NATIONAL PROGRAMME FOR RODENT PEST MANAGEMENT

ICAR

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COORDINATING & MONITORING CENTRE
CENTRAL ARID ZONE RESEARCH INSTITUTE, JODHPUR

The second All India Workshop on Rodent Research and Training recommended that as far as possible all AICRP and other Centres functioning in different agroclimatic zones should follow a uniform method for the study of various aspects of rodent research. With this in view the protocols being followed at Coordinating and Monitoring Centre for Rodent Research are outlined in this number of the Newsletter.

Social engineering activity in rodent control

The objective of this work is to find out threshold level of rodent population in the crop fields (various crops) and residential premises, the interval between two rodent control operations, to assess the cost worthiness of the entire control operation, in relation to the returns of benefit in the form of reduction in the magnitude of rodent damage to crops (or stored grains) and resultant increase in production per unit area. Besides, emphasis is also to be laid on training the farmers and to study the adoption of innovation.

About 2000 hectares area will be divided into nine equal parts separated from each other. Each part will include some residential premises and cropped area. These 9 parts will be grouped in 3 major areas namely (i) Maintenance, where operational work (control and education, propaganda) will continue for full duration of work (ii) Neglected, where control and education will be made for half of the period then will be stopped (iii) Survey, which will receive no control and or education, and be left totally under control of farming community. The calender of operation should be as per schedule on P. 10.

Social aspects

The major areas of enquiry for the action programme study should be : Relevant elements of the village social system, agricultural setting, leadership structure and attitude of people towards rat killing. Who communicated information to whom, when, and where ? How often was information received by each member ? Amount of information (information bits) received by each member. This should be followed up by an evaluative and review study to find out the amount of information (given during the action programme) retained by the sample population and extent of adoption of the rodent control strategies by the people after a time gap of about 3 years.

Calender of Action Schedule of the Social Engineering Activity in Rodent Control.

Months	Maintenance (treatment) area	Neglected area	Survey ('control') area
Kharif			
May	**A.** *Census* 1. Crop fields 2. Houses **B.** *Control operation* a. crop fields with 2% zinc phosphide followed by Aluminium phosphide b. in residential complexes with 0.5% warfarin **C.** *Post control census in crop fields and houses*	Same as in maintenance area in both seasons	Only census in cropfields and houses in both seasons
June	**D.** *Extension and education*		
July	—	—	—
August	Census	Census	Census
September	—	—	—
October	—	—	—
Rabi			
November	As *of Kharif* A to D	Only Census (No control or extension work)	
December			
January	—	—	—
February	Census	Census	Census
March	—	—	—
April	—	—	—

Pre-harvest damage assessment

Five crop fields may be selected on randomised basis. In each field, 6 plots, each of 1 m^2 may be studied, following a multistage random sampling technique (stage sowing, seedling/nursery, vegetative growth, grain formation, ripening, drying in the field, threshing etc). Out of 6 plots, 4 plots may remain fixed for a crop season/year and the site of 2 plots can be changed, if required. Since these plots should cover periphery as well as centre of the field, plots be selected diagonally. Observations may preferably be recorded at a 15 day interval in the following proforma.

Crop.....Variety.....

Date and crop stage	No. of affected plots (a)						No. of undamaged tillers (b)						No. of damaged tillers (c)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6

Rodent species.....
.....

Losses at vegetative growth can be assessed using following formula.

$$\% \text{ loss} = \frac{a \times c}{b + c}$$

Actual loss is proportional to accumulated number of cut tillers at the time of harvest. A number of cut tillers, however, regenerate but generally do not produce healthy grains. Yield from such tillers can be evaluated and loss can be computed or corrected accordingly, i.e., average yield from regenerated tillers (or plants) can be deducted from average yield of normal tillers (or plants). However, loss in yield can be worked out as per the following the table :—

Total No. of plants N	No. of damaged plants N1	No. of healthy plants N–N1	Yield of grains from healthy plants (g) Y	Average yield per plant (g) $\frac{Y}{N-N1}$	Total yield in g $\frac{Y}{N-N1} \times N$	Loss in yield (g) $\left(\frac{Y}{N-N1 \times N}\right) - Y$

Hoarding activity of rodents is also responsible for severe pre-harvest losses. These losses are accounted in the previous table but even then if these are worked out and adjusted with those obtained from the table, will tell the amount of loss due to their feeding activity. This can be done after the crop is harvested.

