# PROCEEDINGS

## INTERNATIONAL WORKING GROUP ON THE IMPLEMENTATION OF THE AFRICAN REGIONAL PEST MANAGEMENT RESEARCH AND DEVELOPMENT NETWORK (PESTNET) FOR INTEGRATED CONTROL OF CROP AND LIVESTOCK PESTS NAIROBI, KENYA

**22 - 26 JUNE 1986**

ICIPE
INTERNATIONAL CENTRE OF
INSECT PHYSIOLOGY AND ECOLOGY (ICIPE)
P.O. BOX 30772, NAIROBI, KENYA

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**EXECUTIVE SUMMARY**

The idea for an "African Regional Pest Management R & D Network (PESTNET) for Integrated Control of Crop and Livestock Pests" was formulated in July 1985 as the outcome of two planning missions sponsored by the USAID, UNDP and ICIPE. A Regional Workshop held from 6-8 October 1985, in Nairobi, reaffirmed the proposal to establish a network to enable the exchange of scientific experience and methodologies, to provide for multi-locational testing of new pest management techniques, and to develop scientific leadership in Africa by training at different levels. The Workshop recommended that a PESTNET implementation meeting of government representatives be held to formulate a work programme within a framework of cooperation.

At this meeting, details of national pest problems were presented through a series of country papers as well as in a report of an ICIPEsponsored mission to several of the countries represented. The areas for ICIPE participation in collaborative work in crop and livestock pests through scientific exchange and training under a networking arrangement were clearly defined.

To this end, representatives from national governments and other institutions in East and Southern Africa met in Nairobi from 22-26 June 1986 to finalise plans for the implementation of an African Regional Pest Management R & D Network (PESTNET) for Integrated Control of Crop and Livestock Pests. The representatives issued a Communique in which they recognised the great importance of insects as pests of livestock and agricultural crops which limit productivity and economic development. They endorsed the PESTNET initiative, drew up recommendations for a programme of work; and agreed to launch it from 1st October 1986.

They recognised the mandate of the ICIPE to develop and promote methods of pest and vector control which are appropriate for African ecosystems. They agreed that ICIPE shall act as coordinator for the PESTNET programme on behalf of the participating institutions.

They further agreed to assist the ICIPE to manage the programme through advisory mechanisms established in a framework of cooperation.

The funding arrangements for PESTNET were discussed and it was agreed that ICIPE should seek funding for the operational centre (based at ICIPE), for collaborative projects and for training. A draft 3 year budget was drawn up for this purpose. It was agreed that national programmes would seek bi-lateral funding for specific within-country activities.

# PART I

## WELCOME ADDRESS

## MINISTERIAL ADDRESS

## COMMUNIQUE

## and

## FRAMEWORK OF COOPERATION

## WELCOME ADDRESS

By

**Thomas R. Odhiambo**

Dear Colleagues,

Almost exactly one year ago, the International Centre of Insect Physiology and Ecology (ICIPE) commissioned two planning Missions, headed and staffed by groups external to the ICIPE, to undertake a detailed assessment as to whether there was crucial need for an African Regional Pest Management Research and Development Network (PESTNET) in the Eastern and Southern African region; whether the research and training results at the ICIPE had advanced sufficiently to make the ICIPE a productive participant within such a network; and what form and content such a network would take. One mission (July 1985) was headed by Dr. Paul E. Lippold, and funded by the U.S. Agency for International Development (USAID); and the other mission (August/September 1985) was led by Dr. A. Ghani Ibrahim (Malaysia), Dr. Bede N. Okigbo (Nigeria) and Professor C. Pavan (Brazil), and funded by the Technical Cooperation among Developing Countries (TCDC) division of the United Nations Development Programme (UNDP), as a prelude to the convening of the Planning Workshop for PESTNET held in Nairobi from 7th to 9th October 1985.

The PESTNET Planning Workshop gave a positive reaffirmation to the proposal to establish a network for pest management research, development and training, with the following principal objectives:

- Generation of scientific information and methodologies which can be adopted in pest management within Africa.
- The exchange of scientific information and experience between participating institutions.
- The testing of methodologies, technologies and information for validity in different ecological zones of Africa.
- The development of scientific leadership in Africa in the field of pest management by training at different levels.

In this context, I am clear in my own mind that what the ICIPE is seeking is an interactive partnership with the national pest management R & D programmes in the region. As I indicated in my introductory address to the October 1985 Planning Workshop for PESTNET:

> "We are seeking a longterm partnership that will facilitate the testing of the technologies (of pest and vector management) in varying ecological zones (of eastern and southern Africa); that could catalyse the development of agro-industrial base for rural Africa; and that will assure a continuing interaction between the various partners".

### PROSPECT

The Planning Workshop had recommended that the nucleus for the proposed PESTNET be composed of (a) a Secretariat, to be based at the ICIPE, which would coordinate and facilitate the activities of the network; and (b) national programmes from 11 countries which would form the initial membership of the network Burundi, Ethiopia, Kenya, Malawi, Rwanda, Somalia, The Sudan, Tanzania, Uganda, Zambia and Zimbabwe. The PESTNET Mission, led by Mr. John J. Ondieki (Deputy Director of Research, Kenya's Ministry of Agriculture and Livestock Development), visited 7 of these countries in May 1986 Burundi, Malawi, Rwanda, The Sudan, Tanzania, Zambia and Zimbabwe. Apart from briefing senior officials of the respective Ministries and Institutions of the countries visited on the background and rationale for the proposed PESTNET, as well as reviewing with them the national needs in respect of pest management R & D, training, and financial support for the proposed PESTNET, the Mission had two principal goals:

- To identify problems presently being undertaken by national institutions in which PESTNET could make a major contribution, and other crucial problems in which the country concerned has not the resources to tackle and in which PESTNET can be an initiator.
- To obtain commitment in principle from the potential participating countries to join PESTNET.

The Mission Report has succinctly presented its detailed findings and specific recommendations arising from these which have been made available to the workshop we are attending this week, THE INTERNATIONAL WORKING GROUP ON THE IMPLEMENTATION OF PESTNET.

It has become obvious from the Mission Report that the major pests and disease vectors of the countries visited had global importance; that the strengthening of manpower and R & D capacities in the region were of crucial importance; and that there existed a general commitment to the proposed PESTNET.

National Delegations to the Implementation Workshop have come prepared to discuss the particulars of PESTNET:

1. The programme content of the PESTNET - the workplans for R & D, the actual training needs and how to fulfill them, and the mechanisms for the exchange of information and documentation.
2. Organization of the network and linkage arrangements.
3. Financing and funding arrangements for PESTNET.

The intention of the Workshop is clear: to agree on the content and functional details, to develop an operational calendar, and to make an actual start in January 1987. Africa is ready for this important move. I sincerely hope we shall do so without any delay - but with care and a resolve that we must succeed.

**ADDRESS BY THE GUEST OF HONOUR ASSISTANT MINISTER FOR AGRICULTURE AND LIVESTOCK DEVELOPMENT, HON. W.M.A. SAINA, M.P AT THE INTERNATIONAL WORKING GROUP ON THE IMPLEMENTATION OF THE AFRICAN REGIONAL PEST MANAGEMENT RESEARCH AND DEVELOPMENT NETWORK (PESTNET) 23RD JUNE 1986**

Distinguished Guests
Members of the Diplomatic Corps
Honorable Visitors
Ladies and Gentlemen

It gives me great pleasure to be present here today at this international meeting that seeks to implement a very important programme of the African Regional Pest Management Research and Development Network for Integrated Control of Crop and Livestock Pests, with the acronym "PESTNET".

I am particularly pleased to note the presence of delegates from: BURUNDI, KENYA, RWANDA, SOMALIA, SUDAN, TANZANIA, UGANDA, ZAMBIA and ZIMBABWE.

As the host nation, I offer you a special welcome on behalf of our Government and His Excellency the President.

I understand that your meeting here is to implement the decisions of an earlier workshop held in Nairobi in October 1985 when you agreed on three main common problems:

Firstly, that the main food crops in the region suffer heavy losses due to insect pests and the principal control methods using pesticides are problematic and disappointing. Problems have arisen through insect resistance, environmental pollution and high economic costs. In addition the majority of our farmers are small holders and do not have adequate resources or the technical knownow to safely use pesticides.

Secondly, that the availability of meat and other livestock products for human use has declined in recent years as a result of the slow growth in production and rapid increase in human population. Tick and Tsetse borne diseases are the principal constraints to increased meat production.

Thirdly, you have recognised that science and technology are the major components of economic development, but that in Africa the ratio of scientists to the total population is much less than in the developed world.

This, therefore calls for closer cooperation between our countries, and the need for extensive training of young African scientists and technologists.

With this in mind you have decided to meet together to plan and implement a network of cooperation to reduce and control our major insect pests.

You are seeking to develop a horizontal relationship with all partners being equal and with the objectives of jointly:

- generating scientific methods which can be commonly adopted in pest management.
- exchanging scientific information and experiences.
- testing methodologies and technologies for validity in different ecological zones.
- developing scientific leadership by training at practitioner, masters and doctorate levels.

In all this you are aware, and I urge you to keep in the forefront of your endeavours, the small-holder farmer. This man and his family are the backbone of our agriculture and national economies. Whatever we do should be within his economic means and socially acceptable.

In following the call of our President, my Ministry is specially undertaking programmes and projects to help our smallscale farmers.

I am sure that in your own countries, you are following similar plans. We are all aware of the severe food shortages in many of our countries and of the need for long-term measures to solve them.

Your gathering here to adopt a scientific and technological course is within our national and Africa-Wide Plan of Action envisaged by the Organization of African Unity. It is for example reflected in the Lagos Plan of Action and in the Continental discusssions we have held this year to combat starvation, malnutrition, disease and illiteracy.

You have chosen the right path of regional cooperation and development of scientific methods, information and technology. In this, I commend you and wish you well and I trust we shall see a practical outcome of your meeting that will be to our mutual benefit.

Thank you.

**INTERNATIONAL WORKING GROUP ON THE IMPLEMENTATION OF THE AFRICAN REGIONAL PEST MANAGEMENT RESEARCH AND DEVELOPMENT NETWORK FOR INTEGRATED CONTROL OF CROP AND LIVESTOCK PESTS (PESTNET): NAIROBI, 22—26 JUNE 1986**

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## COMMUNIQUE

We, representatives from Member Governments and other institutions in Africa, **recognizing** the great importance of insects as pests of livestock and agricultural crops which limit productivity and economic development, note the need and **endorse** the proposed programme for establishing an African Regional Pest Management Research and Development Network for integrated control of crop and livestock pests (PESTNET).

**Noting** that the number of insect scientists in Africa is inadequate and that the need exists to collaborate in research and training at all levels in order to use the scarce resources to full advantage, and **recognizing** the mission of the International Centre of Insect Physiology and Ecology (ICIPE) to develop and promote insect science, especially methods of pest and vector control which would be appropriate in African ecosystems:-

1. We **agree** in principle to cooperate in establishing an African Regional Pest Management R & D Network (PESTNET)through a Collaborative Programme, and **agree** that the Programme should commence as soon as the appropriate approvals have been received from at least three Government Authorities and satisfactory financial arrangements are assured. The target date for implementation of the Programme is January 1987.

2. We further **agree** that the ICIPE shall act as Coordinator for the Programme on behalf of participating institutions.

3. We finally **agree** that, in order to fulfill the objectives of the Programme, Participating Countries and other relevant institutions shall: (a) Assist the ICIPE to manage the Programme through advisory mechanisms established by the Participating Countries in consultation with the ICIPE as indicated in the Framework of Cooperation detailed in Annex 2 attached. (b) Permit other countries and institutions in Africa to join the Programme on terms acceptable to all parties as and when appropriate.

