PROCEEDINGS OF
THE FOURTEENTH ALL INDIA GROUP MEETING ON RODENT CONTROL

Held at

CENTRAL AGRICULTURAL RESEARCH INSTITUTE
PORT BLAIR (A&N ISLANDS)
(MARCH 19-21, 2010)

भाकृअनुप
ICAR

Coordinating Unit
AINP on Rodent Control
Central Arid Zone Research Institute
Jodhpur-342 003

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ALL INDIA GROUP MEETING ON RODENT CONTROL

Central Agricultural Research Institute, Port Blair
(March 19-21, 2010)

PROGRAMME

Inaugural Session (19.3.2010)

10:00 AM : Lighting of lamp

10.05 AM : Welcome address : Dr. Krishna Kumar, Head, Division of Field Crops, CARI, Port Blair

10.15 AM : Project Background : Dr. T.P. Rajendran, Assistant Director General (PP), ICAR, New Delhi

10.25 AM : Project Report : Dr. R. S. Tripathi, Project Coordinator, Rodent Control, CAZRI, Jodhpur

11.00AM : Chairman's address : Dr. R. C. Srivastava, Director, CARI
Release of Publication/Innovative Extension Materials

11.10AM : Inaugural Address : Dr. P. Vijayachari, Director, Regional Medical Research Centre, Port Blair

11.25AM : Vote of Thanks :Dr. Ajanta Birah, Sr. Scientist, CARI, Port Blair

11:30AM : Inaugural Tea

TECHNICAL SESSION - I
PROGRESS OF RESEARCH AT AINP CENTRES (RODENT CONTROL)

19.3.2010 **12.00 – 13.30 hrs**

Chairman : Dr. T.P. Rajendran
Rapporteurs : Dr. D. K. Bora, Dr. S. K. Verma

1. PAU, Ludhiana
2. ANGRAU, Maruteru
3. UAS, Bangalore

LUNCH BREAK 13.30 – 14.30 hrs

TECHNICAL SESSION - II
PROGRESS OF RESEARCH AT AINP CENTRES (Contd.)

1430 –17.00 hrs

4. CAZRI, Jodhpur
5. AAU, Jorhat
6. CARI, Port Blair
7. CAU, Pasighat

TEA BREAK 16.00 – 16.15 hrs

TECHNICAL SESSION – III

20.3.2010 **10.30-12.0 hrs**

RODENT PROBLEMS: SPECIAL LECTURE SERIES

Chairman : Dr. T. P. Rajendran
Co- Chairman : Dr A.M.K.Mohana Rao
Rapporteurs : Dr. R.S.Tripathi
Dr. Neena Singla

- **Release of Publication/Awareness Material on World Sparrow Day**

1. Leptospirosis: A Rodent Borne Zoonotic Disease : Dr. P. Vijayachari, RMRC, Port Blair
2. Rodent faunal diversity in Andaman & Nicobar Islands : Dr. (Mrs.) Rina Chakraborty, ZSI, Kolkata
3. Rodent Problem in Public Health, Sea Ports and IH Regulations : Dr. Shyamal Biswas, NICD, Bangalore
4. Rodent Pest Management: Current initiatives of Deptt of Agriculture & Cooperation Govt of India: Dr. A. M. K. Mohan Rao, NIPHM, Hyderabad
5. Spatial distribution of birds using GIS/GPS tools : Dr. V. Vasudeva Rao, ANGRAU, Hyderabad
6. Changing scenario of Rodent Pests in India : Dr. R. S. Tripathi, CAZRI, Jodhpur.

TEA BREAK 12.00 – 12.15 hrs

TECHNICAL SESSION –IV

REPORT FROM VOLUNTARY/ SELF FUNDED CENTRES AND STATES

20.03.2010 **12.15 -1.30 hrs**

Chairman : Dr. R. S. Tripathi
Rapporteurs : Dr. M. Nanda Kishore &
Dr. S. K. Verma

1. KAU, Thrissur
2. NIPHM, Hyderabad

3. Haffkine Institute, Mumbai
4. SKUA&T, Jammu
5. Department of Agriculture : Tamil Nadu, Maharashtra, Mizoram and A&N Island
6. Rodenticide Industry

LUNCH BREAK 13.30 – 14.30 hrs

TECHNICAL SESSION - V
RECOMMENDATIONS FOR EXTENSION/DEVELOPMENT AND FUTURE RESEARCH PROGRAMMES

20.3.2010 **14.30 – 16.00 hrs**

Participants : All Cooperating Centers

Chairman : Dr. T.P.Rajendran
Co chairman: Dr. A.M.K.Mohan Rao
Rapporteurs : Dr. R. S.Tripathi &
Dr. V. Vasudeva Rao

20.3.2010 **16.00-17.00 hrs**

PLENARY SESSION

Chairman : Dr. T.P. Rajendran
Rapporteurs: Dr. R. S. Tripathi
Dr. V. Vasudeva Rao

Presentation of recommendation by Chairman of Session
Chairman's Concluding Remarks

Vote of Thanks : Dr. V. Vasudeva Rao and Dr. R. S. Tripathi

21.3.2010 : Field Visit

INAUGURAL SESSION

The Fourteenth Group Meeting of All India Network Project on Rodent was organized under the aegis of ICAR, New Delhi at Central Agricultural Research Institute, Port Blair from 19-21 March 2010. The Meeting was jointly organized by AINP on Rodent Control and AINP on Agricultural Ornithology. The Inaugural function began with the lighting of lamp by honourable guests. Dr Krishna Kumar, Head, Division of Field Crops, CARI Port Blair outlined the brief history and salient achievements of CARI, Poprt Blair and welcomed the Guests and delegates. and thanked Dr P. Vjayachari, Director, RMRC, Port Blair, Dr T.P. Rajendran,ADG (PP) ICAR and Guest of Honour, conveyed the greetings and best wishes of DG ICAR and DDG(crop Sciences) and thanked Dr R.C. Srivastava, Director, CARI, Port Blair for hosting the joint Group meeting at Port Blair. Dr Rajendran also outlined the networks of AICRP, PDs, Institutes, NRCs and SAUs under National Agricultural Research System. He was of the opinion that, besides tourism, the A&N islands have very high potential of earning foreign exchange through exports of produce of several commercial crops.

Dr. R.S.Tripathi, Project Coordinator (Rodent Control) and Dr V. Vasudeva Rao, Project Coordinator (Agril. Ornithology) presented the progress report of their Projects for the biennium and highlighted the work done by different centers during the last two years. Dr R. C. Srivastava, Director CARI, Port Blair and Chairman of the function highlighted the role of rodents in agriculture, particularly in Island agro-ecosystems and thanked ICAR for initiating researches on rodent management at Port Blair under the All India Network Project. He assured that the center will generate valuable information for evolving region specific technologies for rodent management. On this occasion bulletins on *Bandicota bengalensis* and Rodent management in Andaman and Nicobar Islands and awareness creation materials and two CARI Bulletins were also released by honourable guests. Dr Vijaychari, Director RMRC, Port Blair and Chef Guest of the ceremony presented the inaugural addressed. Rodents being the pests in agriculture as well as vectors/ reservoirs of zoonotic diseases, he expressed the need for horizontal research where line departments can collaborate for developing effective management technologies for enhanced food productivity and health security.

The Inaugural Session concluded with vote of thanks proposed by Dr Ajanta Birah, Senior Scientist and PI, CARI Port Blair center of AINP on Rodent Control.

ADDRESS BY DR T.P. RAJENDRAN
Assistant Director General (Plant Protection)
Indian Council of Agricultural Research, New Delhi

I am happy to be at this island after 1974 and to see many changes around the Sea during last over three decades. I find immense amount of development which has taken these islands to a characteristic lifestyle of our country. We look forward from the main land and find this place is full of tourism and over a long time it has been interest of the mainland people to come and feel immense pleasure that Andaman & Nicobar have progressed extremely well. Government of India more specifically, Ministry of Agriculture is looking forward these Island as a major source of GDP of the Country. The growth in GDP has been enabled by both fisheries and agricultural activities. In current Five year Plan period the Government has given lot of scope for enlarging livelihood security activities in these Islands.

Looking at the themes of the Group Meeting we have the agricultural problems created by vertebrate pests, rodents and birds. In case of birds we have a system where many of them are friendly also, so there are two sectors in the analysis of agriculturally important birds. Birds can be useful to control not only insects but also the pest rodents. We have huge populations of barn owls in several agro ecological regions and, probably owls can be a very potent biological agent for rodent control. We have developed a good scale of work by developing nesting and roosting technologies for certain species of owls, though the project. We find extremely very good reduction in the rodent population. During the phase of bamboo flowering which is going on in the NE region and historically talked to create episode of famine creation and may be for last 2-3 centuries we have records of human local traditional knowledge relating bamboo flowering to famines. This is the first opportunity for us to have scientific analysis of the bamboo flowering versus rodent population explosion. It is reported that two flowering cycles which are generally : one 18 years and second of 30 years cycle, 7-8 species intermingling their flowering sequences of cycles create a situation of combination of 30+18 years'= 48 years' cycle. The country has never reported any large scale famine from that region so far, which shows that awareness creation and blending modern knowledge into traditionality have helped to mitigate certain amount of threat which we could have had from rodent population explosion. Although, the threat is not over as yet because, it is happening in a very small way in certain pockets, affecting the human food security.

The two projects (Rodent Control and Agril. Ornithology) used to go parallel without meeting each other. During XI Plan period I brought in a reformation of bringing them together as vertebrate pest management and since birds and rodents have some synchrony of biological activity also, we felt that these groups should interactively meet and would therefore be able to synergize many of the research experiments and programmes. This is the third meeting we have undertaken in this fashion.

ICAR operates 61 All India Coordinated Research Projects, one of the largest research networks on the Globe. We have different crop based research projects on crop development and improvement plus animal husbandry aspects where in all the plant protection issues are discussed and deliberated for research purpose. Research and development agenda are created in these workshops. In addition to that we have the ICAR Institutes and State Agricultural Universities under the National Agricultural Research System (NARS). Thus if we put all together, there are around 150 Institutions which provides us enough confidence that that Agricultural Research has got immense importance and significance in this country. Management of knowledge and dissemination / percolation of knowledge generated through the vast network of NARS as

technologies are a major task with Governmental agencies in evolving developmental plans. Government of India has put up programmes for knowledge management for taking the knowledge to the villages which are not accessible. The Ministry of Agriculture has taken allegiance to some of those developmental activities in relation to agriculture.

These two Coordinated projects which we have kept in position, have added new center in XI Plan period and look forward for their active participation because they have been identified for specific untouched research issues and certain concerns of region or states, so we may look towards those new centers for the kind of zeal and activities, they try to bring up by sharing the experiences of senior centers, who are in the system for quite a long time and that sorts of exchange of experiences will fortify these networks very well.