Date and crop stage	No. of burrow opening in a burrow system	No. of burrow systems per hectare	Food hoarding chamber in a burrow system			Food Eaten or intact
			Numbers		Amount of food stored	
			Without food	With food		

Species involved.....,

$$\text{Food hoarding/ha} = \frac{\text{Avg. amount}}{\text{Food stored}} \times \text{Avg. No. of burrow systems per ha.}$$

For sugarcane, similar procedure can be adopted and data may be recorded in the following proforma.

Date and crop stage	No. of affected lumps (a)						No. of undamaged canes (b)						No. of damaged canes (c)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6

$$\% \text{ loss} = \frac{a \times c}{b + c}$$

For plantation crops like coconut, 10 trees/100 trees may be randomly sampled and data be collected on a monthly interval in the following proforma. The place, around the tree to be observed, may be cleaned so that fresh nuts fallen can be distinguished from the old ones.

Date	No. of nuts fallen/damaged Young/Medium/Mature	Remarks Rodent species involved

$$\text{Yearly \% damage to nuts} = \frac{\text{Damaged nuts}}{\text{Total No. of nuts (Harvested)}} \times 100$$

Population census

Estimation of rodent numbers is a difficult problem because they develop trap shyness/addiction. To overcome this problem more than one method for rodent counting should be taken into account.

A. Indirect Method (Burrow counting)

In agricultural lands the number of "active" burrows is a useful index of the rodent population. Burrows are plugged with soil late in the evening and all freshly opened burrows are counted in the morning within thirty minutes of the start of the rodents' activity on the surface. However, most rodents are nocturnal and burrows should be plugged in the afternoon and counted after the rodent activity starts or early in the morning. Exact correlation between active rodent burrows and their number should be worked out. This method, however, gives only a rough estimate.

B. Direct Methods (Trapping) Lincoln Index

The method is based on capture, marking and recapture. Traps are set, as far as possible, in a grid pattern at intervals of fifteen metres. For example, in an area of 9,000 m² (say, 120 x 75 m) fifty-four traps will be needed. Grids should be replicated by three in each habitat. The traps should be left for some days, containing a bait such as grain but not set; the rodents can then overcome their neophobia and develop the habit of entering them. The duration of this 'prebaiting' should be 2-3 days. Then the traps are set and (when the animals to be trapped are nocturnal) left for one night. In the morning, all trapped animals are marked by toe-clipping and released.

The second trapping could, in principle, come immediately after the first, but it is better to leave an interval of one or more weeks. The exact interval depends on the species. The second trapping will include some marked rodents from the first trapping. The size of population at tue birst trapping can now be calculated.

$$N = \frac{M \times n}{m}$$

Where N = Population size
M = Number trapped in first trapping
n = Total number trapped in second trapping
m = Number retrapped (marked) in second trapping.

Removal Method

This method is based on removing (kill trapping) the rodents from the study area. 94 snap (break-back or bow) traps should be fixed in a hectare in a checker board fashion, traps fixed at an interval of 15 m. Trapping be carried out for 72 hours. The trapping block should be replicated atleast by 3 in every habitat.

The relative density of rodents per hectare will be the number of animals collected If an accurate number is desired, trapping should continue till there is no catch.

From the same data, for comparison purpose, a trap index (I) can also be calculated.

$$I = \frac{M}{n \times t} \text{ rodents/day/trap}$$

Where n = Number of traps used in trap line
t = Number of days during which traps were set
M = Total number of animals trapped

All these methods can be used both in fields and godowns. Census operations should be carried out at least once in each of the four seasons during the year.

Bait shyness among rodents

The test poisons will be zinc phosphide, RH-787 and other newly introduced compounds.

(a) The rodents should be oriented in laboratory for 10 days prior to starting the experiments. 12 individuals (6 males and 6 females) of one species may be maintained in separate cages and be provided with weighed quantities of two preferred foods. Drinking water will be provided *ad libitum*. The total daily intake of the two foods may be recorded for three consecutive days. Thereafter, a sublethal dose of the test poison along with 1 per cent vegetable oil should be mixed with the preferred food and the intake of these two foods will again be recorded for five days. The resultant decrease in the consumption of poison bait and increase in the intake of the less preferred food will indicate the magnitude of poison aversion.