NAIROBI, KENYA 25th June 1986

Annex 1:
Representatives of
Member Organizations

22 to 26 June 1986

| SIGNED | COUNTRY |
|---|---|
| Dr. Joseph Niyongabo | Burundi |
| Dr. Pascal Ndayiragije | Burundi |
| Mr. John J. Ondieki | Kenya |
| Dr. William W. Wapakala | Kenya |
| Dr. Sam Chema | Kenya |
| Dr. Joel Kipngeno Koske | Kenya |
| Dr. Boniface Rushigajiki | Rwanda |
| Dr. Abdullahi N. Alio | Somalia |
| Dr. Abdulkadir Farah Nur | Somalia |

| | |
|---|---|
| Dr. Osman M. Osman | Sudan |
| Dr. Hassan A. Farrag | Sudan |
| Dr. Geoffrey Habimana Semuguruka | Tanzania |
| Mr. Christopher Simon Tarimo | Tanzania |
| Professor Okot Bwangamoi | Uganda |
| Dr. Dennis Musuku Wanchinga | Zambia |
| Dr. Moses Lawrence Kabuswe | Zambia |
| Dr. Peter Gilbert Sinyangwe | Zambia |
| Dr. Welbourne Ndabaningi Madzima | Zimbabwe |
| Mr. Simon Zuka Sithole | Zimbabwe |
| Professor Thomas Risley Odhiambo | Director, ICIPE |

**ANNEX II**

# INTERNATIONAL WORKING GROUP MEETING ON THE IMPLEMENTATION OF THE AFRICAN REGIONAL PEST MANAGMENT RESEARCH AND DEVELOPMENT NETWORK (PESTNET)

NAIROBI, KENYA: 22ND TO 26TH JUNE 1986

## FRAMEWORK OF COOPERATION

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The International Working Group discussed the following main elements in a Framework of Cooperation:

I. Organisation and Linkages for PESTNET.

II. Extent of Cooperation and Work Plans for Research, Training, Information and Documentation.

III. Funding and Financing Arrangements for PESTNET.

## I. ORGANIZATION AND LINKAGES FOR PESTNET

The International Working Group noted the following important points raised in discussion of the country reports and relevant ICIPE research and training highlights presented: (a) that the case for PESTNET is strong and urgent, especially in the areas of training and collaborative programmes; (b) that there was similarity in the nature of pest problems and national research programmes, but there were marked differences in the total capabilities of national programmes; (c) that some control technologies offered for adoption in the PESTNET had reached a stage for field testing, while others were still to be perfected; (d) that the PESTNET technologies should be readily applicable as some governments of participating countries may be hardpressed for quick results; (e) that PESTNET should not merely be a transfer of information but must have a strong component of member-to-member research collaboration on equal partnership; (f) that PESTNET should take note of national and regional linkages existing in relevant programmes.

### A: ORGANIZATION

1. **Location**

   It was agreed that a PESTNET Secretariat be established and that the ICIPE will host the Secretariat.

2. **Staffing**

   Initially, a Scientific Coordinator for PESTNET at the Secretariat shall be the main Coordinating Officer of PESTNET reporting in the same way as other special projects of the ICIPE do. It was recommended that the staffing should be expanded over the years. And further assistance would also be required.

   Initially, the Scientific Coordinator will be supported by an Assistant Coordinator, a Secretary and other supporting staff.

3. **Supporting Facilities**

   The Secretariat will require supporting facilities - office space and equipment, computer/word processor, and a vehicle.

4. **Date of Initiating of Network**

   It was recommended thast the Secretariat be initiated by 1st October 1986 subject to availability of funds.

### B: LINKAGES

The participants recommended that in the establishment of Pestnet linkages, the following steps should be taken:

1. That ICIPE should communicate directly to the link persons in the areas of tsetse, crop and livestock tick research to obtain government approval in principle to the pestnet programme.
2. That Government Commitment to participate in PESTNET should be communicated to the Secretariat by 1st September 1986.
3. That an assessment of the national capability profiles be part of initial PESTNET activities in the establishment of linkages with the purpose of maximising utilisation of total national resources in the relevant fields of research, training and development.
4. That a mechanism be established at the national level to coordinate linkages between PESTNET, relevant research and development programmes in the member countries and other international linkages in the relevant subject areas. Within the framework of these national linkages, effort should be made to encourage interface between biological and social sciences for effective technology generation, transfer and application.
5. That training linkages be strengthened at all levels of relevant research and application and should as far as possible use facilities at ICIPE and at any other national institutions with the capability to offer such training. It was further recommended that a multidisciplinary curriculum be developed.
6. That linkages be established through seminars, and workshops and that these workshops be held in various participating countries.
7. That other linkages should be through exchange of information between the Secretariat and member countries, as well as between member countries themselves in the form of PESTNET Newsletter, periodical reports by the network scientists, Annual PESTNET Review Conference, Methodology Workshops, etc.

## II. EXTENT OF COOPERATION AND WORK PLANS FOR RESEARCH, TRAINING, INFORMATION AND DOCUMENTATION

### A: RESEARCH AND DEVELOPMENT

The International Working Group noted that there were eight common items to be discussed for Pestnet Research and Development (listed below) and made recommendations separately for ticks, tsetse and crop pests.

1. Contents of Pestnet - priority pests, disease vectors and target crops for the first three years (1987-89).
2. Investigation of Technology Packages available for sharing within Participating Countries.
3. Research aspects requiring incountry or regional experimental testing.
4. Research and Development aspects requiring in country field testing for new technological packages.
5. Exchange of Research personnel between network members for practical work and collaborative trials.
6. Development of joint research strategies for neighbouring countries with similar problems.
7. Items requiring further basic research.
8. Short Methodology Workshops for specific areas of concern for the network, and in order to standardise procedures and reporting for comparative purposes.

RECOMMENDATIONS

A. TICKS

1. The Tick pests to be included in the network should be the genera *Rhipicephalus, Amblyomma, Boophilus* and *Hyallomma.* All species of value to pestnet members should be included in the network mandate.

The tick subnetwork should have close links with other Tick Borne Disease Network since disease cannot be separated from tick control regimes.

2. Acaricide resistance testing is an area of concern, uniformity of approach is essential. The network should concentrate on the FAO acaricide resistance testing technique. Scientists from the network should collaborate with FAO on the current proposed training package to be held in Nairobi.
3. The ACIAR T3 HOST model is already being validated in strategic dipping trials in Zambia, Zimbabwe and Burundi. The data required for the package should be clarified and countries identified who are interested in validating the scheme and assisted to do so.
4. The exchange of personnel between network members is highly recommended. Funds for such exchanges should be budgeted to encourage training; to provide assistance to national programmes that require it; and for collaborative field work.
5. Joint Research strategies between neighbouring countries are highly recommended to economise efforts and promote regional understanding. The Pestnet Secretariat should identify areas suitable for joint research in conjunction with members.
6. Two principal areas were identified for basic research. (i) The artificial stimulation of immunity to ticks in cattle, sheep, goats and the camel. (ii) Development of methods to measure breed tick resistance and tick productivity losses.
7. **Methodology Courses**
   (i) Methodology of registration and efficacy testing of new acaricides and methods of tick control (e.g. sytemics, pour-ons, and eartags). (ii) Joint Workshop with Tsetse on "The disposal of insecticides, environmental pollution, and mammalian residue problems." Possibly to be held in conjunction with UNEP. (iii) Modern Methods of estimating host resistance. (iv) Methods of acaricide resistance testing.

It was recommended that the venue for Workshops should circulate around member countries and not be only held in Nairobi.

B: TSETSE

1. It was agreed that tsetse be included in the PESTNET.
2. Priority vectors of African trypanosomiasis to be included in the PESTNET (1987-1989) are *G. morsitans* and *G. pallidipes*.
3. The tsetse control technology package available for field testing to the PESTNET Member states are the odour-baited traps being developed by ICIPE and the insecticide impregnated targets being tested by the Zimbabwe group. These packages are fairly low cost and should be within the financial resources of most member states.

The above suggested technologies should not stop member states from using whatever measures available to them to cope with outbreaks of human trypanosomiasis.

4. Field testing of promising odour-baits (natural and artificial products) where suggested for experimental testing.
5. It was suggested that the ICIPE and Zimbabwe groups get together and explore areas of collaboration since both groups have made significant progress in low cost tsetse control technologies. The ICIPE is already planning to have a pilot tsetse control in Kenya (Rift Valley) in collaboration with Kenya Government Ministry of Agriculture and Livestock Development.
6. It was highly desirable to have exchange of research personnel between network members for practical work and collaboration trials such as trials of odour-baited devices between the EEC-funded project in Zimbabwe and the odour attractants developed by the ICIPE. The ICIPE was already having discussions with Tanzania Livestock Research Organization on collaboration on testing various odour baits using traps.
7. It was agreed that studies on population modelling be encouraged as this was essential to the understanding of the population dynamics of the tsetse.
8. A workshop on "Recent developments on Sampling techniques" be convened at an appropriate time.

C: CROPS

1. Maize and Sorghum were the main crops to be covered.
2. The insect pests of these crops in order of priority are: (a) Regular Pests: *Busseola fusca, Chilo partellus, Eldana saccharina, Sesamia* spp, *Cicadulina* spp; *Atherigona soccata; Heliothis armigera Contarinia sorghicola* (b) Sporadic serious pests: *Spodoptera* and *Agrotis* spp. (c) Pests of localised importance: the rootworm of maize *Buphonella murina;* the armoured cricket *Acathoplus* spp, *Enyaliopsis* spp.
3. Technology on the following components of pest management is currently available in several member countries and at ICIPE for testing and collaborative work: (i) Chemical pesticides (ii) Plant resistance to pests (iii) Intercropping effects on pest attack (iv) Other cultural practices (v) Biological control
4. The research to be undertaken jointly under PESTNET by the participants would aim at developing the above multi-component pest management packages, while striving to reduce the current usage of chemical pesticides. The areas for such collaborative programmes are given below: (i) **Plant resistance to target pests:** (a) detailed evaluation of local maize and sorghum germplasm or cultivars for resistance to target pests, using the standardised methodology developed by certain national programmes and the ICIPE and various International Agricultural Research Centres; (b) tests and trials with the resistant cultivars of maize and sorghum identified by various national programmes and the ICIPE to be conducted in different

PESTNET zones for their efficacy; and (c) collaboration with plant breeders of national programmes for developing cultivars combining resistance to the pests with other desirable qualities (ii) **Intercropping as a Pest Management Component:** (a) effects of different crop combinations as intercrops on the pest attack and consequent crop losses to be investigated in different participating countries; and (b) efficacy of the combinations which suppress the pest attack to be tested in different PESTNET zones. (iii) **Other Cultural Practices for Pest Management:** strategies for utilising the planting time, field sanitation, disposal of crop residues, crop rotation, etc. for pest management to be developed in the participating countries. (iv) **Biological Control:** (a) surveys of incidence of the natural enemies (parasitoids, predators, pathogens) of the target pest to be undertaken in different PESTNET zones; and (b) potential of already identified, promising biocontrol agents for the target pests to be tested in the participating countries. (v) **Chemical pesticides:** (a) development of strategies for the limited/ reduced use of conventional pesticides; and (b) search and development of strategies for using non-toxic botanicals for pest control.