I am extremely pleased that Central Agricultural Research Institute, Port Blair could imagine to host this meeting in this campus, I deliberately vowed upon to see that it got enabled and we have good chance to see this Island system in various ways , various angles in professional as well as personal interest. The more crucial part when I wanted to organize this meeting was to have very close interaction with the Institute at the personal level as Assistant DG because in the Council we have a feeling that integration of multidisciplinary research is significantly workable for creating technologies and sorts of output which shall be not only useful for the farmers of this Island system but also for the mainland.

I would like the Institute to create a database on good agricultural practices and potential of agricultural marketing through a project which I urged the Council and Ministry of Agriculture and Cooperation. I believe that, it could be one boosting point for you all to develop an export potential from here to various countries. In fact why we shouldn't earn foreign exchange as an Island system as there is a good scope for it, I believe.

I remember the days when I came here in 1974, like a parish priest, to talk about cultivation of rubber in those areas where erosion was very high and huge amount of land utilization problems were coming in. The local Government had to rehabilitate a number of humans that came into this place. The Island utilized the opportunity to going for commercial crops and that's how we brought rubber to these Islands which has grown very well. I believe that in current Global scenario of rubber, these Islands can be richer and richer day by day.

Thank you very much for being kind to invite me and I am very happy to see several specialists of Zoological Survey of India, Indian Council of Medical Research, National Institute of Communicable diseases and of course, Dr P. Vijayachari, Director Regional Medical Research Centre (RMRC), Portblair (as Chief Guest of today's inauguration), besides our project workers, who have come over here from different parts of the Country. It is interesting to note that RMRC, the pre-independent institute was established to address Andaman hemorrhagic fever which was proved as nothing but Leptospira induced fever and it has become globally recognised body of pathogen repository. The experts who have come over here from different developmental organizations and representatives of different states could be our feedback systems and enlightening avenues to frame our next year's technical program and we very seriously look forward to your indulgences.

Thank you.

CHAIRMAN'S ADDRESS
Dr .R.C. Srivastava, Director
Central Agricultural Research Institute, Port Blair

It gives me immense pleasure to welcome you all on the Inaugural Session of the Joint Group Meeting of AINP on Rodent Control and Agril Ornithology. I am glad to see that the scientists/officers from several organizations from all over the country who are concerned with vertebrate pest management, be it rodents or birds are attending it. At the very outset I would like to extend hearty welcome to Dr. Vijaya Chari, Director, RMRC, Port Blair, for sparing his valuable time and joining us as Chief Guest for this function. I also welcome Dr. Rajendran, Assistant Director General (Plant Protection) ICAR for gracing the occasion as guest of honour. I feel happy to welcome all the scientists and officers belonging to different organizations of the country for attending the Group Meeting.

I shall like to thank the ICAR for holding this joint group meeting of two different projects-the All India Network Projects (AINP) on Rodent Control and AINP on Agriculture Ornithology at this institute. Bringing the scientists of two different projects on a common platform to discuss the progress of their work and future programmes would surely generate new ideas and would help to improve up on the research experiments.
Both these projects are unique in character and function because the birds are adapted to above – ground aerial life and the rodent live underground and nocturnal life. Birds are most conspicuous and visible component of all the ecosystems on the earth, mainly because they are brightly coloured, highly mobile and vociferous. That is why the birds have become integral part of our daily life, its esthetic values has impressed not only the poets like Valmiki or Kalidas but Laymen of all the ages. Hence, for long we had not viewed the birds from any economical point of view. Saint Kabir in 15th Century said that "It isGod's birds and Gods fields eat as much as you can." The moment man started cultivating his crop; he started to alter the habitat by destroying forests and the grasslands which was habitat of the birds. This resulted in a conflict between birds and farmers which has intensified with increasing farm activities. This conflict has led to extinction of many birds. I remember huge number of birds descending in paddy fields being puddled and transplanted during my childhood days, but now I find few birds in paddy fields during seasons. I don't know whether it is impact of AINP or something else.

In spite of all talks of advancement of our country in different fields, agriculture is our lifeline. Besides providing food security essential for our sovereignty, livelihood of 52% of our population depend upon it and about 77% of our population is very adversely affected by any fluctuation in food prices. Unfortunately this sector is generating just 17% of GDP and growing between 0 - 4%.This means that this sector need to enhance its income by enhancing productivity and reducing losses. Presently the losses by birds and rodents are about 5-6%. Although it has been reduced from 15-20%, some two decade ago, the credit of which goes to our scientists and extension workers, there is need to further reduce it at lower cost. It is essential for two reasons: firstly the resource poor farmers which constitute the major chunk loses most by these; and secondly for enhancing competitiveness in international market. Our contribution in international market is increasing but it can be sustained only if the quality standards are strictly adhered.

Island agriculture, arable or perineal suffers rodent damage to a greater extent. Coconut and oil palms orchards are one of the most preferred habitats of rodents and suffer up to 50% damage by these tiny vertebrates. The historical Andaman Hemorrhagic Fever (AHF) disease later named as Leptospirosis highly prevalent in Andaman & Nicobar Islands and other humid regions of the country is also a rodent borne problem. I remember the Training workshop organized at Port Blair by RMRC Port Blair and Dte of Agriculture in 2006, highlighted many issues related to rodent problem in Agriculture and Health. Dr Tripathi, the Project Coordinator (Rodent Control) attending that Workshop had desired to initiate systematic research work on rodent management for this region. I am extremely happy that ICAR has granted a centre in CARI, Port Blair during XI Plan Period. The center has started in this financial year only and therefore is in infant stage. I assure you that this center will generate valuable information for evolving region specific technologies for rodent management.

If we trace the history of agriculture, some 30-40 years ago, the entomologists used to chase the farmers for spraying insecticides, but now the agronomists and farmers have merged the use of insect pest management practices in the package of crop production. It is not so with the rodent management so far, although the losses due to rodents are more visible. However, with the sincere efforts of ICAR and you all, the scenario is changing fast but more efforts still need to be made. The rodent management technology must find its place in Package of Practices of different crops. It is heartening to see that officers of some state agriculture departments are also participating in the Group Meeting. They are the people who are directly in the extension network of the States because Agriculture is a state subject. Therefore a closer coordination of scientists and State extension functionaries is very important. I am happy to see participation of rodenticide industry also. I am sure a combination of researchers, development officials and industry can be of great help in popularizing the rodent management technologies to the grass root level.

At the end, I would like to extend hearty welcome to you all in this beautiful island city Port Blair. Hope your stay at Port Blair will be enjoyable and you will have fruitful discussion here.

I wish you and the Group Meeting a grand success.

ADDRESS BY CHIEF GUEST
Dr. P. Vijayachari, Director
Regional Medical Research Center, Port Blair

First of all would like to thank the organizers particularly Dr R.C. Srivastava, Director CARI, Port Blair and Dr R.S. Tripathi and Dr V. Vasudeva Rao, ICAR Project Coordinators, Rodent Control and Agricultural Ornithology for providing me an opportunity to interact with agricultural rodentologists and ornithologists on this occasion. I am happy to be with Dr T.P. Rajendran, ADG (PP), ICAR, Dr Mohan Rao, Dr Biswas and all eminent scientists and development officials representing different departments from different parts of India. I would like to tell you few words about agriculture, health, rodents and ornithology. I saw the title of the Programme "All India Group Meeting on Rodent Control and Agricultural Ornithology" which is wonderful title; we can draw so many conclusions from it, conclusion regarding health, agriculture and so on. In any research department mostly the vertical research that is research is restricted to their own field, is being pursued. The time has come that we have to look beyond one department and therefore we need the horizontal research i.e., inter-sector collaborative research. I am of a very strong view that line research departments should synergies their efforts. I call agricultural research as the backbone of India and all other countries. However at the same time, to make the backbone healthy, we need the essential medical research. If backbone is not well we cannot stand properly, so we have to put together several departments, more specifically, agriculture, medical and health, to make our research horizontal and more productive.

Coming to the subject particularly rodents, it is well known that rodents cause immense losses to standing crops and to stored grains and other commodities and I am happy that ICAR sponsored project, AINP on Rodent Control has evolved effective technologies for rodent management. I call the rodents as golden mines for medical scientists because of their very important role as experimental animal for various immunological works. Since they are mammals, the research results can later be used for betterment of human being. At the same time we are unhappy as many rodent species act as carrier, vector or permanent reservoir of several diseases of humans and live stock. Thus they help to spread various diseases like Leptospirosis, Pneumonic plague etc. There are about 120 rodent species found in India, out of which 10 species are known as vectors. The same species are also regarded as pests in agriculture.

According to my knowledge, regarding Leptospirosis there are four major rodent species namely *Bandicota indica, Bandicota bengalensis, Rattus norvegicus* and *Rattus rattus* harbor the leptospirosis bacteria, therefore act as a vector, particularly permanent vector or reservoir. The first report of Leptospirosis in India came from Andaman and Nicobar Islands in 1928 which was earlier called as Andaman Hemorrhagic Fever (AHF). Everybody was afraid of visiting Andman because of this disease. Now the disease is very common in many parts of the country, like, Tamil Nadu, Gujarat, Orissa and Maharashtra. Clinical presentation of Leptospirosis in Andman is entirely different as compared to mainland where it is just like jaundice or fever but unfortunately in Andman patients are having pulmonary hemorrhage and high fever so it's very difficult to save the patients. One year ago WHO was not bothered about leptospirosis they thought leptospirosis is not a that much dangerous disease but now a days there are few cases in Nicaragua, South Africa and then WHO has started talking about leptospirosis . They made a separate committee for Leptospirosis consisting of five members including

myself. Our Institute, Regional Medical Resesrch Center (ICMR) is WHO reference center on Leptospirosis.

It is a matter of great satisfaction that ICAR has initiated research on rodent management under All India Network Research Project at CARI, Port Blair which would definitely provide an opportunity to medical scientists of RMRC, Port Blair for collaborative programmes. I look forward for a strong linkage between ICAR and ICMR. Rodent pest/vector management will pave a way for enhanced food security and improved public health.

Once again I thank you all for inviting me to inaugurate the Group meeting.

PROJECT COORDINATOR'S REPORT

Dr. R.S. Tripathi
Project Coordinator (Rodent Control)
Central Arid Zone Research Institute, Jodhpur

Systematic research work on Agricultural Rodentology was in fact initiated by ICAR with the launch of the Coordinated Project on Rodent Control, which was later rechristined as All India Network Project on Rodent Control. I feel satisfied in mentioning here that the Project scientists have strived hard in generating valuable information to meet the challenges posed by rodents under present scenario. We are meeting here after a gap of over two years. We are meeting for the first time after approval of SFC of XI Plan Period. It is really a very happy moment to inform you that we were present only in 5 locations during X Paln period but now our presence is at 7 locations. For this I would like to thank ICAR, particularly, ADG (PP) for his whole hearted support and also DG and DDG (CS) in getting ICAR's nod for two more centers in this Plan period. One at Port Blair and the other one at CAU Pasighat. These new centers have been created for addressing rodent problem of island ecosystem in A & N Islands and Tribal agriculture in North east. Our old centers are located in SAUs i.e., PAU, Ludhiana,UAS, Bangalore, ANGRAU, Maruteru and AAU, Jorhat with CAZRI, Jodhpur as Project Head Quarters.Though all these centers will detail their achievements in the next technical sessions, I would, however, like to give you a brief account of some salient achievements of the Project.