(b) For the determination of the period for which the bait shyness persists, the rodents exposed to the sublethel dose of a poison will be maintained on mixed food avoiding the two experimental foods utilised earlier. Each group of rodents will then be divided into two. One group will be exposed to the food in which the sublethal dose of poison was mixed, at an interval of 7, 15, 30 days, 1 to 6 months. The total daily intake of the foods will be recorded. The two sets of experiments will indicate the persistence of bait shyness and poison aversion.

(c) For confirming that the poison aversion and bait shyness is actually due to the exposure of the rodents to a sublethal dose of the poison, 12 rodents should be maintained in individual laboratory cages and be provided with the same two test-foods. The total daily intake may be recorded. On the fourth day, instead of mixing the sublethal dose in the preferred food, it will be administered to all the test animals by a stomach tube oral intubation. The animals should again be given the same foods and their intake may be noted for next five days. This experiment will indicate if the administration of poison has any effect on the consumption of test foods.

Evaluation of bait preferences

A sample of 10 rodents of each species lodged in individual cages should be provided with three baits from a series of baits for a six day period. The 24 hour consumption may be recorded. The baits will be replenished each day after random selection. For finding out the additive value of various oils, sugar and salt, these will be added to baits in different proportions (1, 3, 5 and 10 per cent). The consumption of mixed baits will be recorded. The consumption figures of each test bait will be worked out. By conducting these bait preference trials, It will be possible to find out the medium for poisoning the species.

Evaluation of rodenticides

(a) **Acute**

Lethal dosages of acute poisons should be determined by stomach tubing technique. The toxic chemical can be dissolved in water, or suspended in oil or in 1 per cent solution of gum arabic. Various dosages (mg/kg) of the poison can be calculated for individual rodent according to its body weight. The requisite quantity should be administered by a stomach

tube/oral tube. For each dosage a sample of 12 rodents (6 males, 6 females) of a species should be tried. The poison can also be given in different concentrations with the bait and rodents should be observed for poisoning.

(b) **Chronic**

The efficacy of chronic rodenticides (anticoagulants) should be worked out in three steps—

Oral toxicity : The technical grade compound should be suspended in a solvent and orally administered to individually caged rodent for five consecutive days to determine the chronic LD_{50} values. Doses should be calculated on mg/kg basis according to the body weights of the animals.

No-choice test : Acclimatized and individually caged rodents (10 males, 10 females) should be provided with only poisoned bait for a fixed number of days (e. g. 2, 4, 6. 8) till a 100 per cent mortality is achieved. This should be repeated with different concentrations (for example, 0.005, 0.0125, etc). After each treatment period, the rodents should be obeserved for at least 14 days to record symptoms and time to death. Dead animals should be autopsied to confirm the sign of anticoagulant poisoning. The poison ingested (mg/kg) can be calculated by the amount of bait intake.

Choice test : An alternative plain food should also be provided along with the poison bait. The positions of the food containers should be altered daily to avoid any place preference. Palatability of poisoned bait in comparison to plain bait should be worked out for a period which has provided 100 per cent kill in no-choice test.

Base line susceptibility : Lethal feeding period to kill 50 per cent (LFP_{50}) and 98 per cent (LFP_{98}) animals with their respective confidence limits should be calculated by plotting log days feeding against probit mortality using the method of Finney (D. J. Finney, 1971 (Ed.). Probit Analysis, Cambridge University Press) or Litchfield and Wilcoxon (Litchfield, J. T. and Wilcoxon, F. 1949. A simplified mothod of evaluating dose-effect experiments. *Jounral of Pharmacology and Experimental Therapeutics. 96*, 99-113).

Reproduction biology

Animals should be weighed, sexed and dissected. In case of females, both the ovaries should be examined for the number of corpora lutea and the uterine horns for the number of implanted embryos and for embryonic mortality. The teats should also be checked for any indication of lactation. Epididymal smears should be examined for the presence of sperms. The testes and ovaries should also be weighed for establishing the reproductive cycles. The study should continue for two years and a minimum of 50 animals (25 male, 25 females) should be examined every month.

The prevalence of pregnancy[1] and annual productivity[2] can be calculated as follows.

1. $\frac{\text{Total No. females in the sample}}{\text{No. of pregnant females}} \times 100$

2. $\frac{\text{Length of breeding period (days)}}{\text{Gestation period (days)}} \times \text{Prevalence of pregnancy} - \text{Embryonic losses}$

The next issue will appear in Aug , 1981. Contributions for inclusion in the Newsletter may please be forwarded to :

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