5. Exchange of Personnel between participating countries is very important and highly recommended for collaborative research activities as shown above.
6. Basic Research: the following topics were suggested: (a) population monitoring, modelling and forecasting of target pests to be developed; and (b) crop loss assessments, (c) methodology for evaluation of germplasm/cultivars for resistance to target pests. (d) methodologies for the biological control.
7 **Short methodology courses** were considered esential. The suggested themes are: (a) methodology for mass rearing of the target pests, (b) methodologies for crop loss assessment, (c) methodology for evaluation of germplasm/cultivars for resistance to target pests. (d) methodologies for the biological control.

**B: TRAINING**

The members considered the merits of training to be given within Participating Countries or at the Operational Centre, as a contribution to the training needs of national programmes in the following categories:

1. **Short-Term Training**
   - **Practitioners** Group Courses (for research, field and technical assistants with due consideration to number of participants, type of courses, etc.)
   - **Research Officers Training:** - group training courses, seminars, study workshops (topics, frequency, venue, etc.)
   - **Research Consultants:** short-term visits by principal national scientists to provide advice to specific research programmes, demonstrate new techniques or research methodology as may be required by those programmes being visited.
2. **Medium-Term Training**
   - **Research Associate Scheme**
   Linkage with the ICIPE to enable middle-level and senior scientists to spend up to 1-4 months each year as a member of a research group at the ICIPE for a period of 24 years once a well defined project is underway in the scientist's country.
   - **Master of Science Training**
   Linkage with national universities to enable junior scientists working on network projects to obtain postgraduate qualifications as a result of their contribution to the project work.
   - **Postdoctoral Research Fellowships**
   To enable senior research scientists incharge of national PESTNET programmes to spend up to one year as a member of a research group at ICIPE early in the launching of a collaborative network programme where this is deemed necessary. Postdoctoral fellowships may also be undertaken at later stages of the national collaborative programmes where it is determined that basic investigations are necessary for elucidating any special aspects of the programme.
3. **Long-Term Training** Ph.D training under the ARPPIS (The African Postgraduate Programme in Insect Science) programme. To upgrade middlelevel scientists in national collaborative projects so as to develop their abilities to undertake leadership roles for the longterm conduct of pest management projects within their countries. Training will be given for 3 years at the ICIPE including coursework and research project work.

RECOMMENDATIONS

1. **Short-Term Training**
   (i) It was recommended that the following group courses should be organized at ICIPE (a) **For Livestock Ticks:** A course on biostatistics emphasizing the statistical evaluation of acaricide tests. (b) **Crop Pests:** Courses for technical and field staff on The Methodology of Crop Pest Management and biological control. (ii) **Research Consultants.** The meeting recognized the importance of providing funding for short-term visits by research consultants. In particular it recommended that the Head of the ACIAR (Australian Centre for International Agricultural Research) African Ticks Research Project should visit the ICIPE to discuss the network strategic dipping package.
2. **Medium Term Training**
   (i) **Research Associates Scheme**
   It was agreed that the Research Associates Scheme should be implemented. The Scheme will facilitate the exchange of research ideas and developments. The Meeting recommended that the associates will have a specific programme to work on; will be middle-level and senior scientists and will spend upto 4 months at ICIPE. Initially the visits will be radial but the group expressed the desire that visits between network countries should become possible

as PESTNET evolves. (ii) **Master of Science Training.** It was noted that ARPPIS is already reviewing the feasibility of introducing a masters programme. The Meeting strongly supported this and recommended that their discussions should begin with regionally identified universities to implement such a programme as soon as possible. (iii) **Postdoctoral Research Fellowships.** The group recommended that a programme should be evolved that will enable senior research scientists in charge of national PESTNET programmes to spend upto one year as a member of a research group at ICIPE early in the launching of a collaborative network programme where this is deemed necessary. Postdoctoral Fellowships may also be undertaken at later stages of the national collaborative programmes where it is determined that basic investigations are necessary for elucidating any special aspects of the programme. Fellowships will be advertised in international and regional publications and in the PESTNET newsletter.

3. **Long-Term Training**

   The Meeting recognised that ARPPIS offers the facilities to upgrade middlelevel scientists in national collaborative projects so as to develop their abilities to undertake leadership roles for the long-term conduct of pest management projects within their countries.

   It was recommended that linkages be established between ARPPIS and PESTNET both for the formal degree training and through the ARPPIS Scientific Network of graduates who have returned to their national programmes.

**C: INFORMATION**

The members of the Implementation Meeting considered the following aspects of information exchange:

1. There should be a multiway exchange of information.
2. There should be established channels for this exchange. This exchange should reflect technological transfers in Research and Development between members of the network for general benefit.
3. Member countries should agree that country protocols for release of collaborative R & D data and relevant information be simplified in the interest of the network and for mutual gain.
4. Final technology transfer within countries should be through extension services, through development and testing of visual and other aids suitable for individual communities in the local language, with due regard to social traditions.

RECOMMENDATIONS

It was decided that:

1. The Secretariat should develop a register of all individuals contributing to the PESTNET activities in the participating countries.
2. The Secretariat should identify link persons in each of the participating countries to cover the three disciplines (ticks, tsetse and crops).
3. A multiway exchange of information was considered vital and should be established between the secretariat and appointed respondents in each counry. A newsletter should be basis of cementing the two-way exchange and should contain, among other things: (a) scientific studies and abstracts, (b) personnel news, (c) advertisement of jobs and training courses, (d) list of publications - (current contents).
4. One important linkage for the exchange of scientific information should be an annual multi-disciplinary conference with a plenary session on network administration.
5. A simplified data release protocol should be generated by the Secretariat and agreed by the members. It should be signed for each major transfer of technology between members. Such a protocol should embrace the publication/pestnet holding of data problem with a mutually acceptable solution.
6. Technology transfer between countries should be through the appropriate national authority and the relevant department through the country pestnet representatives.

**D: DOCUMENTATION**

The members of the Implementation Meeting considered the following aspects of PESTNET documentation:

1. To prepare reports of a high standard on all collaborative R & D work for circulation to Participating Countries.
2. To fully document all training programmes given under the collaborative network (PESTNET) for circulation to Participating Countries.
3. To prepare a 3 or 6monthly Newsletter on the progress made over the reporting period and to include short reports and summaries of collaborative programmes underway and new investigations being planned.
4. To hold an Annual Pestnet Conference, for the purpose of in-depth review of progress made in the year, to draw up workplans for the following two years on a rolling basis, and to highlight achievements ready for developing into technology packages.

RECOMMENDATIONS

It was decided that:

1. Reports of a high standard on all collaborative R & D work should be prepared for circulation to participating countries with a Pestnet Release Protocol.
2. All training programmes given under the collaborative network (PESTNET) should be fully documented and announced through the Newsletter for circulation to Participating Countries.
3. A 3-monthly Newsletter should be prepared on the progress made over the reporting period and should include short reports and summaries of collaborative programmes underway and new investigations being planned. This should include all details regarding country release of collaborative R & D data.

4. An Annual Pestnet Conference should be held for the purpose of in-depth review of progress made in the year, for drawing up workplans for the following two years on a rolling basis, and for highlighting achievements ready for developing into technology packages in addition to technology transfers already made between members.
5. A PESTNET data and documentation retrival system should be established.

**ARRANGEMENTS FOR FINANCING AND FUNDING PESTNET**

Financing and funding arrangements for PESTNET discussions centred on three main issues, namely:

1. Source of Funds.
2. Mode of financing.
3. Implementation of PESTNET.

1. **SOURCE OF FUNDS**

Five sources of funding were identified.

(a) **Multilateral and Regional Organizations:**

- United Nations Environment Programme.
- Organization of African Unity/Scientific Technical Research Council.
- International Atomic Energy Agency.
- Arab Bank for Economic Development in Africa Arab Fund for Economic and Social Development.
- African Development Bank.
- Asian Development Bank.
- European Economic Community.
- Food and Agriculture Organization.
- InterAmerican Development Bank.
- InterAmerican Institute for Cooperation on Agriculture.
- International Fund for Agricultural Development.
- OPEC Fund for International Development.
- United Nations Development Programme.
- World Bank.

(b) **Bilateral Assistance Organizations** Australia, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, The Netherlands, New Zealand, Norway, Sweden, Switzerland and United States of America

(c) **National Programmes:**

Provision of local infrastructure

- Personnel, laboratory and field facilities, land, customs clearance, etc.

(d) **Funding support through ICIPE institutional funds:** The Director of the ICIPE indicated that the ICIPE would endeavour to support some of the preimplementation activities for 1986 while donor support is being mobilised.

(e) **Private,Non-profit, and Autonomous Institutions.**

- Arab Authority for Agricultural Investment and Development.
- Ford Foundation.
- International Development Research Centre.
- W.K. Kellogg Foundation.
- Kuwait Fund for Development.
- Rockefeller Foundation.
- Saudi Fund for Development.
- Swedish Agency for Research Cooperation with Developing Countries

2. **MODE OF FINANCING**

Four components were identified. (a) **Short-term funding of the Secretariat and Cooperation activities** It was suggested that both multilateral and bilateral donors such as UNDP and USAID be approached. It was however considered necessary to explore other sources for the long-term funding strategy of PESTNET. (b) **Pestnet Project Proposal.** It was suggested that national PESTNET projects be developed into a project document to be submitted to prospective donors while USAID, UNDP and IDRC were identified as possible immediate potential donors, it was indicated that other organisations such as Private Voluntary Organisations (PVOs), Historically Black Colleges and Universities (HBCU), Consortium for International Crop Protection (CICP), Board of International Funding for Agricultural Development (BIFAD), etc, should also be approached. (c) **Workshops** It was suggested that the ICIPE approaches donors to secure funding for this activity. It was suggested that National programmes should at the same time explore bilateral funding for its nationals to organise and attend workshops organised under the PESTNET umbrella. (d) **Training.** The ICIPE, through its present donors arrangements, as well as national bilateral donor support were seen as possible main funding sources for the training component of PESTNET.

3. **IMPLEMENTATION OF PESTNET.**

The Participating Countries and ICIPE felt strongly that the immediate implementation of PESTNET was crucial to establish credibility for the network and to maintain the momentum that has been attained so far. It was therefore recommended that the most effective way of implementing PESTNET was to identify areas of common priority concern to Participating Countries, namely those represented at the meeting, i.e. Burundi, Kenya, Rwanda, Somalia, Sudan, Tanzania, Uganda, Zambia, Zimbabwe. It was recommended that other countries in the region not present at the Meeting should also be given the option of joining PESTNET.

The following priority projects were identified by PESTNET Participating Countries (as the network develops, it is expected that other projects would be included). Four specialized areas were recommended: (a) Livestock Ticks (b) Tsetse (c) Crop pests; and (d) Information.

The selected priority project activies for each specialised area are the following: (a) **Livestock Ticks** Two Training workshops on: (i) Methodology of the efficacy of new acaricides and methods of tick control (e.g. systemics, pourons eartags etc). (ii) Modern methods of estimating host resistance and artificial stimulation of immunity to ticks in cattle, sheep, goats, and camels (b) **Tsetse** (i) Regional

evaluation of odourbaited traps developed by ICIPE and insecticide impregnated targets originated by Zimbabwe (ii) Two training Workshops on:

- Trapping, bait methods and population assessment
- In conjunction with tick activities a Workshop on the disposal of insecticides, environmental pollution and mammalian residue problems is proposed.

