shafi, M.M., S. Ahmad, M.S. Ahmad and A. Pervez, 1991. Taste additives improve poison bait acceptance in Indian gerbil, *Tatera indica*. *J. Plant Protec. Tropics*, 8: 77–82.

Shafi, M.M., S. Ahmad, A. Pervez, 1992. The influence of some additives on poison additives in short-tail mole rat, *Nesokia indica. Int. J. Trop. Agric*., 10: 54–9.

(Received 03 March 2000; Accepted 29 March 2000)