We registered steady progress in understanding the rodent pest scenario in different agro-ecological regions of the country, evaluation of newer strategies of rodent pest management and transfer of rodent management technologies. The period was full of challenges from Northeast sectors due to reports of gregarious flowering in many states, particularly Mizoram resulting in severe losses to standing crops in jhoom and WRC fields. However it was a rather happy situation in Meghalaya where despite gregarious flowering of *Melocanna bacifera in* all the three Garo Hill districts and West Khasi Hills no rodent out break was observed, except in certain locations, where slight increase of 8-10% crop damage was reported in paddy and maize in bamboo flowering areas. This may be because of the fact that, unlike Mizoram, Meghalaya has mixed forest and when bamboo plants are dried up the rats are getting shelter and alternate food in forest and not coming out of forest. We were able to break the myth related to gregarious bamboo flowering as the laboratory studies did not reveal effect on reproduction of rats after feeding bamboo fruits. Similarly in Assam, and Arunachal Pradesh sporadic flowering in some bamboo species was seen however, population explosion of rodents was not reported.

The works initiated on botanicals could provide some information on effects of neem, cotton seed oil, Gossypol, etc. as anti feeding/ antifertlity effects on rodents. A new plant based compounds containing glycosides of *Tryptoregium wilfordi* showed antifertility effects on Indian rodents. The highlights of the year also included investigations on critical timings of rodenticide baits and their delivery systems through different bait stations. The Project scientists acted as resource persons in many of the Training programmes as part of capacity building in rodent management.

The distribution pattern of rodents indicate almost equal sharing of different arid farming systems viz., horticultural, silva and cropfields/ grasslands etc. In Bathinda and

Mansa districts of Punjab *T. indica* was the predominant species in sugar cane fields otherwise *B. bengalensis* was the major culprit species in other districts. Irrigated rice fields at Mandya (Karnataka) and in Godawari delta of AP harbored *Bandicota bengalensis> Mus booduga*. *Rattus rattus* was a problem species in coconut orchards whereas in coconut nurseries *B. bengalensis* is the major pest. In Upper Brahmaputra Valley Zone of Assam, four rodent species viz. *B.a bengalensis*, *Rattus nitidus*, *R.sikkimensis* and *Mus booduga* were encountered. Similarly in North eastern hill region six species of rodents, viz. *Bandicota bengalensis, Rattus nitidus, Rattus rattus, Cannomys badius, Berlylmys mackenziei*, *Niviventer fluvescens, Rattus sikkimensis* and *Mus musculus* were collected and identified from bamboo flowering areas.

The lesser bandicoot rats continued to spread in arid zones and NEH region. It is a matter of great concern that lesser bandicoot is behaving the opposite of its name (lesser) and is spreading in new areas. Indian gerbil, *T. indica*, essentially a field rodent species continued to establish its population in residential and grain storage areas in Jodhpur. The gerbils inhabiting in such premises were observed to be heavier than the field collected gerbils. Similarly our monthly trappings in Institute Frarm revealed replacement of truly xeric rodents viz., *Meriones hurrianae* and *Gerbillus gleadowi* continuously for last many years.

In Godawari delta region of Andhra Pradesh breeding females of *B. bengalensis* were more when the rice crop was at reproductive phase in both rabi (March and April) and kharif seasons (October to December). *B. bengalensis* population could breed 2.75-3.24 times with a mean litter size of 7-8 youngs/female during kharif season and 1.44-2.14 times in rabi with a mean litter size of 10 youngs /female. The annual productivity per female was 17.43- 24.34 young ones./ female. Mulching is a common agronomic practice to conserve moisture and enhancing organic manuring. However the mulched fields encouraged higher rodent population in Assam. Maximum rodent abundance (4.67 burrows/20 sqm) and damage (11.65%) was recorded in water hyacinth mulched and intercropping with pumpkin as compared to 0.33 burrows/20 sqm, in control.

Rodent damage to irrigated rice, ragi, maize and cowpea was upto 8.0 % in Karnataka at different crop growth stages. Cardamom fields with rodent infestation of 30 – 35 rodent burrows/ha suffered 5-11% damage to cardamom capsules in Mudigere. Tuberose, a flower crop at Bidar, registered 11% damage during flowering stage. Cashew plantations registered 4-5% damage by rodents from seedling to 4 years old plants at Kolar and Mudigere, Karnataka.

From Punjab, rodent damage data indicated a loss of 41.3 kg/ha (wheat) and 119.2 kg/ha (rice in three districts viz., Mansa, Bathinda and Ferozepur. Similarly sugarcane crop experienced up to 6.5% in Ludhiana and Jallandhar Districts. In coastal regions of Andhra Pradesh, 26.7 per cent of the coconut trees are reported to be infested by rodents. *B. bengalensis* casused considerable damage (10-15%) to the coconut seedlings in nurseries. Rodents (rats and squirrels) inflicted about 54.2 per cent pod damage to cocoa, intercropped in coconut orchards in South Andaman preferably to young and tender coconuts in both dwarf as well as tall varieties. The damage from 8.57 to 26.67% was observed in all the coconut growing areas of South Andamans. In Assam field crops viz., rice grown as *Bao* suffered maximum rodent damage (13.75%) followed by sugarcane (11.33%), pea (9.43%), rice grown as *Sali* (9.02%), potato (8.98%) etc. Rabi vegetables, also suffered to the tune of 9.89 % (pumpkin), 6.59 % (bottle gourd) last year.

Various trials with botanicals revealed anti rodent properties in some plants parts. Feeding of baits supplemented with 1, 3, 5, 7 and 10% latex of *Calotropis procera* to *R. rattus* resulted in range of antifeeding index from 1.03 to 41.95%. Daily consumption of baits having *C. procera* root powder @ 2, 4 and 6% was found to prolong the cyclicity of treated rats. Male house rats when fed on Beiao (an antifertility agent extracted from *Tripterygium wilfordi)* mixed in baits at 0.1, 0.2 and 0.3% revealed significant reduction in weights of reproductive organs, sperm motility, live sperm count, and sperm concentration etc as compared to control. Leaf powders of *Vitex nigundi* and *Polygonum* treated food recorded least preference by *Rattus rattus* in laboratory indicating anti rodent properties. Field trials with some botanicals viz., castor based herbal repellent (Eocdon) showed higher repellency (27.6-40.7%) against rice rodents followed by Castor oil 10% (8.3 -40.7%) and pongamia oil 10% (4.8- 32.8%) in Godawari delta region. Among theses, Econdon offered better protection for a longer period over the other botanicals. Five days exposure of bait containing 0.1% eucalyptus oil to *B. bengalensis* revealed repellent effect of eucalyptus oil. Feeding of bait containing 0.01% pure gossypol for 18 days causes a significant increase in the duration of estrous cycle.

Toxicological studies on cholecalciferol, a vitamin D_3 based rodenticiode revealed that its feeding results in significantly higher values of calcium and phosphorus level in the serum that leads to death due to mineralization of soft tissues like heart, liver, lungs, kidneys and stomach..Single oral administration of triptolide to male *R. rattus* revealed no mortality at 50 mg/kg dose however, at 100 and 150 mg/kg, it resulted in 16.67 and 33.33% mortality with in 1-3 days. The LD_{50} value was 182.81 mg/kg bw for male *R. rattus.* There was no significant difference observed in the weights of reproductive organs and accessory sex glands and sperm density amongst treated and control groups after 45 days of treatment however sperm motility, viability and morphology were significantly affected in terms of sperm decapitation in treated rats.

Two anticoagulant rodenticides viz., bromadiolone(0.005%) and brodifacoum (0.005%) ands a new experimental formulation of aluminium phosphide were evaluated. Studies from Karnataka indicated that application of zinc phosphide through plastic cover at tillering and maturity stage of rice, removal of bushes and weeds, trimming and cleaning of bunds at monthly interval results in 62.68 and 70.96 percent reduction in crop damage and rodent population, respectively. In Assam trapping with cage trap@40 nos/ha at maximum tillering stage followed by one application of 2% zinc phosphide baiting at panicle initiation stage could effectively control *Bandicota bengalensis* in irrigated Boro paddy.

Two rodenticidal treatments during July and October was found effective in managing the rodents in sugarcane fields in Punjab. Rodent problem in wheat sown with happy seeder after paddy harvest without going for straw burning and tillage (zero tillage) is very serious in Punjab. For such situations double rodenticidal treatments first with zinc phosphide (before sowing) followed by bromadiolone (at ear filling stage) yielded complete rodent control success. Similarly in case of ground nut two treatments provides 77.79 to 82.14% rodent control success leading to saving of 71.7 to 146.6 Kg/ha with a net benefit of Rs. 1442.3 to Rs.3016 / ha. A recommendation on modification in critical timings of rodent pest management in groundnut crop was approved in 102nd REC meeting held in Feb, 09 and included in Package of Practices for *Kharif* crops of PAU, Ludhiana for the benefit of farmers.

Efficacy of encapsulated formulation of zinc phosphide was worked out under laboratory conditions. Cent per cent mortality of house rats (both young and adult) with in 1-5 hours and 22-24 hours was observed with 2% zinc phosphide bait and zinc phosphide powder filled in capsules, respectively. In case of *B. bengalensis,* the time taken to death was less (8 to 12 hours) when exposed to such capsules than the zinc phosphide bait (12 hours to 5 days).

A detailed survey of indigenous storage structures in Assam indicated two types of structures; one in indoors for small to medium period storage (*Duli, Mer, Tum, Bakharu,* and *Hak)* and other one for longer duration bulk storage in out doors , locally called as *Guchi bharal(* for unthreshed paddy*) and Guti bharal* (for threshed paddy). Both types of storage (mainly utilizes bamboo and mud plaster. For making these structures rodent proof it was suggested to fix rat guards made of GI or aluminum sheet on pillars supporting the platforms at 60 cm above ground.

In NEH region the rodent damage to almost all crops increased significantly after shedding of bamboo fruits in Mizoram. Upland rice, lowland rice, jhum paddy and maize suffered losses between 14.67–32.54%, 18.52-30.05%, 32.70–36.90% and 18.60–40.12%, respectively. Apart from these, rodent also damaged chilies (25-30%), potato (5%), oil palm (70-80%), banana (10%), papaya (15%), tapioca (45-65%) and pigeon pea (5%) in Mizoram state. Among the local traps, *Vaithang* proved most effective with 70 - 90% catches in different locations followed by *Chepthang* (50-80 %). Percent catches with these two local traps was fairly high in comparison to Sherman traps (10-20%) and Snap traps (10-30 %). Similarly locally made bamboo bait stations proved very effective as they reduce the problems of contamination to soil and water and the secondary hazards to non-target species.