(c) **Crop Pests.** (i) Regional tests and trials with resistant cultivars identified by PESTNET (sources including National programmes, International Centres - ICIPE, IITA, CIMMYT, ICRISAT); (ii) National biological control trials (maize and sorghum and cowpea); (iii) Assessment of cultural practices such as intercropping, rotation, and time of planting. (iv) Training Workshops on:

- Evaluation of plant resistance to target pests.
- Crop loss assessment with emphasis on sorghum and maize.
- Farming systems methodologies including multidisciplinary activities. The latter is to specificaly consider the interface of social and biological sciences, and application to small farmers, gender issues and the role of the extension service.
- Biological control of crop pests (parasites, predators and pathogens).

(d) **Information.** To promote the immediate exchange of information on PESTNET acitvities, the following two activities will be undertaken (i) Establish a PESTNET Newsletter to be titled PESTNET TODAY, to be produced on a Quarterly basis (ii) Hold the first PESTNET Annual Conference, to coincide with the ICIPE Annual Research Conference.

It was agreed that the project document embodying the above identified activities should be prepared by the PESTNET Secretariat and submitted to donors by 1st October 1986.

A proposed budget subject to subsequent change and modification is attached. One additional expenditure proposed is in the respect to vehicles (at least two, four wheel drive type) for each country, a total of 20 vehicles for 10 countries plus a vehicle for the Secretariat. Total costs are approximately 21 x 12,000$ i.e. U.S.$252,000.

**DRAFT THREE-YEAR BUDGET FOR PESTNET, 1987 — 1989 (IN U.S. DOLLARS)**

| | 1987 | 1988 | 1989 | TOTAL |
|---|---|---|---|---|
| **1. Personnel Emoluments** | | | | |
| **(a) International Professional Staff** | | | | |
| PESTNET Coordinator | 25,000 | 26,000 | 27,000 | 78,000 |
| **(b) Administrative and Support Staff** | | | | |
| Senior Secretary | 12,000 | 12,500 | 13,000 | 37,500 |
| Driver | 6,000 | 6,500 | 7,000 | 19,500 |
| **(c) Leave Passages (1)** | 2,000 | 2,500 | 3,000 | 7,500 |
| | 45,000 | 47,500 | 50,000 | 142,500 |
| **2. Consultations and Training** | | | | |
| (a) Travel by network scientists/ administrators and student supervisors | 25,000 | 30,000 | 35,000 | 90,000 |
| (b) Visiting scientists and Research Associates | 10,000 | 12,000 | 14,000 | 36,000 |
| (c) Postgraduate Training (M.Sc. - 12 students at $12,000 each) | 144,000 | 150,000 | 156,000 | 450,000 |
| (d) Short Group Training Courses for Practitioners (30 students/year) | 90,000 | 100,000 | 110,000 | 300,000 |
| | 269,000 | 292,000 | 315,000 | 876,000 |
| **3. Collaborative Trials** | | | | |
| (a) Supplies and expendables | 48,000 | 50,000 | 52,000 | 150,000 |
| (b) Equipment for specified countries (microscopes, balances, etc) | 36,000 | 72,000 | 108,000 | 216,000 |
| | 84,000 | 122,000 | 160,000 | 366,000 |
| **4. Operational Centre** | | | | |
| Vehicle (1) | 15,000 | | | 15,000 |
| Word Processor (1) | 8,000 | | | 8,000 |
| Photocopying Machine (1) | 6,000 | | | 6,000 |
| Rent (2 Offices) | 4,000 | 4,500 | 5,000 | 13,500 |
| Maintenance (vehicle) | 2,000 | 2,500 | 3,000 | 7,500 |
| Maintenance (Equipment) | 1,000 | 1,500 | 2,000 | 4,500 |
| Supplies Office | 2,000 | 2,500 | 3,000 | 7,500 |
| Newsletter (Printing & Postage) | 3,000 | 3,500 | 4,000 | 10,500 |
| Other Reports and Publications | 5,000 | 6,000 | 7,000 | 18,000 |
| Miscellaneous | 1,500 | 1,500 | 1,500 | 4,500 |
| | 7,500 | 22,000 | 25,500 | 95,000 |
| TOTAL PROGRAMME COST | 445,500 | 483,500 | 550,500 | 1,479,500 |

# PART II
## PESTNET MISSION REPORT
## PESTNET OVERVIEW

## FINDINGS AND RECOMMENDATIONS OF A PESTNET MISSION TO EASTERN AND SOUTHERN AFRICAN COUNTRIES:

(4th—30th May 1986)

By

**J.J. Ondieki, P.B. Capstick, G.W. Oloo**

CONTENTS OF PAPERS



### THE CONCEPT OF PESTNET

1. The basic idea of PESTNET was proposed by "The Planning Workshop on the African Regional Pest Management R & D Network for Integrated Control of Crop and Livestock Pests", 6 8 October 1985. It was supported by several national government representatives and by a number of international donor agencies, notably, USAID (REDSO/ESA and UNDP (TCDC).
2. In broad terms, the concept of PESTNET advocates effective collaboration between ICIPE and National as well as International Agricultural Research Insitutions in the area of research and development on integrated control of major crop and livestock pests, with a view to increasing food production in tropical Africa.
3. It also recognizes the training component to be crucial for manpower development and successful and sustained implementation of pest management strategies at the national level.
4. The ICIPE and potential donors believe that much more can be achieved in pest management and food production in the Region through PESTNET by pooling together manpower, financial and other resources available at our disposal.

### ICIPE's CONTRIBUTION TO PESTNET

1. After several years of research on certain major crop and livestock pests, ICIPE has come up with a few promising components which, could be tested initially in different countries and eventually incorporated in their national pest and vector management programmes under the auspices of PESTNET.
2. ICIPE has also established and developed over the years, an infrastructure especially designed for advanced training programmes in insect science aimed at strengthening research capacity and scientific leadership in the national programmes in tropical Africa. These facilities could be expanded and modified, where necessary, to cater for specific training needs of the national programmes under PESTNET.
3. ICIPE could also play a major role in fundraising for PESTNET projects, once the network is established and research programmes carefully identified.

### PESTNET PLANNING WORKSHOP

In October 1985, a Planning Workshop was organized and convened a Planning Workshop in Nairobi, to draw up a tentative conceptual framework for PESTNET. The Workshop made several recommendations including the proposal to establish PESTNET. A detailed report has been published on the Workshop Proceedings available at ICIPE Headquarters.

### PESTNET MISSION TO EASTERN AND SOUTHERN AFRICA: TERMS OF REFERENCE AND COUNTRIES VISITED

As a follow-up of the PESTNET Planning Workshop, the Director of ICIPE, Professor Thomas R. Odhiambo, appointed a four-man Mission to visit and discuss the Planning Workshop recommendations with high-ranking government officials in different countries in Eastern and Southern Africa, i.e. The Sudan, Burundi, Tanzania, Zambia, Zimbabwe, Malawi and Rwanda from 4-30 May 1986.

### TERMS OF REFERENCE

- To brief senior government officials on the background and rationale for PESTNET by presenting and reviewing the Planing Workshop Proceedings and discussing their recommendations.
- To identify, visit and draw-up a profile of the institutions visited in relation to their expected contribution to PESTNET viz: manpower, research prgrammes, physical facilities, equipment, financial resources, and other relevant items.
- To identify specific problems presently being handled by national institutions in which PESTNET can make a major contribution, and other crucial problems in which the country concerned has not the resources to tackle (e.g. because of lack of trained manpower) and in which PESTNET can be an initiator.
- To obtain commitment in principle from the potential participating countries to join PESTNET, and therefore to send two high-level officials each to the PESTNET Implementation Meeting which will be held at the ICIPE, in Nairobi, from 22nd to 26th June 1986.
- To prepare a comprehensive report on their findings and recommendations, to be available not later than 30th May, 1986 to the Director of the ICIPE for his consideration.

**FINDING OF THE PESTNET MISSION**

Within the limits of the Terms of Reference, the Mission explained the broad concept of PESTNET and held discussions with senior officials of the Ministries dealing with agriculture and veterinary services on the possibility of setting up the proposed network. The Mission also gathered information on major crop and livestock pests, status of research of these pests and constraints in the national programmes of the countries visited.

The following is a brief outline of discussions and findings from each country:

**THE SUDAN 4TH—6TH May 1986**

**Introduction**

The visit coincided with two public holidays - an Easter for the Coptic Church on 5th May 1986 and a national day for the inauguration of the new Government on 6th May 1986. For this reason, we were unable to meet officials in the Department of Crop Protection based in Gesira, but met and discussed with Dr. Abdalla M. Osman, Under Secretary, Ministry of Animal Resources and Dr. O.A. Osman, Head, Veterinary Research, and thanked them for taking their holiday time to meet the Mission members at the Airport and to hold discussions.

**Discussion**

The Mission Leader opened the discussion by explaining the main purpose of the visit and outlining the Mission's Terms of Reference. The Mission explained and discussed in detail the concept of PESTNET so as to stimulate participation of the national programmes in the network. The Mission also sought information on specific pest problem areas, resources available as well as constraints experienced in the national food crop and livestock production programmes.

Dr. G.W. Oloo elaborated on the components of pest management strategies that ICIPE had developed through its research efforts, and which could be tested and incorporated in the national programmes in the proposed network. It was noted that ICIPE had identified and evaluated several cultivars of maize and sorghum and cowpea as sources of resistance for cereal stem borers of maize and sorghum and the legume pod borer of cowpea. ICIPE had also identified promising biocontrol agents and demostrated intercropping as effective means of controlling these pests. Similarly, the Centre had developed promising approaches for livestock tick control.

In the discussion that followed, the following major points were noted:

- Officials of the Ministry of Animal Resources whole-heartedly welcomed the idea of PESTNET and will give it every support.
- Ticks and tsetse rank as the two major pests in livestock production, with ticks being considered, by far, a top priority for the proposed collaboration under PESTNET.
- Sudan has an estimated population of 22 million cattle, 15 million sheep, 14 million goats and 3 million camels, mainly kept by nomadic communities.
- East Coast Fever (caused by different species of Theileria) is the most important disease of cattle and severely limits national livestock improvement programmes. They also have Heartwater and Anaplasmosis.
- Sudan has many species of ticks, including *Ripicephalus appendiculatus* occurring throughout the country, and 7 species of tsetse, including *G. palpalis* and *G. pallidipes* in Southern and Western Sudan.
- Use of acaricides is very limited; Sudan has no dips.
- Sudan would encourage a programme that involves breeding for tick resistance using indigenous breeds that already show a high degree of resistance
- A project on the control of tsetse and trypanosomiasis has been carried out in Southern Sudan; a similar project on tsetse and tabanids on livestock has been recently initiated in Gezira to study the effect of intensive pesticide use against crop pests on the biology, behaviour and dynamics of the tick population in the scheme.
- Sudan has considerable expertise in veterinary, agriculture and entomology. Some of the experienced scientists could participate in the training programme.
- Sudan prefer their M.Sc. graduates to be trained outside the country and the Ph.D's to be trained within the country.

Before the meeting ended Dr. A.M. Osman expressed the hope that more frequent visits on an exchange basis would be encouraged to learn more about the problems in the respective countries.

Because of the public holidays, it was not possible to arrange a visit to Gezira or contact the Crop Protection officials. However, it was pointed out that the main food crops are millet in Western Sudan, sorghum (including dura) in Central and Southern Sudan, and wheat in Northern Sudan. Pesticides are used extensively, especailly in Gezira Irrigation Scheme to control crop pests. There is a breeding programme for high-yielding dura varieties and against whiteflies on cotton.

The Mission Leader concluded the discussion by kindly requesting Dr. A.M. Osman to convey the same ideas about PESTNET to nominate a highranking official from his Ministry to attend the PESTNET Implementation Meeting in Nairobi from 2226 June 1986; similar representation was requested from Crop Protection Department in Gezira. The two delegates were asked to bring with them to Nairobi a short paper giving information on major pests of important constraints in conducting the research.

The Under Secretary (Dr. A.M. Osman) indicated that Dr. O.A. Osman, Head, Veterinary Research, will represent the Ministry of Animal Resources at the PESTNET Implementation Meeting and undertook to request his counterpart in Crop Protection at Gesira to nominate somebody for the meeting. He also assured the Mission that they will prepare a short paper for the meeting.

The Mission Leader once more thanked the officials

most sincerely for sparing their holiday time to meet and discuss with the Mission. The Meeting then ended.

**BURUNDI: 7th to 9th May 1986**

**Introduction**

The first meeting was held in the Office of the DirectorGeneral, Ministry of Agriculture, Dr. oscar Ndabikingiye, at the Institute de Science Agronomique du Burundi (ISABU). The meeting was also attended by the Head of Veterinary Services, Dr. Barahino, and the Officer-in-Charge, Crop Protection, Mr. Pascal Ndayiragije.

In his opening remarks, the Mission Leader, Dr. J.J. Ondieki, introduced the members of the Mission, and thanked, on behalf of the Mission, the Burundi officials for their warm welcome and for being able to meet the Mission during their public holiday. The Mission Leader then briefly explained what ICIPE is and its research activities before introducing the subject of PESTNET. He pointed out that, following a PESTNET Planning Workshop attended by representatives from several African countries, ICIPE was organizing a meeting on 22-26 June 1986 in Nairobi to discuss the possibility of establishing and implementing PESTNET. He noted that one of the Mission's Terms of Reference was to seek the country's participation at the PESTNET Implementation Meeting.

Dr. P. Capstick elaborated on ICIPE's tick research and indicated that the approach was to embark on a strategic dipping scheme based on population modelling and to develop as a long-term project, a vaccine for immunizing cattle against ticks. He noted that Burundi had a good team working on a tick control programme based on population modelling. He also pointed out that ICIPE intended to set up a Secretariat for PESTNET to coordinate collaborative research with other national programmes. The Secretariat would also facilitate exchange of information and experience in the network. Finally, he pointed out, it was intended to provide training facilities in the network.

Dr.G.W. Oloo then outlined ICIPE's crops research and, as in Sudan, elaborated on specific areas of research and components of pest management on which ICIPE for a start, sought collaboration with national programmes under the auspices of PESTNET. These included testing and evaluating sources of resistance, promising biocontrol agents, and intercropping patterns already identified by ICIPE as effecaive pest management strategies against stem borers of maize and sorghum and the cowpea pod borer.

In response, the Director-General welcomed the Mission Members and handed out a booklet giving ISABU activities. He then outlined the organization for crops and animal production research and the manpower available.

He noted that Burundi is at a disadvantage because the country has little connection with West Africa and geographically it is in Eastern Africa. His Ministry was therefore completely interested in the PESTNET proposal as ecologically they would fit well in this regional network.

The following is a summary of the major points that came out of the meeting with the Director-General, Ministry of Agriculture:

- Burundi fully supports the PESTNET proposal
- Dr. Baralino, Head, Veterinary Research and Mr. Ndayiragije, in charge, Crop Protection, were nominated to represent Burundi at the PESTNET Meeting.
- The main food crops include banana, cassava, potatoes, beans, rice, maize, sorghum and wheat. Cowpea is not a major crop and there is no work on it at the moment.
- Burundi is interested in applied research for the small scale farmer with limited funds and other resources.
- ISABU has a difficult task in trying to find solutions for small farmers for crop and livestock production because of lack of trained manpower and funds to conduct research.
- Although banana is the most important food crop, Burundi produces too much banana and has a big regional programme on banana together with Zaire and Rwanda.
- Livestock are kept primarily for manure and, to limited extent for milk production - they have similar diseases to those in East Africa.
- For communication at the Workshop, they can understand English but find it difficult to speak the language.

The Director-General then indicated that the Mission would have a detailed discussion with his officers the following day.

**Discussion on Veterinary Research**

A programme was made for the Mission to meet first with Dr. Baralino (Veterinary Research) and Mr. Ndayiragije (Crop Protection Research). Dr. Baralino indicated that the Department of Animal Science under the Ministry of Agriculture has departments in the following areas:

- Animal breeding, where local Ankole breed is crossed with exotic breeds (Sahiwal, Jersey and Ayrshire).
- Animal nutrition, where research is conducted to provide suitable grasses for pasture.
- Animal health, established recently but research work not yet started due to lack of funds.

He noted that the Department has 3 veterinarians, 3 agronomists with B.Sc., 3 animal scientists with B.Sc. and 4 technicians. Dr. Baralino pointed out that East Coast Fever is a major problem.

The Mission also visited the Centre for Animal Sciences Research at Rukoko and held discussions with Dr. Kaiser, Tick Ecologist and Team Leader, FAO tick control project in Burundi. Dr. Kaiser told the Mission that they had just finalized an FAO funded project on tick population modelling. The data had been collected over a threeyear period from 5 ecological zones in Burundi. Based on this study, developed from the Australian population model on *Boophilus*, the team had already advised the Government to embark on a strategic dipping programme.

He noted that the project was the first one of its kind in Africa and that, if implemented, would reduce the tick population to 10% and save the country 60% foreign exchange on acaricides as the programme only required dipping once in 3 months. The FAO team had helped repair and calibrate all cattle dips throughout the country in readiness for the launching of the strategic dipping programme.

The main points noted in the discussion on livestock research were the following:

- Burundi has an estimated population of 600,000 cattle (3,000 of which are grade animals), 1.3 million of sheep and goats put together.
- There are 13 species of ticks, including 8 *Rhipicephalus spp.*, Amblyoma variegatum and Boophilus.
- East Coast Fever is not a major problem.
- The national livestock improvement programme puts more emphasis on manure and milk production. About 50% of farmers keep cattle.
- Tsetse is not a problem, although a few cases of animal trypanosomiasis transmitted by *G. palpalis* has been reported; human trypanosomiasis not yet observed.
- Burundi could possibly collaborate with ICIPE on tick population modelling and strategic dipping programme.
- The National Research Insitute, ISABU, was experiencing a severe shortage of manpower for research. In the ISABU training programme, Belgium provides about 2-3 scholarships in 3 years.
- Burundi feels that short-term training programmes are more important than training for a degree.
- The University of Burundi only produces B.Sc. graduates in biology at the moment.

**Discussion on Crop Protection Research**

The Crop Protection Department has 3 sections:

- Entomology Section with 1 Belgian, 2 local entomologists with B.Sc. in biology and no technician.
- Phytopathology Section with 1 Belgian, 1 local phytopathologist with B.Sc. and 2 technicians.
- Virology Section with only 1 Belgian virologist, no local scientist and no technician.

The important food crops include banana, cassava, sweet potato, beans, maize, sorghum, irrigated rice and others already listed.

The following is a summary of the major pests of important food crops and some work on their control:

**Maize and Sorghum**

- The stem borers, *Busseola fusca* and *Sesamia calamistis on the highlands; Eldana saccharina* in the lowland areas. They cause up to 50% loss in grain yield depending on planting date - late planting usually results in higher borer damage. There is limited chemical control of the stem borers. There is no work on either plant resistance or intercropping for borer control. Some experiments have been planned to assess borer damage on maize. Traditionally, farmers intercrop cassava/maize, maize/beans, cassava/bananas, cassava/sorghum, etc.
- Two species of *Cicadulina (C. mbila* and *C. storey) transmit maize streak virus.* A project supported by IDRC has been started to look for resistant maize varieties form IITA for the virus.
- Apart from the common storage pests *(Sitotroga, Tribolium,* etc) recorded elsewhere in East Africa, the Greater Grain Borer, *Prostephanus truncatus,* has been introducted across the border from Tanzania into Burundi.

**Banana**

The banana weevil, *Cosmopolites sordidus,* causes some damage. No work on its control is undertaken.

**Casava**

- The cassava green spider mites, *Mononychellus* spp, cause severe damage, especially in the lowlands. It was noted that the cassava mealybug has been reported to occur in the neighbouring Rwanda.
- The present work on the cassava green spider mites include assessment of damage, suitable planting dates, evaluation of resistant cassava varieties IITA and local services, and observations on local predacious phytoseiid mites and other natural enemies.
- The whitefly *Bemisia,* transmits mosaic virus but is not a major problem.

**Beans**

- The beanfly an important pest. Breeding work is being undertaken for its control.
- The bean aphid is also important. Natural enemies have been introduced from Belgium and Czechoslovakia for biological control of the aphid.

It is emphasized that there are only two young local B.Sc. graduates working on crop pests in the whole country, and they have no technicians to assist them in their work.

**TANZANIA: 11th to 14th May 1986**

The Mission met and discussed with the Director of Research (Agriculture), Dr. Geoffrey H. Semuguruka, the Director-General of Tanzania Livestock Research Organization (TALIRO), Dr. A.M. Macha and the Director of Research, TALIRO, Dr. S. Tarimo. Before the discussion started, the Mission Leader introduced the Mission Members to TARO and TALIRO officials and explained the concept dof PESTNET together with other items contained in the Mission's TERMS of Reference.

**Discussion on Crop Pest Research**

At the TARO offices, the Director of Research, Dr. Semuguruka explained that TARO is a parastatal organization with a mandate to conduct all aspects of research on crop production. The organization has a total of 11 Research Institutes (each with substations) that carry out commodity research throughout the country. Research on maize and beans is based at Kilyamungu in Northern Tanzania; that on sorghum, millet and legumes is based at Ilonga, while work on root crops is carried out at Ukiriguru near Mwanza.

The important crops in descending order are the cereals, maize, rice, sorghum and millet and wheat; and the legumes, beans (high potential areas) and cowpea (marginal agricultural areas..

The major pests of these food crops and reseach on their control may be summarized as follows:

**Maize and Sorghum**

- The African armyworm, *Spodoptera exempta,* ranks as the most important pest of maize, sorghum and other ceals. The armyworm problem is handled on a regional bases by the desert Locust Control Organization, although outbreaks still occur.
- The maize stalk borer, *Busseola fusca,* is another major pest of maize and sorghum. The main thrust of research is on screening for resistance at Ilonga using maize lines from CIMMYT and sorghum lines from ICRISAT. In these studies, promising resistant sorghum lines for stem borers have been identified; no resistant maize cultivars have been obtained. There is no programme on biological control for stem borers. Previous research on intercropping mainly carried out at the Sokoine University, Morogoro, looked into yield benefits and reduction in pest infestation when maize and sorghum are intercropped with legumes, such as beans and cowpea. However, no recommendations have been made to farmers. Some work is still going on on pest population densities under cereal-legume intercrops. Although farmers are advised to burn stalks after harvest to destroy stem borers, this conflicts with recommendations of the farming systems which discourage the practice.
- The shootfly and midges cause damage on sorghum. Some selection work is going on to identify shootflyresistant varieties.
- *Sitophilus, Sitrotroga,* and *Prostephanus* are among the major storage pests of maize and sorghum.

**Rice**

The stalk-eyed fly, Diopsis, is the main pest.

**Cowpea**

- The pod borer, *Maruca testulalis,* is one of the important cowpea pests. Screening work has been going on since 1973 at Ilonga with material from IITA, but no satisfactory resistant varieties have been developed.
- Aphids and thrips are also important.

**Beans**

The beanfly and aphids are the major field pests of beans, while the bean bruchid causes considerable damage in storage.