Regular awareness programs like on and off campus trainings and field demonstrations on rodent management were carried out by all AINP centers in the adopted villages. The activity helped in reduction in rodent damage and yield losses. Rodent management technologies were demonstrated through exhibitions during Kisan melas. Regular trainings and field demonstration on rodent management were also conducted by Project scientists of Jorhat and Barapani in NEH region. Maruteru center organized rodent campaigns on community basis during *kharif*'07 in coordination with State Department of Agriculture (AP) in Krishna District. Rice and black gram crop covering 54,882 and 28,816ha respectively, in Krishna District were brought under Rodenticidal baiting with bromadiolone (0.005%). The impact analysis of the campaign revealed a control success of 78-81%. During 2008-09 an area of 80.0 ha in Penumachili village of Achata Mandal, West Godavari district was brought under rodent management. As a result, farmers harvested an additional yield of 240.5 kg/ha in *kharif* and 202 kg/ha in *rabi.* Farmers were benefited with Rs. 50 in *kharif* and Rs. 54 in *rabi* for every one rupee spent towards rodent control. In Punjab, farmers trainings along with field demonstrations on rodenticide bait application were organized. On an average, > 90 % adoption of rodent control practice was observed after this programme. Among them 85% of the farmers started using recommended dose of zinc phoshide with 73.05% doing pre-baiting also. Use of anticoagulant rodenticides as an alternative to zinc phosphide was reported by 72 % farmers.

Regular Apex level Trainers Trainings were organized at Maruteru center. Awareness programmes on bamboo flowering and associated rodent problems were also

conducted for the officers of all the districts of Meghalaya at Shillong by Directorate of Agriculture, Govt. of Meghalaya in collaboration with ICAR Research Complex Barapani. Project scientist at Jorhat and Jodhpur imparted training to NE state officials during in situ State trainings organized by NPPTI in Assam, Tripura and Meghalaya. AINP Rodent Control provided expertise during 'Training cum workshop on Rodent management' organized by Deptt of Agriculture, Gujarat at Gandhinagar, Vapi and Navsari Districts. Similarly The Project acted as one of the coorganizers of Apex Level Training Programme on Rodent mamagement held at NIPHM, Hyderabad. An exhibition was arranged during NE Agri Fair 2009 held at Pasighat.

Based on recommendations of the Hyderabad Group Meeting, A proposal for Extension based National Plan on Rodent Management was prepared and submitted by Dr Mohan Rao of NIPHM Hyderabad. ADG (PP) and myself were also involved in formulation such an ambitious Project, which will operate in a consortium mode, where NIPM Hyderabad and AINP on Rodent Control will work together. The major objectives of the Plan are (a) Capacity building among scientists/Teachers/stakeholders. (b) Awareness creation among stakeholders and farming community (c) Creation of Nucleus of trained manpower on rodent pest management in all states and UTs. (d) Bringing community effort by involvement of concerned departments, viz., Gram Panchayats and other local bodies and farmer associations and (e) Rodent control campaigns at village level.

I am quite hopeful that during this Group Meeting we will deliberate on important researchable issues and decide our future research programmes. It is needless to mention, that education and training of rural masses including farm women and school children, in rodent management needs to be strengthened. The AINP through its Social Engineering Activity on Rodent Control has endeavored on these lines, but in a limited scale. I would suggest that all our centers may organize trainings for extension personnel, senior district level officials, NGOs etc. of their State at least once in a year.

TECHNICAL SECISSION - I &II

PROGRESS OF RESEARCH AT AINP CENTRES

The Session started with the presentation of Action taken Report on the recommendations of last Group Meeting held at Hyderabad. Project Coordinated (Rodent Control) presented the ATR which was approved by the house after discussion. After that center wise presentations were taken up. A brief Report is given as under;

Punjab Agricultural University, Ludhiana
(Speakers: Drs. Neena Singla and Bhupinder Kaur)

Crop fields were predominantly inhabited by *B. bengalensis* followed by *T. indica*, *Mus* spp and *Golunda ellioti* were reported, whereas in poultry, dairy and rabbit farms only *R. rattus* was present. *B. bengalensis* was first time reported to commensalize in Punjab.

Feeding of bait containing 2% papaya seed powder for 10 days in no-choice feeding test to male *R. rattus* revealed zero percent motility and live sperm count. Laboratory trials with Beiao (an antifertility agent obtained from plant *Tripterygium wilfordii* in baits exposed to *B. bengalensis* for 10 days in no choice tests resulted in reduction in sperm motility, viability and density to negligible levels and no conception in female rats bred with beiao treated male rats was reported. Feeding of imidazole treated baits at 0.05 and 0.1% to male *R. rattus* revealed significant reduction in sperm motility, viability and concentration. Similarly, single oral administration of 50, 100 and 150 mg/kg bw of triptolide to male *R. rattus* revealed LD_{50} value of 182.81 mg/kg bw. Significant difference was observed in sperm motility, viability and morphology between treated and untreated groups of rats. Under laboratory conditions, the time taken for death was more after consumption of encapsulated zinc phosphide than 2% zinc phosphide bait in *R. rattus* and the opposite was true for *B. bengalensis.*

For sustainable management of rodent pests in sugarcane, multiple rodenticidal treatments at stages vulnerable to rodent damage in relation to agronomic practices in surrounding crop fields are required. Similarly in ground nut double poison baiting proved most effective as compared to single poison baiting. In wheat crop sown under rice residue management with Happy Seeder. burrow baiting with rodenticides just after sowing and during February-March showed better efficacy in reducing rodent infestation and damage. Acceptance and efficacy of 2% zinc phosphide bait when kept on paper pieces was higher than when kept in polythene bags and paper bags in wheat and rice crops.

Eucalyptus oil at 0.1% conc revealed repellent action against male and female *B. bengalensis* in different choice conditions. Administration of single oral doses i.e. 40 and 80 mg/kg body weight of pure gossypol and 100 and 200 mg/kg bw of cotton seed extracted gossypol was not found effective as toxicant and/or sterilant. Feeding of bait containing 0.01% pure gossypol for 18 days to female *B. bengalensis* caused a significant increase of estrous cycle. Feeding of bait containing 0.2 and 0.5% cotton seed extracted gossypol for 7 days to females, however, caused non-significant increase in duration of estrous cycle. Spraying of 5% castor oil in grain stores around stacks and integration with chemical control proved effective in reducing rodent infestation and damage.

Trapping of *R. rattus* in multi catch traps was found affected by the odours of their conspecifics. Adult males were trapped from both adult male and female scented traps while adult females preferred odors from adult male scented traps. Similarly immature males preferred odors from both adult male and female scented traps while immature female preferred odor of adult male scented traps.

Laboratory breeding of *T. indica* revealed 78.6% breeding success with 21.4% females breeding more than once consecutively. The interval between consecutive breeding ranged from 28 to 48 days.

Social Engineering activity in adopted villages resulted in significant reduction in damage and increase in yields. Additionally, adoption of various rodent management techniques among farmers varied between 20-100%.

Acharya NG Ranga Agril. University, APRRI & RARS, Maruteru
(Speakers: Drs. Nanda Kishore and N. Srinivasa Rao)

Seven rodent species were recorded from Northern Telangana Zone (NTZ). Among these *Bandicota bengalensis* (49.7%) was predominant followed by *Mus booduga* (21.9%), *Rattus rattus* (21.2%) and *Millardia meltada* (10.8%). Other species recorded were *Bandicota indica, Mus musculus and Tatera indica.* Lesser bandicoots were prevalent in all the cropping systems and inflicted 4-6% tiller damage to paddy and 2.4% cane damage to sugarcane crops. Population growth estimate indicated that population could breed 2.75 times in *kharif* and 1.44 times in *rabi* season with an annual productivity of 17.43 young ones per female in rice-rice cropping systems in Godawari delta region.

The predominant rodent species identified from coconut, coconut-cocoa inter cropped orchards of East Godavari district were *Rattus rattus* (96.3%) followed by *Bandicota bengalensis* (3.7%). About 23.82 per cent trees suffered rodent attack. In coconut nurseries, *B. bengalensis* was found predominant and caused considerable (10-15%) damage to coconut seedlings. In cocoa intercropped in coconut orchards, rats and squirrels inflicted about 47.29 per cent pod damage in cocoa. In general, the nut damage was progressively increased with the onset of summer and decreased later, where as cocoa pod damage was increased up to January and decreased later.

Among the botanicals tested for their repellency against *B. bengalensis* in paddy, Castor based 'Ecodon' recorded highest rate of reduction in live burrows over control during both the years (24.12 – 55.32%) followed by pongamia oil 10% (4.8-41.06%) and castor oil 10% (8.3-40.7%). Further, Econdon offered relatively better protection for a longer period over the other botanicals.

The relative consumption of the bait from various bait stations revealed higher bait consumption with open bating (94.16%) followed by PVC pipe bait stations (81.66%) and hallow bamboo bait stations (75.0%). Considering the safety to non-targets and weathering of baits, PVC pipe bait stations were found satisfactory. Evaluation of trap barrier systems during *kharif* 2008 and 2009 showed poor trapping success therefore the hallow protection effect of the TBS on surrounding crop was negligible and it was insignificant.

Studies on effect of smoke generated by burrow fumigator and Aluminium Phosphide fumigation on soil fauna revealed reduction in colony forming units of *A. flavus* by both the fumigation technologies. However there was an increase in the control. Reduction in the population of *Trichoderma* species and colonies of *A. niger* was

significant in smoke fumigation treatments only and no such effects was seen with AlP treatment.

Rodent control success during 2008-09 was 84.8 and 80.24% (in *kharif*) and 90.58 & 65.85% (in *rabi*) in viz., Penumanchili and Padamatipalem, respectively, the adopted villages under social engineering activity. In the latter village only the knowledge was provided by the Project.

University of Agricultural Sciences, Bangalore
(Speakers: Drs. Mohan I. Naik and V.Shivayya)

The data on rodent species composition and extent of rodent damage to rice, ragi, maize, cashew and cardamom was presented. The major rodent species infesting cereal crops were *B.bengalensis> Mus booduga>* Tatera indica in Mandya and Sulivara villages causing 2-7% damage. Rice and ragi fields registered 20-40 burrows/ha. In case of cashew nut the burrow density ranged from 3 – 44/ha with rodent damage of up to 8.0 %. However, the predominant species was *T. indica* at both the location followed by *M. booduga* at Chintamani and *Funambulus palmarum* at Balajigapade. The cardamaom crop in both Mudigere and Coorg suffered 5-6 % rodent damage (*Funambulus palmarum > B.bengalensis> M. booduga.* Rodent surveys in Northern transitional zone (Dharwad) revealed predominance of *B.bengalensis>* followed by *M. booduga and Tatera indica*. Similarly at Mudigere, Coorg, and Sirsi in Hilly zones *Fenambulus palmarum* followed *B.bengalensis* were the problem species in plantation crops, whereas in rice fields *M. booduga* was predominant during the year. Cardamom, coffee arecanut and rice experienced up to 9.6, 7.0, 3.1 and 7.1 % rodent damage respectively.