**Cassava**

A biological control project on the cassava green spider mites has been initiated at Ukirguru near Mwanza.

**Socioeconomic Research**

Socioeconomists have started gathering information on farming systems at one Centre; it is planned to set up 5 similar centres in the country.

**Manpower Requirements**

TARO has 7 entomologists conducting crop pest research. Of these 2 have Ph.D. degrees; 4 M.Sc. and 1 B.Sc. The Ph.D graduates have been trained at ICIPE (ARPPIS programme) and UK respectively.

It was indicated that Tanzania would prefer training their nationals at M.Sc. level.

Dr. Semuguruka concluded the discussion by declaring that TARO was interested in the PESTNET Programme, especially since non-chemical methods are to be developed.

He also expressed the hope that some funds would be available in the programme to equip their laboratories at Ilonga, where food crop research is based.

**Discussion on Livestock Research**

The Mission members held discussions with the Director-General of TALIRO, Dr. A.M. Macha and the Director of Research and Planning, TALIRO, Dr. S. Tarimo. In response to the Mission Leader's briefing on PESTNET, the Director-General pointed out the following:

- That Dr. Tarimo will represent TALIRO at this and future PESTNET Meetings.
- Although they have no mandate to speak for the Ministry of Agriculture and Livestock Development, he had full authority to speak for TALIRO as a parastatal organization.
- That TALIRO is already a beneficiary of ICIPE's ARPPIS training programme for a Ph.D.

However, Dr. Tarimo felt that M.Sc. training programmes should be included under PESTNET (and at ICIPE) for the benefit of Tanzania, since Sokoine University, Morogoro has only limited places for Master's degree.

In response, the Missioner Leader, Mr. Ondieki pointed out that if most participating countries were unanimous on an M.Sc. training programme, then ICIPE could be asked to review their stand on postgraduate training to cater for the national training needs.

In their livestock production programmes, Dr. Tarimo indicated that both tsetse and ticks were a major problem and that East Coast Fever is the most important livestock disease in Tanzania.

Dr. Capstick explained that ICIPE's Tick Research Programme adopted two approaches;

1. To develop a vaccine to immunize cattle against ticks, as a long-term programme, and
2. To develop both strategic dipping and threshold dipping programmes, as short-term solutions with a view to reducing the use of acaricides.

The Director-General, Dr. Macha, closed the discussion and, to the Mission's appreciation, kindly invited members of the Mission to a luncheon.

**ZAMBIA: 14th - 16th May 1986**

The Deputy Director of Agriculture (Research) welcomed members of the Mission and explained the organizational structure of the Ministry of Agriculture. The Ministry is made up of the Departments of Agriculture, Veterinary, Water Resources and Rural Information. He made three important remarks before handing over the Mission to other officials for detailed discussion:

1. That he was confident Zambian scientists will benefit a lot from the proposed remarks.
2. That the Ministry will send the required representatives to the Meeting. He undertook to write to the Permanent Secretary who will communicate with ICIPE on the issue soon.
3. The main interest is in research intended to benefit small scale farmers.

**Discussion on Crop Pests Research**

A visit was arranged to the Headquarters for Crop Research at Mount Mukulu. The Mission was informed by the Chief Research Officer, Dr. B.K. Patel, that the most important food crop in Zambia is maize. Other food crops are sorghum, cassava and beans. The discussion was conducted by Dr. Lawrence Kabuswe, in charge, crop pests research, who kindly conducted the Mission members around throughout the visit.

**Pests of Maize and Sorghum**

- Maize streak virus, transmitted by leafhoppers, is a major problem. Some screening work is going on for the disease but not for the vector.
- Borers, presumably including *B.fusca,* cause damage.
- Sorghum improvement programme is affected by armoured crickets, especially along the Zambezi Valley in the Southern Region.
- Outbreaks of the red locust are occasional but devastating when they come.
- The great grain borer, Prostephanus truncatus, is a threat along the Tanzania border.

**Beans**

The beanfly is a major pest.

**Cassava**

The cassava green spider mites and the cassava mealybugs cause serious damage in the whole of Northern Region along the border with Zaire. IITA team was due to make aerial releases of natural enemies in late May or early June 1986.

The Mission was informed that no active research is currently conducted on plant resistance, intercropping and biological control against pests of maize and sorghum.

Dr. Patel noted that a newsletter could be useful in disseminating information in the proposed regional network and pointed out that ICIPE was in a position to alert the region on the importation and spread of pests from foreign sources such as the cassava mealybug, cassava green mite and the greater grain borer. The reporting system could also include forecasting for armyworm.

Finally, Dr. Patel pointed out that their Crop Pests Research had an acute shortage of trained manpower.

**Discussion on Veterinary Research**

The discussion was first held with the Assistant Director, Dr. Sinyangwe at the Central Veterinary Research Institute. The meeting was attanded by Dr. Musisi of UNDP/FAO Animal Diseases Project; Mr. Lugulu, Research Scientist (Acaricides) and a senior scientist carrying out national tick research. The Institute was recently built, is well equipped and handles research on Protozoology, Helminthology, Vaccine Production, Pathology, Bacteriology and Ticks.

The Assistant Director pointed out that Zambia had 2.4 million cattle of which 1 million were grade cattle. He assured the Mission that they would do all they could to attend the Meeting to find out possible areas of collaboration. He urged that information media be set up to avoid duplication of research effort.

On the last day of the visit, the Mission met the Director of Veterinary Services, Dr. H.G.B. Chizyuka. He strongly welcomed the idea of PESTNET and noted that it would have an added advantage in the dissemination of scientific information in the Region. He declared that they would support the network as they had previously supported networks with similar objectives. He pointed out that they had even held a meeting in the Director's office (Crops) in readiness for the Mission. The Director wondered whether ICIPE was working on tsetse, which Dr. Capstick confirmed.

Finally, Dr. chizyuka stated that their tick programme had inadequate trained manpower, even at M.Sc. level; hence, his team will consult with colleagues in Crops Research and put forward joint proposals for their training needs at the PESTNET Meeting.

**ZIMBABWE: 16th - 21st May 1986**

A joint meeting had been arranged with officers from Crop Protection and Veterinary Services at the Plant Protection Research Institute in Harare. The Meeting was attended by Dr. Fenner, Deputy Director, Department of Crops Research, Dr. S.S. Mlambo, Head, Plant Protection Research Institute, Dr. R.A. Norval, Coordinator, Tick Research, Dr. W. Madzima, Veterinary Services, Dr. C. Munatswa, Veterinary Services and Dr. Brett, Cotton Entomology.

After Dr. Fenner opened the Meeting, the Mission explained the concept and rationale for PESTNET. Dr. Capstick noted that potential donors and countries in the Region so far visited were enthusiastic about the network and that ICIPE will look for funds to set up the network.

The following major issues were raised in the discussion:

- Zimbabwe's crop and livestock pest problems are similar to those in Kenya
- It was Government policy that research should be relevant to the country and would not accept nationals staying out of the country for prolonged periods under training, as is the case with the ARPPIS Ph.D programmes.
- Since Zimbabwe had good facilities and qualified supervisors, they would only participate in a training programme where course work is done overseas for short periods, but the research has to be done in Zimbabwe. However, it is possible to arrange for an M.Sc. programme outside the country; Scientists could also be allowed limited periods, of say 3 months, to learn specific techniques, such as biological control.

The Mission Leader, Dr. Ondieki, noted the comments and urged the officials to bring up some of these issues at the forthcoming PESTNET Meeting. The group then split and held discussions separately on crop and livestock pest research.

**Crop Pest Research**

Dr. Mlambo introduced scientists working on plant protection, i.e., Dr. Mzira, Chief Plant Pathologist, Dr. Tschuma, stored products entomology, Mr. Sithole, cereal stem borers *(Chilo* and *Busseola),* Miss R. Thanyongana, economic entomology and advisory services, Mr. Mvubuta, biological control, and Mtambara, silviculture and Professor Keswani, World Bank,

Consultant, Research and Specialist Services.

As indicated above, the pest problems in Zimbabwe are similar to those in East Africa, especially on maize, sorghum and cowpea. However, cowpea is not an important crop. For example, *B. fusca,* the armyworm, the leafhopper (transmitting maize streak virus) are major pests of maize.

It was pointed out by Dr. Mlambo, that exchange of information on damage thresholds would benefit those participating in the network.

On the training programme, the officials urged that ICIPE adopt a more flexible arrangement in line with national training needs. Already, Zimbabwe is collaborating with other Universities in the United States whereby students spend 6 months in the States for coursework and conduct their research work in Zimbabwe. This is the kind of collaboration they expect from ICIPE. They also prefer the Ph.D students to work on local problems.

Finally, Dr. Mlambo pointed out that the PESTNET Meeting will coincide with World Bank review of Agricultural Research Projects in Zimbabwe; hence, top officials will not be able to attend.

Dr. Mlambo concluded that they were positive about a pest management programme and hoped that the proposed network will work.

**Livestock Research**

The tick research in Zimbabwe is quite advanced. The main thrust has been to develop tick control strategies based on population modelling intended to reduce the dipping programme.

They have also developed and are now testing a tsetse trapping system using black traps baited with synthetic pyrethroids. So far the results are spectacular - they have managed to clear tsetse population to zero along the Zambezi Valley. This is an EEC funded project aimed to eradicate *Glossina pallidipes* and *G. morsitans.* The Project is coordinated by Dr. Brian Hussey. It was acknowledged, however, that the ICIPE buffalo urine is likely to be a breakthrough in tsetse trapping, and Dr. Hussey urged closer collaboration between ICIPE as his department and their research had similar goals.

**MALAWI: 22nd to 23rd May 1986**

All the senior officials in the Ministry of Agriculture were out of the country and Mission met Mrs. B. Ndisale, Research Economist, and briefed her about PESTNET with the hope that she would convey the message to the officials when they came back.

The Mission noted that there was 1 Ph.D scientist and few M.Sc. entomologists under Plant Protection. It was also noted that FAO/DANIDA had launched an EEC Immunization Project in Malawi.

The Mission urged that they send representatives at the Meeting and bring with them a short report on major pests, status of research and constraints.

**RWANDA: 27th to 30th May 1986**

The Mission met the Head, Crop Protection, Mr. Joseph Kaitare and the Agronomist, Mr. Francois Kavanahanga in Kigali.

The following points were noted:

- All Crop Research is conducted at Institute des Sciences Agronomiques du Rwanda (ISAR) in Butare with the Director-General, Dr. Leopord Gahamanyi heading the Institute.
- There are 6 entomologists - 2 Ph.D., 2 M.Sc., 2 B.Sc.
- The important food crops are banana, cassava, sorghum, beans, sweet potato and to some extent, maize.
- Stem borers *(Busseola fusca* and *Sesamia)* are important
- There is handly any work on intercropping and plant resistance against pests; there is a biological control programme for cassava green spider mite.
- The University of Rwanda provides training on general agronomy (at B.Sc. level) with short courses in entomology - there is no specialization in entomology so far. They feel isolated and would be interested in the training programme.
- Rwanda would prefer having M.Sc. research programme done at ISAR, Butare, so that it could be relevant to the national programmes in pest control.
- ISAR is planning joint research with International Service for National Agricultural Research (ISNAR).
- Rwanda will send representatives to the PESTNET Meeting.

The Mission then concluded the discussions by requesting the representatives to bring a short paper to the meeting giving major pests, their national priorities in crop and livestock pest research and constraints.

**GENERAL COMMENTS AND RECOMMENDATIONS**

GENERAL COMMENTS

On the basis of discussions held with officials of different countries, the Mission has the following general comments to make:

- Most countries in the Region have similar crop and livestock pest problems although their relative importance may vary from one country to another.
- The status of research and manpower resources also varies from country to country.
- All of the countries visited were working in the 2 proposed Pestnet subjects.
- Training is an essential need in all the countries visited.

RECOMMENDATIONS

1. The status of and approach in research be assessed to identify appropriate technology and other inputs that would strengthen the on-going national research.
2. The proposed network should accommodate existing collaborations between national and donor funded activities.
3. A careful review of the national training needs be carried out and how these could best be satisfied by the network.
4. The Terms of Reference and objectives of the network should be fully discussed and finalised at the implementation meeting.

5. A comprehensive communication system be set up by the network for collection and dissemination and scientific information.
6. Care should be taken to match network activities to available funds.
7. Every effort should be made to ensure the success of the network to maintain credibility of the network concept in the region.
8. The pest, research and training activities to be included in the network should be clearly agreed at the implementation meeting.

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## OVERVIEW OF PESTNET: THE RATIONALE AND NEED FOR A CROP AND LIVESTOCK PEST NETWORK IN AFRICA

By

**Dr. Paul C. Lippold USAID/IITA Liaison Officer, IBADAN, Nigeria**

Honorable Mr. Chairman
Distinguished Colleagues
Ladies and Gentlemen

It is a distinct pleasure to be able to address you this morning. This is my third trip to Nairobi to work with ICIPE and USAID REDSO/ESA staff on the formulation of PESTNET within the last year. I assisted in the preparation of an initial "REPORT OF THE USAID PLANNING MISSION" for the African Regional Pest Management Research and Development Network (PESTNET) for the Integrated Control of Livestock Pests and Diseases" in July, 1985 (1). This was followed by the Planning Workshop on the African Regional Pest Management R & D Network (PESTNET) for Integrated Control of Crop and Livestock Pests in Nairobi, October 6-8, 1985 (2).

### 1. INTRODUCTION

FOOD production increases in Africa are necessary to assist the continent in development. Faced with a series of devastating droughts, increasing population pressure, internal strife, and shortages in foreign exchange for purchase of necessary equipment and supplies etc., the continent has not been able to feed itself in recent years. The food situation is critical, and is regarded as top priority. The nutritional status and agricultural production in Africa require concerted efforts to reverse the present trend. The daily per capita calorie consumption for selected East and Southern African countries is given in Table 1. Per capita calorie consumption in the U.S. averaged 3,630 calories per day, or 135% of actual requirement. Consumption in African countries ranged from 74ll1% of daily per capita requirement.

QUALITY of food consumed in Africa is of lower value, with significantly higher proportions of carbohydrate eaten compared to protein/fat. Comparative carbohydrate/protein/fat consumption compared with other world regions is given in Table 2. Protein/fat/carbohydrate consumption in Africa is comparable to that of Asia. Protein/fat intake is less than 25% that of North America or Europe.

**Nutritional Status of Selected African Countries, 1982**

| | Percent of requirement | Daily calorie consumption per capita |
|---|---|---|
| United States | 138 | 3,630 |
| Madagascar | 111 | 2,522 |
| Swaziland | 109 | 2,526 |
| Botswana | 106 | 2,368 |
| Tanzania | 105 | 2,409 |
| Lesotho | 103 | 2,365 |
| Burundi | 102 | 2,244 |
| Sudan | 99 | 2,332 |
| Malawi | 96 | 2,220 |
| Rwanda | 91 | 2,115 |
| Zimbabwe | 91 | 2,164 |
| Angola | 90 | 2,110 |
| Somalia | 90 | 2,077 |
| Zambia | 90 | 2,124 |
| Kenya | 88 | 2,036 |
| Mozambique | 80 | 1,864 |
| Uganda | 76 | 1,781 |
| Ethiopia | 74 | 1,729 |

Sources: FAO/WHO, 1982 (Ref.3), 1986.

**Table 2. Daily Per Caput Food Supplies (Calories, Protein and Fat 1979-81 Average for the World by Continent)**

| | CALORIES (number) | | | PROTEIN (grams) | | | FAT (grams) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Vegetable Products | Animal Products | Total | Vegetable Products | Animal Products | Total | Vegetable Products | Animal Products |
| WORLD | 2624 | 2195 | 429 | 68.5 | 44.5 | 24.4 | 63.4 | 30.4 | 33.0 |
| CONTINENTS | | | | | | | | | |
| Africa | 2367 | 2188 | 180 | 59.3 | 46.3 | 13.0 | 48.0 | 36.4 | 11.6 |
| North & Central America | 3305 | 2288 | 1016 | 93.2 | 37.8 | 55.4 | 133.2 | 55.6 | 77.6 |
| South America | 2624 | 2145 | 479 | 66.7 | 36.8 | 29.8 | 59.8 | 25.6 | 34.2 |
| Asia | 2336 | 2131 | 206 | 57.5 | 45.7 | 11.8 | 38.7 | 22.8 | 15.8 |
| Europe | 3453 | 2341 | 1112 | 99.2 | 43.5 | 55.6 | 137.4 | 47.3 | 90.0 |
| Oceania | 2969 | 2010 | 959 | 85.2 | 32.5 | 52.6 | 101.4 | 28.7 | 72.7 |

**Source: FAO Food Balance Sheets, 1979-81 Average, 1984 (Ref. 4)**

POPULATION estimates for Eastern/Southern Africa are given in Table 3. Populations of some countries, with natural annual increase rates of 3.5% or more, are doubling in twenty years of less. Agricultural production, however, is decresing steadily compared with the rapidly escalating population. Food production per capita since time of independence has decreased, with exception of a few countries. The recent drought in the 1980's further contributed to decreased yields. Efforts by all countries on the continent must be mobilised to reverse this trend.

POLICIES of colonial times as well as current regimes, have contributed to the decline in productivity of African agriculture. Pre-independence policies established low priority to:

- Agricultural training.
- Food crops research and
- Internal marketing links.

Likewise, post-independence policies provided few incentives for increasing food production, as characterized by:

- Production and marketing organizations fixing prices.
- Overrated exchange rates making imported food cheap, and
- Investments in agriculture given low priority (6)

## II NETWORKS

NETWORKS are realized as means to effectively address issues, including the necessity of having to increase food production, and reduce losses from pests and diseases. With estimated pre and post-harvest pest losses ranging from 10-30% or more in Africa, curtailment will produce a significant gain in production. A network to effectively address losses in animal and crop production will assist the region to attain eventual self-sufficiency. But networks take time and commitment to develop effectively. Nonetheless, donors are now addressing the mechanism of networking as the most efficient way to provide funding for national programmes. With decreased funding bases, and competition for available funds, networks are now considered a most effective way for addresssing problems. In recent discussions with USAID staff in Washington, D.C., it was indicated there were some 50 or more networks which should be implemented in Africa (7). This includes major networks which have been implemented to date.

TYPES of networks range form informal to formal arrangements (8). Both type networks have common goals and interest. Informal networks are comprised of individuals or organizations who communicate by a variety of means. Formal networks result from relevance of findings and the need to communicate and transmit information to involved parties. There must be the opportunity for participants to 'interact with each other as well as the hub' (9). An illustration of the types of networks is given in Figure 1. Informal networks may be comprised of no more than individuals, or groups of individuals who communicate informally. With identification of a problem(s), and the importance over an area or in several locations, common concerns and interests develop. The result is the formalization of strategies and programmes to address the situation by means of a formal network.

FORMAL networks in Figure 1 are shown progressing from simple to most advanced stages. Formal networks must have a centre or hub. With development of programmes, satellite groups start interacting with each other, as well as with the hub. With further development, initial subsdiary groups are strengthened and further expanded and developed. As certain activities and programmes advance, each contributor component of the network assumes more responsibilities. Frequently a high degree of specialization results, and the subcentres interact more with other groups. At the onset, the "hub" fulfills a virtual parental role.

EXAMPLES of international agricultural research networks operative in Africa are given in Table 4. Many of these networks, such as IBYAN, IPMAT, ISVAT, IRTP, and INTSOY are truly international in scope, with trials in several countries in regions of the world. It must also be empasised that the focus on networks in pre-independence days was on cash crops. Today, with the importance of food production and severe food deficits the focus is now on food crops. Food crops are major mandates of the IARCs. The number of IARCs and international organizations listed in Table 4 is most indicative. All the IARCs and many international organizations are involved in agricultural production in Africa, with emphasis on Sub-Saharan Africa. An example of a local (Nairobi) highly organized network is the

**Table 3. Eastern/Southern Africa Population Data***

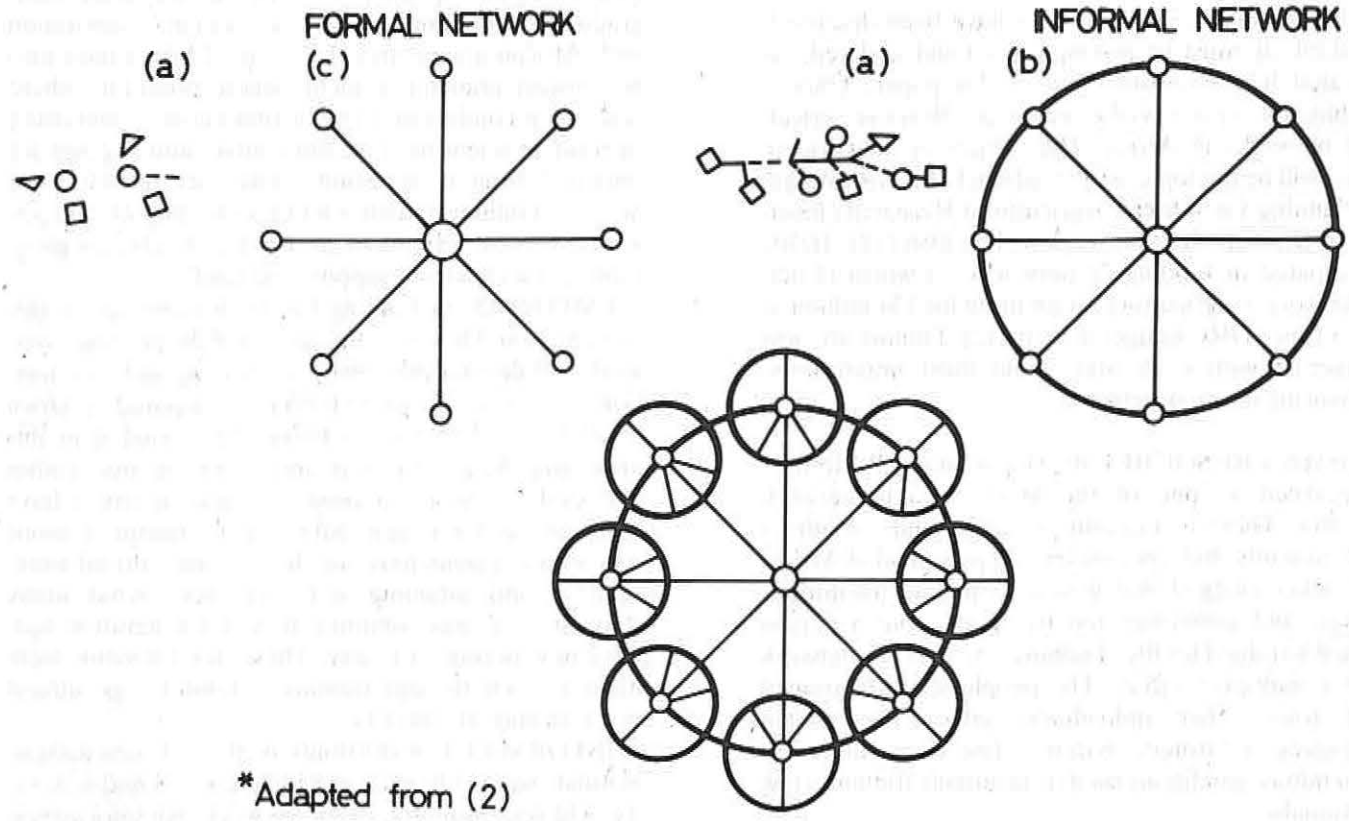
| COUNTRY | Population Estimate Mid-1985 | Natural Increase Annual (%) | Population Doubling Time in Years At Current Rate |
|---|---|---|---|
| EASTERN AFRICA | | | |
| Burundi | 4.6 | 2.7 | 26 |
| Ethiopia | 36.0 | 2.1 | 33 |
| Kenya | 20.2 | 4.1 | 17 |
| Madagascar | 10.0 | 2.8 | 25 |
| Malawi | 7.1 | 3.2 | 22 |
| Mozambique | 13.9 | 2.8 | 25 |
| Rwanda | 6.3 | 3.6 | 19 |
| Somalia | 6.5 | 2.6 | 27 |
| Tanzania | 21.7 | 3.5 | 20 |
| Uganda | 14.7 | 3.5 | 20 |
| Zambia | 6.8 | 3.3 | 21 |
| Zimbabwe | 8.6 | 3.5 | 20 |
| SOUTHERN AFRICA | | | |
| Botswana | 1.1 | 3.7 | 19 |
| Lesotho | 1.5 | 2.6 | 27 |
| Swaziland | 0.6 | 3.1 | 22 |