Baiting with zinc phospide yields with maximum mean per cent reduction in damage (66.64%) and rodent population (70.04%). Further, the evaluation of bait technique and time of application clearly indicated that the bait delivery through polythene cover was more effective (56.04% reduction in damage) as compared to baiting through paper cover (45.97%) or loose baiting (26.75)] during nursery or tillering stage under irrigated rice ecosystem. Among the cultural practices evaluated trimming and clearing of bunds at monthly interval recorded highest reduction (38.26%) in rodent damage and population (44.07%). Among the four modules tested for the management of rodent under irrigated rice ecosystem the module incorporating application zinc phosphide through plastic cover at tillering stage + bromadiolone baiting at maturity stage along with removal of bushes, trimming and clearing of bunds at monthly intervals was reported to be the best module.

Poly houses situated at Ramohalli, Kolur, Bettadabyrapura and Chintamani were found to be infested with *B. bengalensis ,M. booduga and T. indica.* The damage by the rodents to the nursery produce and poly house structure varied between 3.49 to 8.61 per cent, while the rodent density varied between 12.5 to 20.50 LBC/ha.

Social Engineering activity on rodent control in Gangerakaluve, Kolavanahally and Bommanahalli villages of Chikkaballapura District, resulted in reduction in rodent population from 64.92 to 78.71 and reduction in crop damage from 55.46 to 70.50 per cent in various cropping system. The significance and post control census on awareness creation indicated the higher level of adaptation of this technology by the farmers of Chikkaballapura District.

Central Arid Zone Research Institute, Jodhpur
(Speaker: Dr R.S. Tripathi)

The lesser bandicoot rats collected from Jodhpur were robust, the heaviest weighing 360g (male). Bimonthly catches revealed almost constant population through out the year recording a trap index of 0.03 to 0.08 bandicoots / trap/ day. Females proved more vulnerable to trapping as the sex ratio throughout the year was in favour of females, except in November. The breeding profile indicated that the bandiccots breed round the year. The bandicoot population was observed to spread in new areas of the city. Average daily intake of pearl millet grains by *B. bengalensis* was 16.47 g/ day as compared to 6.11 and 6.31 g/day by *R. rattus* and *T. indica*, respectively indicating more than two times higher feed potential of bandicoots.

For management of bandicoots under urban situations, baiting with zinc phosphide yielded immediate rodent control success up to 64% but reduced to 48% after two weeks, whereas anticoagulant baits (bromadiolone and brodifacoum yielded 66% success on 15 th day of treatment. The same anti coagulants registered higher control success of 70-75% in fields. Lower success in urban areas was due to immigration of bandicoots from non-treated areas. This indicated that for urban areas large scale rodenticidal application is required in one go to avoid quicker immigration and more over sustained bait application with anticoagulants are needed for effective management of bandicoots in urban locations besides, proper sanitation measures on community basis and trapping at house hold levels.

Monthly trapping data revealed a mean trap index (rodents/100 traps/day) of 5.54 (range 3.3 –8.5). Relatively higher trap index was noted during winter months (6.1-8.05) (due to higher catches of squirrels), coinciding with fruiting season in ber and pomegranate. Higher index of 6.7- 7.5 was found in summers due to higher catches of *T.indica*. The habitat preference of rodents towards horticultural, silva and cropfields/ grasslands was at par with 33.0, 29.6 and 37.4% abundance in respective cropping systems. Amongst these, *F. pennanti* was mainly trapped from ber and pomegranate orchards, whereas *T. indica* was trapped from all the three habitats almost uniformly. Similar trends are being noticed since last 5 years.

Indian gerbil, *Tatera indica*, essentially a field rodent species continued to establish its population in residential and grain storage areas. The gerbil species had shown predominance round the year with 57-85% share (Mean 66%) followed by *Rattus rattus* (Mean 34%). The gerbils collected from their new habitat i.e., grain mandis were observed to be heavier (120.57g) than the field collected gerbils (111.06g).

A plant origin compound, ‘Bio’ containig glucosides of *Tripterygium ilfordii (GTW)* was evaluated for its palatability and efficacy as a male sterilant against house rat, *Rattus rattus.* The results revealed that sterilant bait is not toxic to the rats even after an intake of over 600mg/kg of a.i. but it was significantly less preferred by male rats as compared to plain bait. Breeding success was nil in case of 15 and 21 days treated males indicating male anti fertility effects.

The results of the field demonstrations as depicted in the Table 4 indicated that reduction in rodent infestation with single treatment of zinc phosphide was between 57% (sesame) and 70% (moth) on 4^{th} day after treatment whereas single baiting with bromadiolone gave only 23 (moth) and 28.6% (pearlmillet) success on same day and upto 78% on 15^{th} DAT. Therefore integration of acute (zinc phosphide 2%)) and followed

by bromadiolone (0.005%) baits prepared in pearl millet using ground nut oil as additive is suggested to obtain sustainable rodent control in kharif crops.

Assam Agricultural University, Jorhat
(Speakers: Drs D.K.Bora and R.K.Bora)

Sporadic flowering of *Bambusa balcooa*, *B tulda*,*B nutans* and *B pallida* was observed in Jorhat,Nagaon ,Barpeta and Dhemaji districts. Of the two hills districts of Assam *Melocanna baccifera* was observed flowering sporadically in Karbi Anglong and gregariously in N C Hills. But no rodent outbreak was observed.

Survey was conducted in five villages of Majuli sub-division, Jorhat during last two years near bamboo flowering areas revealed maximum rodent damage in Bao paddy (15.98& 13.75 % cut tillers) and the lowest was in toria .The burrow density was highest in Sugarcane (35.3 & 35.8 /ha) and Bao paddy (32.8 & 37.8 no/ha.)..During both the years *Bandicota bengalensis* was the only species recorded. Rodent damage recorded in *Rabi* vegetables was up to 11% in Pea; 9.0% in pumpkin and the lowest damage of 2.0% in cauliflower.

Experiments conducted in irrigated summer or 'Boro' rice during 2005-06,2006-07 and 2007-08 revealed that rodent infestation increases with advancement of crop stage from tillering stage onwards reaching a peak at the ripening stage. The appropriate time of application of the rodenticides was found to be at the panicle initiation stage at which the burrow density was 13.22/ha which is just below the economic threshold level.

Field trials on effect of mulching on rodent abundance in potato fields conducted in farmer's field in Majuli indicated maximum damage and rodent abundance in potato mulched with water hyacinth and pumpkin as intercrop followed by water hyacinth alone and rice straw mulching and least in unmulched potato (11.65% haulm damage and 0.33/20 sq m burrow density). Thus mulching and intercropping created a favourable condition for rodent activity in potato and hence effective rodent management strategy must be adopted in such areas.

Laboratory feeding trials with four botanicals viz. neem leaf, neem kernel, *Vitex nigundi, Polygonum* powder mixed with rice grain @20g/Kg revealed almost negligible consumption of food treated with *Vitex nigundi* by *R.rattus*. indicating anti rodent property in this plant. Laboratory trials on Brodifacoum (0.005%) proved highly effective in controlling *R. rattus* and *B. bengalensis* and was closely comparable with Bromadiolone wax cake formulation. Similarly, field efficacy of a new formulation of aluminium phosphide, a 12 g tablet containing 6% AlP was compared with celphos (56% AlP) against *B bengalensis.* The control success was 71.42 and 74.86 % and was statistically at par with celphos tablets.

Rodent problem residential premises storing grains in "Guti Bhoral", an indigenous outdoor storage structure was analyzed. The species composition comprised of *R. rattus* (43.45%) ,*Mus musculus* (30.36%) and *B. bengalensis* (26.19%). Besides damage to grains and storage structure rodents contaminated the stored rice by their faecal pellets to the tune of 8.67 pellets per 100 gm of rice.

Central Agricultural Research Institute, Port Blair
(Speaker: Dr. Ajanta Birah)

The research work at CARI Port Blair was initiated during 2009-10. The Rodents are major pests in coconut, oil palm, storage and household situations in Andaman and Nicobar Islands. As per old records, fifteen rodent species has been reported representing family, Sciuridae (Five stripped squirrel, *F. pennanti*),and Muridae (one mice, *Mus musculus* and 13 species/sub species off *Rattus* genus. Preliminary surveys were made and rodents collected from fields has been sent to Zoological Survey of India, Kolkata for identification. The rodent damage was observed in dwarf as well as tall varieties of coconut. Rodents often prefer young and tender coconuts. Rodent infested trees ranged from 8.57 to 26.67% were observed in all the coconut growing areas of South Andaman. Typically rat damage to coconuts consists of a single hole of approximately 65 x 40 mm usually found near the nut's point of attachment. In oil palms also, rodents cause damage at seedling, flowering and fruiting stages. Both immature and mature fruits were found damaged by rats. Rodent infestation in 40-50% palm trees was recorded.

College of Horticulture and Forestry (CAU) Pasighat
(Speaker: Dr. K.M.Singh)

Field monitoring for bamboo flowering *vis a vis* rodent problem was carried out in the forests of the state. *B. tulda* was bloomed in Koyu village of East Siang in the month of April-May. The inflorescence and grains were collected in the laboratory for further study. Litter size of rodents in bamboo flowering and non- flowering area was 7.52 and 7.27 respectively. Ten species samples were collected from East Siang district of Arunachal Pradesh and preserved in the laboratory. These samples to be sent to Zoological Survey of India, Kolkata for proper identification.

Survey of rodent infestation, damage and trap index in different crops was conducted from September –November months. In wet land rice rodent infestation was 20-65 burrows/ha with a trap index of 18-20 rodents/100trap/day and 4-12% tiller damage. In jhum rice, although the burrows were comparatively lesser (15-41/ha) the damage was higher (16-24%) in different months. The sugarcane fields with 20-26 burrows/ha also registered only 2-3% damage. Similarly tapioca and maize suffered 8-12% rodent damage. Scientists acted as resource in Trainers and Farmers training organized by Dept of Agriculture.

TECHNICAL SESSION – III
RODENT PROBLEMS: SPECIAL LECTURE SERIES

The Session began with release of publications and some awareness materials. Dr T.P. Rajendran and Dr. R.C. Srivastava released special mementoes of House Sparrow as part of celebration of World Sparrow Day. During this session was invited lectures were organized.

Dr. P. Vijayachari, RMRC, Port Blair delivered a lecture on"Leptospirosis: A Rodent Borne Zoonotic Disease". Dr Vijayachari informed that leptospirosis is a direct zoonotic disease with multi organ involvement and variety of syndromes. It has epidemic potential, upsurge mostly during post monsoon. The disease is caused by diverse serovars of leptospira which are difficult to diagnose clinically. Wild, peri domestic rodents, and domestic animals like cattle, pigs, goat, buffalo, cat and dogs are vectors and maintenance hosts. They carry leptospira in their kidneys and shed through urine for longe period. Man is an accidental host, leptospires enters in to the body through abraded skin or mucus membrane –lyphatics – all organs. Transmission dynamics and clinical manifestations of the disease were explained. He informed about the changing clinical patterns of the disease like; severe pulmonary hemorrhage syndrome, acute respiratory distress syndrome (ards); Gastro-intestinal bleeding – haemetemisis, Diarrhoea / dysentery, Meningitis and Myocarditis etc. The possible reasons for such changes may be due to (i) Change in genetic makeup (ii) new serovars of new or new serogroups and intermediate phenotypes - gaining pathogenic potential (iii) conventional agricultural methods – using animals & minimal mechanization. (iv) change in biological spectrum of disease - Sub clinic infection , (v) clinical syndromes & course and out come and (vi) lack of awareness among clinicians and public health personnel. Seroprevalence is very high in agricultural workers and animal handlers. History of leptospirosis and genomic details were also presented.

Dr Rina Chakraborty, ZSI, Kolkata described the rodent faunal diversity in Andaman and Nicobar Islands. She mentioned that the survey reports indicate occurrence of 15 species in the island, mostly (13 sp) belonging to genus *Rattus.* Among others only one sciurid fauna, *F.pennanti* and one Mus (*M. musculus*) are reported. She informed that three rodent species in the islands are under endangered and vulnerable category. She maintained that these reports are very old and the information needs to be updated. Probably *R.norvegicus* and *B.bengalensis* have also reached to these Islands. Only a few of the rodents of the Islands are in pest category therefore ecofriendly management technology be developed and effective farmers awareness programmes be launched. She suggested initiating joint programmes with ZSI and CARI Port Blair center of AINP on Rodent Control.

Dr Shyamal Biswas, NICD, Bangalore, delivered his lecture on Rodent Problem at international Sea Ports and International Health Regulations (IHR). Eight Indian rodent species, viz., *Tatera indica, Bandicota bengalensis, B. induca, Rattus rattus, R. norvegicus, Mus musculus, Meriones hurrianae* and *Funambulus sp* are considered as zoonotic reservoir of different communicable diseases. He listed 39 rodent borne diseases of which, plague, leptospirosis, Leishmaniasis, scrub typhus etc are most common, besides 11 documented and 12 non documented Hanta virus to humans. He explained in detail the transmission and epidemiology of plague, its distribution in the World and plague foci in India. Seven Indian states are regarded as plague endemic states. Tracing the history from the establishment of WHO in 1948, Dr Biswas informed

that IHR was adopted in 1951. During 2005 it was linked to Global Health Security strategy and finally in 2005 the IHR was adopted and therefore it is referred as IHR -2005 which came into effect in 2007. Air ports and sea ports are potential habitats of rodents and therefore rodent borne diseases may spread from one country to other. That is why As per International Health Regulations (IHR-2005) all the International air ports and Sea ports in the country have to be kept free from rodents to prevent migration vis-à-vis transmission of rodent borne diseases particularly Plague from endemic zones to disease free zones. The propose and scope of IHR 2005 is to prevent, protect against, control & provide a public health response to the international spread of disease. Public Health Emergency of International Concern (PHEIC) is an extraordinary event under IHR-2005 which constitutes a public health risk to other countries through international spread of disease and potentially requires a coordinated international response also. He also outlined the rodent surveillance mechanism, issues of ship and port sanitation and rodent management strategies.

Dr. A. M. K. Mohan Rao, NIPHM, Hyderabad highlighted the problem of rodents in crop fields, stores & Godowns and also in public health. He informed that GOI launched National Program on Rodent Management in 1976 with major objective of generating trained man power, preparation of community, actual control and prophylaxis. The programme could not get momentum due to variety of reasons. Deptt of Food also initiated Save Grain Campaigns at its 17 centers. Considering the seriousness of rodent problem at National level for food and health security, Department of Agriculture & Cooperation (GOI) has formulated a National Plan on Rodent Pest management under the central scheme 'strengthening and modernization of pest management approach' which is likely to start from second quarter of 2010 -11. The Plan has five major objectives (i) Capacity building among scientists / teachers / stake holders (ii) Creation of nucleus trained extension personnel (iii) Awareness creation among farming community (iv)Community effort with farmers' bodies, self help groups, commodity interest groups etc. and (v) Anti rodent campaigns at village level.

Dr V. Vasudeva Rao, ANGRAU, Hyderabad spoke on role of modern tool like, GIS and GPS in studying spatial distribution of birds. Deliberating on these techniques, Dr Rao detailed the methods and its application in analyzing the population structure, habitat selection and home range studies. The method is very easy and can provide authentic information in quickly, which can be helpful in planning conservation or management strategies.

Dr R.S. Tripathi, CAZRI Jodhpur presented the Changing scenario of Rodent Pests in India and expressed concerns regarding changes in rodent pest diversity due various human interventions with the natural environment, like intensive and diversified agriculture, canalization of river waters. Large scale urbanization is also leading to major shifts in the rodent species composition due to shrinkage/transformed habitats thereby aggravating the problem manifold. Tracing the history of rodent fauna of arid ecosystems, he mentioned that Indus valley region has witnessed drastic changes during last over 100 years, where deserts have been transformed into croplands through canalization of river waters. With the result xeric rodent fauna have been replaced by submesic and mesic species in Punjab and adjoining Rajasthan. Similarly *B. bengalensis* once unknown to deserts and NEH region is establishing its population in such areas. Similarly *T. indica,* exclusively a field rodent is trying to commensalize in some parts of the Country. Such changes may have implications on faunal diversity, economic losses in agriculture and storage and public health problems.

TECHNICAL SESSION –IV

REPORT FROM VOLUNTARY/ SELF FUNDED CENTRES AND STATES

Kerala Agricultural University, Thrissur

Dr Jim Thomas, Professor of Entomology, presented the achievements of a Front line Research project on rodent management in coconut in the Mathilakom Block in Thrissur District. Coconut plantations in the area were experiencing losses to the tune of 4.85 nuts/palm/week. Detailed analysis of nature of damage revealed that rodents, viz., belonging to the genus *Rattus rattus ruffescence* and *R. norvegicus* are of primarily responsible for the nut damage. The bats, *Pteromallus giganteous* are the secondary feeders. The experimental treatments were (i) Manual disinfestation by clearing and sanitizing the coconut crowns (ii) Tree banding or wrapping around the trunk over 45 cm width at a height of 1.5 m above the ground level to prevent the access of climbing rodents with specially designed sticky polythene sheet rolls (iii)Application of bromodiolone (0.005%) based rodent bait cakes in the palm crown as well as tied around the trunks anmd (iv)Covering the middle bunches bearing tender nuts with plastic fine nets (on two palms only) for excluding the chances of bat landing on the crown. Various management strategies experimented revealed that (i) tree banding on the trunk with sticky polythene sheet at a height of 1.5-2 m above the ground level over a width of 45 cm to prevent the access of climbing rodents, particularly during the maximum attack seasons to avoid the potential accustomation or to use GI sheet banding on susceptible palms as a permanent solution (ii) crown cleaning followed by rodenticide (bromodiolone 0.005%) bait cake application in the crown @ 40 g or 2 sub pieces per palm on need basis during the peak seasons of attack and (iii) periodical trapping of the rodent population in the homesteads. As a long term measure, community based rodent control campaigns to be organized in the problem zones with the active participation of the public was suggested. Besides, fostering of other fruit bearing trees like areca nut, cashew, *Hydnocarpus, Callophyllum*, guava ,cocoa etc., may be promoted within the coconut garden to offer alternate food sources for the rodents. Similarly facilitation for nesting and roosting places to predatory birds may be provided in an around coconut orchards by promoting tall soft wood trees. Periodic campaigns for the disinfestations of the rodent burrows and bushes which support the nesting behavior of the rodent species in the plantations were also suggested.

National Institute of Plant Health Management, Hyderabad

Dr AMK Mohan Rao presented the salient achievements of Plant Protection Division of DAC (GOI) and NIPHM, Hyderabad with regard to activities related to Rodent Control during last two years. He informed that the PP Division extends Technical Guidance through Dte. PPQ&S and NIPHM, Hyderabad, Reviews periodically the rodent situation in the country and extends financial support to States and UTs. Under Macro management the beneficiary states were AP, Haryana, Kerala, Punjab, TN, Bihar and all NE States, whereas special financial support was provided to NE states viz., Arunachal Pradesh, Assam, Meghalaya, Tripura Nagaland and Mizoram under SMPMA scheme. Under capacity building activities, two Institutional Trainings, 2 Apex Level Trainings (in collaboration with AINP, ANGRAU, Hyderabad): six off campus in situ trainings and several In state trainings (in AP, Gujarat, TN, Nagaland, Mizoram and Assam were organized by NIPHM. Expertise on rodent control was provided to Gujarat state for

Health and Agricultural personnel especially in Leptospirosis endemic areas of South Gujarat. Follow up of Action Plan resulted in anti rodent campaign in identified villages. The feed back received indicated >60% reduction in Leptospirosis incidence and 15% reduction in rodent damage in sugarcane during 2009. Similarly in AP the anti rodent campaigns undertaken in six districts yielded over 80% control success. Dr Rao emphasized on development of area specific extension oriented technologies, and initiation of biomedical research on vector control.

Haffkines Institute for Training, Research and Testing, Mumbai

Dr Abhay Choudhari, outlined the mandates and research and testing activities of the Institute. The Department of Zoonosis undertakes surveillance activities on plague and leptospirosis the two most important rodent borne diseases. Under plague surveillance programme rats are collected from different areas for the identification of suspected rodent population, flea index, serological diagnosis and cultural isolation of pathogenic bacilli. Similarly for leptospirosis continuous surveillance is undertaken because animals when infected with this bacterium may suffer from disease or remain asymptomatic. The serological diagnosis, microscopic examination and isolation of pathogenic organism in the blood and urine samples of human and rodents are undertaken. He mentioned that the Institute is initiating repellency testing against rodents and sought technical guidance from AINP on Rodent Control.

SK University of Agriculture Sciences and Technology- Jammu

Dr R. M. Bhagat, highlighted the rodent problem in Jammu region and also the achievements of rodent research undertaken by the University in different crops. Major cropping systems of the region are Rice – Wheat and Maize – Wheat. In addition pulses and oilseeds are also grown. The main fruit crops of the region are Apple, Pear, Walnut, Olive, Mango, Guava, Citrus etc. In Jammu rodents have become a menace in both agricultural and horticultural crops. The most prevalent rat species in Jammu region are *Bandicota bengalensis; Rattus rattus* and *Mus musculus.* Rodent abundance was reported to increase with crop growth in wheat with maximum abundance at maturity stage. Burrow systems of *B. bengalensis* extends up to 1308.7 cm with a mean diameter of 6.7 cm and depth up to 46 cms. Wheat under irrigation experiences higher rodent damage (11%) than the unirrigated crop (8%). Rodent damage is prevalent in other crops also in the region like, pulses and oilseeds including cash crops viz., olive, saffron, apple, Kala zeera etc but no systemic study is available. Outlining the future thrust areas, Dr Bhagat emphasized the need for detailed Systematic study of rodent species, damage and losses in crops like wheat, maize, rice and pulses. Rodent menace especially in adjoining areas of Ravi-Tawi canal is increasing day by day causing huge loss to crops as well as to canal. Besides, rodent problem in High value crops like Saffron in Kishtwar area, Kala zeera and newly introduced strawberry in Jammu area needs special attention.

Department of Agriculture, Tamil Nadu

Mr B. Balaji Govindraj, Dy Director Agriculture (PP), Tamil Nadu, explained about the rodent problem in rice and other crops and the steps taken by the Govt in organizing training programmes for farmers and rodent control campaigns. He informed that State Department has plans to organize trainings and demonstrations on Rodent Control during may-June 2010.

Department of Agriculture, Andamn and Nicobar Islands

Dr G.S. Pandey, Joint Director Agriculture highlighted the problem of rodents and the initiatives taken by the Department in rodent management. Presenting the status of agriculture in Islands, he informed that rice is the main staple crop of the region covering an area of about 7900 ha. Among plantation crops coconut, areca nut and cashew nut is grown in an area of around 21700, 4100 and 1050 ha respectively. Coconut suffers the most (30%) due to rodent attack. He informed that the Department provides 20% cost subsidy and 100% transport subsidy on all pesticides (including rodenticides) and plant protection equipments. Under coconut mission initiatives has been taken to cover 2000 ha under Rodent Management during the 11th FYP in A & N Islands.

Rodenticide Industries

Two rodenticide manufacturing companies, viz., Pest Control India Ltd and M/S Ultima Search Ltd. Participated in the Group Meeting. Mr Sriniwas Reddy of PCIL presented the advantages of using second generation anticoagulants for rodent control in fields as well as in domestic situations. He explained the status of bromadiolone and its availability.

Mr Rajesh Mistry and Mr Stanny Pareira from M/S Ultima Search also explained about their product, aluminium phosphide, the burrow fumigant. He informed that a new formulation of the fumigant in 0.6g pellets and 1.5 g tablets may be suitable for burrow fumigation. The registration of 1.5g tablet is under progress. During the discussion it was felt that new rodenticidal molecules for which efficacy data on Indian rodent are already available may be registered to have more options and also to avoid over dependence on a few compounds.

It was felt that the rodenticide Industry should play a participatory role in implementation of effective rodent control campaigns under the proposed National Plan particularly for validation of their products in new areas. The representatives of both rodenticide Industries agreed that the Industry may collaborate with the scientists of AINP on Rodent Control and NIPHM, Hyderabad in capacity field demonstrations and other extension activities on rodent management under National Plan.

TECHNICAL SESSION - VA
RECOMMENDATIONS FOR EXTENSION/DEVELOPMENT

A. RECOMMENDATIONS FOR AINP CENTERS

- The PIs of the AINP centers should timely submit various reports to Project Coordinator (Rodent control) *(Action : All centers)*

- The PIs to ensure timely submission of expenditure statements to PC (RC). Similarly AUCs and demands of funds for I and II half should also be submitted on priority for timely release of funds *(Action : All centers)*.

- All Centers should develop strong linkages with Agriculture Deptt. of their States for effective transfer of technologies. Attempts be made to disseminate the technologies to neighboring states also *(Action: All centers)*.

- The centers should actively collaborate with Dte of Extension of the respective SAUs and KVKs for better awareness creation in farmers and quicker transfer of rodent management technologies. The technologies should be included in Package of Practices of respective states *(Action : All centers)*.

- The technology developed at Kerala Agril. University (KAU), Thrissur (Plastic trunk banding) for management of rodents in coconut may be popularized and therefore AINP centers at Maruteru and Bangalore may take up operational trials on this technology. Dr Jim Thomas, Professor (Ag Entomology), College of KAU, Thrissur may provide the details of the technology to the concerned PIs of Maruteru and Bangalore centers. *(Action: All concerned centers and Dr Jim Thomas, KAU, Thrissur)*

- The Burrow fumigator developed at Maruteru should be field tested by all the centers of AINP on Rodent Control. The device will be made available to all centers by PI, Maruteru on payment *(Action: All centers)*.

- The PIs of all the centers should make study visits to all other centers of the AINP on Rodent Control during mandated cropping season of the center for closer interaction and intra Project linkages under intimation to the Project Coordinator. A strong linkage with AINP on Agril Ornithology is also desired for sharing and integration of knowledge generated by the center of both the AINPs. A collaborative research program on barn owls is to be implemented at common centers (of Rodent Control and Agril. Ornithology) viz., PAU, Ludhiana, ANGRAU, Maruteru and AAU, Jorhat *(Action: Concerned centers)*.

- Besides publication of monographs, technical and technology bulletins by PC Cell, the Centers should bring out pamphlets / leaflets in regional languages for better dissemination of technologies to farmers and other users *(Action : All centers)*.

- For dissemination of scientific/ research information generated by Centers among scientists of the country and abroad, Occasional Papers may be published by

P.C.Cell. The Centers would submit the manuscript to PC (RC) which may be published after peer review of the paper*(Action : All centers)*.

B. RECOMMENDATIONS FOR FARMERS

For rodent pest management in sugarcane crop in Punjab, multiple rodenticide treatments are recommended at different stages of the crop *vis a vis* surrounding crop fields. First rodenticidal treatments should be conducted in the month of July (after paddy transplantation in surrounding fields) and second in the month of October (after paddy harvest in the surrounding fields). During each of these treatments, two rodenticide baitings (first with 2% zinc phosphide or 0.005% bromadiolone bait followed by second baiting with 0.005% bromadiolone bait after 15 days @ 1Kg/ha each) should be conducted. To save the sugarcane crop with delayed harvesting from rodent damage, a third rodenticide treatment should be conducted in the months of December-January with single application of 2% zinc phosphide or 0.005% bromadiolone bait @ 2Kg/ha each *(Action : All centers)*.

C. RECOMMENDATIONS FOR EXTENSION/DEVELOPMENT

1. National Plan on Rodent management

It is heartening to note that Department of Agriculture & Cooperation included National Plan on Rodent Management under 'Strengthening and Modernization of Pest management Approach' scheme with National Institute of Plant Health Management, Hyderabad as the implementing Agency in collaboration and technical support of ICAR (AINP on Rodent Control). It is further noted that the plan would function with four-pronged approach, i.e., capacity building, data validation, awareness creation and actual rodent management operations to take up timely and appropriate rodent management operations with community involvement as a regular agricultural practice. After detailed discussions following recommendations were made;

- The technology validation centers may be identified and the technologies developed by AINP on Rodent Control (AINP RC) may be validated at identified centers with financial support from the National Plan.*(Action: NIPHM & ICAR)*

- Curriculum development to be undertaken for different levels of academic courses and trainings in the National Plan on priority by NIPHM and AINP on Rodent Control. *(Action: NIPHM & AINP RC)*

- ICAR Network project will extend assistance for implementation of various components of the National Plan.*(Action: AINP RC)*

2. NIPHM Activities

- All the new scientists and technical staff recruited/drafted in the AINP non Rodent control and its cooperating centers should undergo training on research methodologies of rodent control at NIPHM, Hyderabad. *(Action: PC (RC)/NIPHM)*

- NIPHM may also include Agricultural Ornithology in the institute programs and organize them with the technical support of All India Network Project on Agricultural Ornithology (AINP AO). *(Action: NIPHM & AINP on Agri. Ornithology)*

- A technical Bulletin on Rodent management in Rice may be brought out jointly by AINP on Rodent Control (ICAR) and NIPHM depicting success stories in various states during last few years. Besides the technological back up and other details, the Bulletin may also document ICAR and GOI' s efforts in managing rodents in rice based ecosystems. *(Action: NIPHM & AINP RC)*

- Social Engineering Document to be fine tuned by Project Coordinator in consultation with Rodent Specialist, NIPHM, Hyderabad. *(Action: NIPHM & AINP on RC)*

3. CIPM Centers (Dte. of PPQ&S)

- Dte of Plant Protection Quarantine and Storage (Ministry of Agriculture) has a network of CIPM Centers throughout the Country. These centers may record data on rodent pestilence as part of Pest Surveillance measures and incorporate the same in their periodic reports. A copy of the same may be forwarded to Project Coordinator (Rodent Control). *(Action: DPPQ)*

- CIPMCs may undertake capacity building programs to Farmer Trainers and also Farmers' Field Schools on rodent pest management, as identified by the Nodal institute of National Plan. *(Action: DPPQ)*

4. Management of Rodent-borne Diseases: Considering the twin role played by rodents as pests of Agricultural crops and vectors of several zoonotic diseases, following recommendations were made;

- Working paper may be submitted by PC (Rodent Control) to ICAR for developing a joint mechanism between ICAR and ICMR & allied medical and health Departments for collaborative programmes on research and extension on rodent management *vis a vis* food and health security. Various Institutes, like IVRI, Izatnagar; NDRI, Karnal, NBSSLUP, Nagpur, NIAMP, Bangalore, CARI, Port Blair; AINP on Rodent Control, Jodhpur (from ICAR) and NCDC, Delhi (Ministry of Health), RMRC, Port Blair (ICMR), ZSI, Kolkata, Haffkine Institute, Mumbai etc may be actively involved in formulating the detailed Program for preventing rodent related problems in health and agriculture sectors.*(PC, AINP RC)*

- AINP on Rodent Control (CARI, Port Blair center) may initiate work on identifying various rodents, in particular *Rattus* species in A & N islands and provide RMRC (ICMR), Port Blair animal samples for identification of serovars of Leptospirosis.*(CARI & RMRC, Port Blair)*

- Agro medical workshops, particularly for Leptospirosis and plague may be organized for diagnostics and therapeutics of the disease and its impact on human and veterinary systems. *(CARI, Port Blair & AINP RC)*

5. Zoological Survey of India

- Trainings on specimen preservation, taxidermy, identification of rodents and Museumology for all the Scientists of AINP on Rodent Control and Agril Ornithology to be arranged in consultation with ZSI, Kolkata.*(AINP RC & AO/ZSI)*

- Surveys in A & N Island may be taken up by AINP (Rodent Control), CARI Port Blair in collaboration with ZSI Center, Port Blair. ZSI will assist in identification.*(CARI and ZSI Station, Port Blair)*

- Development of a Rodent Museum at CARI, Port Blair may be implemented. Regional Station of ZSI, Port Blair may provide guidance.*(CARI and ZSI Station, Port Blair)*

- AINP on Rodent control may propose a winter School on Rodent Management covering various applied aspects of rodontology and Museumology including recent advances like chemical / molecular taxonomy etc. ZSI Kolkata may extend expert resource for the same.

  (AINP RC, Jodhpur and ZSI, Kolkata)

6. Rodent Problem in Jammu & Kashmir

- Issue of severe rodent problem in agriculture in Jammu region, particularly in saffron and olive crops was discussed. It was decided that AINP on Rodent Control may provide technological backstopping to SKU AS&T-Jammu in managing the rodent problem. PAU, Ludhiana center was identified for this purpose. *(PC AINP RC, PAU, Ludhiana center and SKU AS &T Jammu)*

- SKU AS&T-Jammu may initiate research on rodent management. Funds for the same may be explored from other agencies. After generating preliminary data the University may be considered as a voluntary center of the Project.*(SKU AS & T Jammu & ICAR)*

7. Rodent management in Oil Palms

- Project Coordinator (Rodent Control) to collaborate with NRC on Oil Palms, Eluru for documentation of the rodent management technologies.*(PC,AINP(RC) & ANGRAU Maruteru center /NRC OP)*

8. Rodenticides

- Rodenticide manufacturing industry should play an active role as partners in the implementation of effective rodent control campaigns under the proposed National Plan. *(Action: All Rodenticide industries).*

- Voluntary participation of rodenticide manufacturing industry is requested in Social Engineering activity on Rodent Control, a farmer's participatory research programme undertaken by all the Centers of the AINP. The PIs of the centers may approach the Industry for their participation. *(Action: PIs and Rodenticide industry).*

- CIB & RC may consider approval of protocols developed for bio-efficacy by the Scientific Advisory Committee on Rodenticides, CIB for developing data on newer rodenticides. *(Action: Secretary (CIB&RC)*

- In view of recent reports of reduced rodent control success while using bromadiolone baits in three districts of Andhra Pradesh and observations of AINP center of ANGRAU, Maruteru, it was recommended that burrow fumigation with aluminium phosphide may be considered as one of the options. Since the dosage requirement of this fumigant is 1.2 - 1.5g/burrow, aluminium phosphide with 1.5 g formulation could be brought out on priority by the pesticide industry. In case of delay in bringing this formulation, the group felt that 0.6 g pellet formulation may be used at 2 pellets/burrow. Industry may supply this pellet formulation till 1.5 g formulation is brought out.*(Action: DPPQ &S and Rodenticide Industry)*

TECHNICAL SESSION - VB
FUTURE RESEARCH PROGRAMMES

A. Multi location Programmes

RM 1: Surveillance of pest rodents in predominant cropping systems.

Methodology: Trapping, live burrow counts, extent of damage and reproductive status of the species at bimonthly intervals. Center wise cropping systems is specified below:

Centers	Crops/Cropping system
PAU, Ludhiana	i. Rice-wheat-sugarcane & ii. Cotton -wheat
ANGRAU, Maruteru	i. Groundnut- Pulses & ii. Plantation crops
UAS, Bangalore	i. Groundnut - Sesame & ii Cardamom and cashew
AAU, Jorhat	Rice-vegetables
CAZRI, Jodhpur	wheat-cumin
CARI, Port Blair	Rice-Coconut- Oil Palm
CAU (CH& F) Pasighat	Jhum rice-vegetables
ICAR (NEH), Barapani	Garo hills

RM 2: Monitoring of rodent abundance and damage in selected agro-climatic zones of the region (once in two years).

Centers	Regions
PAU, Ludhiana	Less Irrigated zones
ANGRAU, Maruteru	High altitude zone
UAS, Bangalore	Coastal & SouthTransition zone
AAU, Jorhat	Lower Brahmaputra valley zone
CAZRI, Jodhpur	IGNP Command areas
CARI Port Blair	South Andaman
CAU (CH& F) Pasighat	East and West Siang Districts
ICAR (NEH), Barapani	Garo hills

RM 3: Evaluation of botanicals against rodent pests for anitfeedant /deterrent/ attractant effects (For old centers). Castor based formulation named ‘Ecodon’ to be field evaluated by Jorhat and Maruteru center on payment basis in consultation with PC (Rodent control).

RM 4: Evaluation of chemical compounds for toxic and anti-fertility properties for data generation on Indian rodents (For old centers). Cholecalciferol to be evaluated at PAU, Ludhiana, UAS, Bangalore and ANGRAU, Maruteru.

RM 5: Bio-ecology of major rodent species (Habit, habitat, food, feeding /burrowing behaviour, population dynamics, reproduction & Breeding Biology etc.

Centers	Rodent species
PAU, Ludhiana	*Tatera indica*
ANGRAU, Maruteru	*Mus booduga*
UAS, Bangalore	*Bandicota indica*
AAU, Jorhat	*B. bengalensis*
CAZRI, Jodhpur	*Tatera indica*

RM 6: Development of integrated rodent management modules for different cropping systems. (It may include non lethal methods, habitat manipulations, biological control, burrow fumigator, critical timings and bait delivery technique for Rodenticidal baiting etc. Burrow Fumigator developed by Maruteru center should also be evaluated by all the old centers.

RM 7: Development of rodent management technologies under storage conditions.

RM 8: Social Engineering Activity on Rodent Pest Management as Participatory Adaptive Research in adopted villages.

RM 9: Studies on predatory potential of barn owls and its utilization for bio-control of rodent pests. (This programme is a joint programme in collaboration with AINP on Agricultural Ornithology. (Project Scientists of Ornithology is to set experiment and generate data on Ornithological aspects including establishment of the nest boxes and Rodent Scientists to generate data on rodent management aspects). The methodology is to be finalized jointly by both PCs and concerned PIs of both the Project. PC Agril Ornithology to convene meeting for the purpose. (For PAU, Ludhiana, ANGRAU, Maruteru and AAU, Jorhat)

B. Location Specific Programmes

1. PAU, Ludhiana

- Behavbioural studies on predominant rodent species.
- Evaluation of triptolide and Beio for antifertility effects on *Bandicota bengalensis* and *Rattus rattus*.

2. UAS, Bangalore

- Analysis of Rodent problem in Poly house agriculture and development of management strategies.

- Field evaluation of Aluminum phosphide for the control of *Tatera indica* and rat flea in collaboration with NICD, Bangalore (to be concluded in 2010-11)
- Rodent management in grape gardens under drip irrigation.
- Operational trial on trunk banding technology developed by KAU, Thrissur for rodent management in coconut.

3. ANGRAU, Maruteru

- Evaluation of bait stations
- Development of Rodent forewarning systems in Godawari Delta region of A.P. (by correlating climate data *vis a vis* population dynamics of last over 15 years).
- Studies on Tolerance behavior of *B. bengalensis* against bromadiolone.
- Operational trial on trunk banding technology developed by KAU, Thrissur for rodent management in coconut.

4. AAU, Jorhat

- Evaluation and documentation of rodent hunting and/ hearding by tribals of Assam. (Data on nutritive value of rodent meat is also to be generated).
- Field evaluation of bamboo bait stations and local traps.

5. CAZRI, Jodhpur

- Monitoring the spread of *Bandicota bengalensis* in and around Jodhpur.

6. CARI, Port Blair

- Collection of rodent species and development of Rodent museum.
- Monitoring of spread of *Bandicota bengalensis* in Port Blair.

7. CAU (CF&F Sci) Pasighat

- Collection of rodent species and development of Rodent Museum.
- Monitoring of spread of *Bandicota bengalensis* in Arunachal Pradesh.

8. ICAR (NEH), Barapani

- Monitoring of spread of *Bandicota bengalensis* in Meghalaya and Mizoram.
- Species composition and monitoring of rodent population, habitat analysis and management techniques (including local traps, bamboo bait stations).

PLENNARY SESSION

The Plenary Session was chaired by Dr T.P. Rajendran, ADG (PP). In this Session the proceedings of Technical Sessions on progress of research were presented and approved The points emanating from the discussions were taken up in the next session on Extension /Development/Constraint analysis/Recommendations which also formed the action points under recommendations. Report of the Technical Session on "Extension /Development/Constraint analysis/Recommendations for Rodent Management" and "Future Research Programme" was also presented and approved after detailed discussion, which is listed in the previous pages of the Proceedings.

Dr. T.P. Rajendran, Assistant Director General (PP), ICAR, in his concluding remarks congratulated the AINP on Rodent Control for its accomplishments. He assured the House to provide fullest cooperation of ICAR. He requested the PIs of all centers to send information on various technical and financial reports (monthly/ quarterly/half yearly/annual) to PC in time. He, however, felt the need of publication/documentation of monographs/Technology bulletins/occasional papers by the Project for greater visibility of our programmes. He was of the opinion that a close liaison should be maintained with other AICRPs and Institutions. He expressed satisfaction that National Plan on Rodent Management would be launched very soon. He expected that the programmes chalked out for various centers are implemented following uniform methodology. He reiterated the need for strict compliance and monitoring of the research and extension programmes of the Project.

The Group Meeting ended with vote of thanks proposed by Dr R.S.Tripathi, Project Coordinators (Rodent Control) and Dr. V. Vasudeva Rao, Project Coordinator (Agril Ornithology).

ACKNOWLEDGEMENTS

I am extremely grateful to the Dr R.C. Srivastava, Director, Central Agricultural Research Institute, Port for giving his kind consent to host the Group Meeting at Hyderabad. He deserves our sincere thanks for providing guidance and all the necessary facilities for its successful organization at Port Blair. He has been kind enough to Chair the Inaugural Session and also guide us during all the technical sessions. He outlined many issues regarding vertebrate pests, which are highly informative and useful in planning research and extension programmes.

I feel deeply indebted to Dr P. Vijayachari, Director, Regional Medical Research Center of Indian Council of Medical Research, Port Blair for accepting our request and inaugurating the Joint Group Meeting as Chief Guest. He outlined several commonalities in agricultural and medical research as for as rodents are concerned, as these tiny vertebrates are serious problem as pests and vectors alike. Despite his busy schedule he was very kind to spare his valuable time on the second day also and delivering a special lecture on Leptospirosis.

I express my deep sense of gratitude to Dr T. P. Rajendran, ADG (PP) ICAR for accepting our request to be the Guest of Honour during the Inaugural Session. His address during the inaugural cermony was very informative and the researchable issues highlighted by him guided us in planning the future research programmes. His support, guidance and presence in all the sessions have been a great source of inspiration to us, which has further ensured its overall success.

I am indebted to Indian Council of Agricultural Research, New Delhi for financial support and guidance at all the stages of its organization. We were indeed unfortunate that Dr S.K Dutta, Dy Director General (Crop Sciences) ICAR, New Delhi has always been a great support to the Project which made our work much easier. He was very keen to attend the Group Meeting however because of some most urgent official assignments in Delhi at the last minute; he had to cancel his visit. Dr. T. P. Rajendran ADG (PP) conveyed his blessings during the Inaugural Session.

The success of this Group Meeting could only be achieved by the advice and guidance received from a number of reputed scientists and the zeal and dedication of all my colleagues working in AINP on Rodent Control at different centers. Special thanks are due to Dr V. Vasudeva Rao, Project Coordinator, and AINP on Agril. Ornithology, ANGRAU, Hyderabad for all his help and support in making the Joint Group Meeting a successful event. I am highly thankful to the Heads of different organizations for deputing their scientists and officials in the Group Meeting. Thanks are also due to our colleagues in non-AINP centers who enthusiastically came forward to share the progress of their work. Their input has been highly beneficial in formulating the future programmes.

The Special lectures delivered by Drs P. Vijayachari, Rina Chakraborty, AMK Mohan Rao, Shyamal Biswas and V. Vasudeva Rao were an added attraction in this Group meeting. These thought provoking lectures helped immensely in developing some of the important recommendations. I thank all the eminent speakers on this ocassion.

I feel pleasure in expressing my thanks to Dr. M.M. Roy, Director, Central Arid Zone Research Institute, Jodhpur for his guidance and providing all the facilities required

for Group Meetings. Dr. Roy has also been a constant source of inspiration for advancing the work of AINP on Rodent Control for which I am sincerely thankful to him.

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