*** Source: Population Reference Bureau, 1985 (Ref. 5)**

**Table 4. Selected International Agricultural Research Networks**

| NETWORK | COORDINATORS | REGION | NUMBER OF COUNTRIES | STARTED |
|---|---|---|---|---|
| IBYAN (International Bean Yield Adaptation Nursery) | CIAT | World | 30 | 1976 |
| CEAREP (CIMMYT Eastern Africa Regional Economics Programme) | CIMMYT | E. Africa | 14 | 1976 |
| PRAPAC (Programme Regional Amelioration de la Pomme de Terre en Afrique Central) | CIP | C. Africa | 4 | 1983 |
| IPMAT (International Pearl Millet Adaptation Trial) | ICRISAT | Asia, Africa, Latin America | 22 | 1975 |
| ISVAT (International Sorghum Variety Adaptation Trial) | ICRISAT | World | 37 | 1977 |
| ARNAB (African Research Network on Agricultural ByProducts) | ILCA | Africa | 6 | 1980 |
| Trypanotolerance | ILCA/ILRAD/ ICIPE | Africa | 9 | 1983 |
| INSFFER (International Network on Soil Fertility and Fertilizer Evaluation on Rice) | IRRI/IFDC | Asia, Africa | 19 | 1976 |
| IRTP (International Rice Testing Programme) | IRRI/IITA/ WARDA | World | 75 | 1975/1985 |
| WAFSRN (West African Farming Systems Network) | IITA/Ford Foundation | W. Africa | 10 | 1983 |
| INTSOY (International Soybean Programme) | Universities of Illinois and Puerto Rico | World | 70 | 1973 |

**Source: Modified from (9).**




*Adapted from (2)

Fig.1. A schematic view of networking. Relationships become more complex as the network evolves until more than one hub emerges*
(a) NO NETWORK

'Nairobi Cluster' (10). This network is comprised of 12 local institutes and agencies, all of whom are engaged in research on animal diseases, their vectors, and impact on animal productivity.

**III. RATIONALE** for establishment of a PESTNET has already been established by the need to improve food production. The many advantages of networks, and their advantages in addressing and solving problems have been previously given (9). However, for emphasis and impact, they are restated: (a) Facilitation of communication or technology transfer; (b) Collaborated, coordinated effort is more successful than isolated, individual projects; (c) The problem is common and shared by all members; (d) Efficient use of existing information for generation of new knowledge; (e) The identification of specific components for members to emphasize avoids duplication and waste; (f) Concerted attention by members results in aggregate success of the programme; (g) Cost effectiveness; and (h) The combined efforts of industrial countries, developing nations, and International Agricultural Research Centres (IARC's) provide an organization more likely to attract International and multi-donor support (6).

COMPONENTS of a successful network depend on cooperation and coordination of all involved parties. There must be commitment and intent, and resolve. These components have also been previously stated (II), but for emphasis and for those who do not have copies of the reference, they are restated here. The following are regarded as prerequisites of a network: (a) the problem should be clearly defined, and a realistic agenda drawn up; (b) the problem must be widely shared by the wouldbe participating countries; (c) there must be self-interest, rather than mandating, by the participants; (d) participants must be willing to commit resources, for example, personel and facilities, to the programme; (e) there is always a need for outside funding to facilitate operations, training, and international travel, particularly in the Third World; (f) participants must have sufficient training and expertise to make a contribution; and (g) leadership of the programme should be strong and efficient, and should recognise the contribution of each participant.

**IV ACTIVITIES** of networks have been described previously (8). Research coordination is a primary responsibility of the network, and a major premise on which many are founded. The combined efforts of networks usually more than justify expenses and costs once they have become established and operative. Eventualy, some networks are even self-supporting. The role and

impact of the PESTNET in Eastern and Southern Africa in reducing pest losses and increasing farmer revenues and nutritional status will constitute a most significant achievement.

ADVANTAGES of networks have been discussed, but similarly must be re-emphasized and updated. As indicated in the introduction of this paper, USAID Washington conceives of at least some 50 active agricultural networks in Africa. The subject of networks in Africa will be the topic of international SPAAR (Stragetic Planning for African Agricultural Research) meetings in Brussels the first week in July 1986 (12). IDRC participated in funding 72 networks, of which 17 networks were in agriculture, accounting for $34 million or 43% of the IDRC budget in 1970's (2). Donors are now interacting with each other, and most importantly, cofinancing network activities.

HUMAN RESOURCE development = TRAINING is regarded as one of the most valuable network activities. There is a dearth personnel and sometimes too frequently, but a person trained personnel in Africa. It is acknowledged that governments and institutions change, and sometimes too frequently, but a person trained is trained for life. Training activities of a network have a multiplier effect. The people who are trained then train other individuals, either professional colleagues or farmers. Within a few years, there are tremendous benefits accrued from initially training a few individuals.

SHORT-TERM training can be comprised of workshops, seminars, or one to two week training courses conducted in-country, or in the region. Monitoring tours are also a type of short-term training. The advantages of this type of training are that costs are low, and more people can be reached with minimum costs. All levels of staff and participants can take advantage of short-term training. Senior researchers or consultants can conduct or be brought into countries to conduct a series of shortterm courses at less cost than sending trainees abroad.

MEDIUM-TERM training to be focused on in network activities can involve a duration of several months to follow a given crop or research topic. Of increasing importance in this area is M.Sc. degree training where students take course work at a parent university, and then conduct thesis research at another location, with an international agricultural research institute having the advantage of increased staff available facilities for conducting field/laboratory studies. Post-doctoral programmes, of up to a year, are becoming increasingly popular in Africa. Sabbatic leaves of six months to a year are included in this category.

LONG-TERM training applies specifically to academic degree study, M.Sc. and Ph.D. programmes. Many countries are now expressing a desire to train more students, to the M.Sc. degree level, with fewer Ph.D. students. Emphasis is also to train students in Africa, where support costs are less expensive, and research is country-orientated. Costs of student training are one-half to one-third of maintaining a student abroad. A notable development in this area is the ICIPE establishement of ARPPIS (African Regional Postgraduate Programme in Insect Science) in collaboration with African universities (13). Some IARC's have also established graduate student degree programs where research is conducted at the Institute under supervision of resident scientific staff, but courses and degrees are obtained from a sponsoring university in Africa or abroad. Training activities and sponsorship of students are convenient, expedient and comparatively easy programmes for donors to support and fund.

EMPHASIS on training has been extensive in this presentation. However, the success of the proposed network will depend principally on training and coordination of activities. Training is urgently required in Africa at all levels. Extension activities are included in this area, and the gender issue and socioeconomic studies and evaluations are necessary. These activities have been ignored too long in Africa, and constitute reasons why other regions have accelerated agricultural programmes and attaining self-sufficiency. What many thought were impossibilities in Asia a generation ago, have now become a reality. These developments were made possible through training, extension, agricultural research and reform policies.

INFORMATION distribution, through newsletters, manuals and fieldbooks, and bulletins, is a major activity, and responsibility, of the network. All information activities have a bearing on extension programmes, and the transfer of newlydefined or improved technologies to the farmer. Many of the publications will be of a popular nature, readily understandable by extension staff and diploma and degree personnel. The periodic bulletin or newsletter published by the network will constitute the vehicle of communication of many facets of the programme(s). Contributions from as many staff and countries as possible will add to credibility and effect results.

## V SUPPORT

NATIONAL resources are necessary to support networks, with many needs directly provided by respective countries. This includes principally staff, land, equipment. Vehicles are often mentioned as a constraint. Mobility is a necessity in the proposed PESTNET network. Provision of vehicles to countries is a definite consideration in the proposal to be submitted to donors.

DONOR funding is essential for networks. As indicated previously, donors themselves are now getting together to jointly finance networks. Formerly, there was a lessened degree of cooperation among donors. As indicated, major world donors will be meeting in Brussels in July 1986 to consider support of proposed network activities for Africa. Networking is fast becoming the "buzzword" of development/relief programmes. Donors and recipients alike are now cognizant of merits of cooperation and planning and results of network activities. The identification and signing up of supportive donors is so important that an extensive list is given in Table 5. Omitted from the listing are the extensive number of PVO and NGO organizations, who receive

funds from major donors and private donations; and universities including BIFAD and the HBCU's. In the past there have been instances where donors have been in countries, they were literally "stumbling over" each other in efforts to identify programmes and disperse funds. This situation is fast disappearing from the scene. Donors are now coordinating efforts; and programmes with purpose and need, and definitive proposals will be recipients of increasingly diminishing and restrictive funds.

## VI. PROGRAMMES

> "Cattle are the main form of wealth for peasant farmers in much of the region (Eastern and Southern Africa). Cattle diseases such as foot and mouth or rinderpest, and cattle pests like tsetse fly, ignore borders"(15).

CROPS and cattle are the focus of programmes in PESTNET. Pests of crops also ignore borders, as witnessed by the spread of the larger grain borer *(Prostephanus truncatus)* and the migratory activities of several additional pest species. Weeds such as witchweed or *Striga,* pathogens of both plants and animals, and vertebrate pests must receive attention. Improved fodder for cattle is a necessity. Specific national programmes will be presented by country representatives at this PESTNET implementation meeting. The common and shared pests and problems of countries in the region will lead to prioritization of most salient areas to be initially addressed.

## VII. BUDGET

COSTS of initial, proposed PESTNET activities were given previously (1). Review of these costs and the proposed initial funding for the first three years of operation will be established this week.

**Table 5. LISTING OF DONOR ORGANIZATIONS***

**MULTILATERAL AND REGIONAL ORGANIZATIONS**

- Arab Bank for Economic Development in Africa
- Arab Fund for Economic and Social Development
- Asian Development Bank (ADB)
- European Economic Community (EEC)
- Food and Agricultural Organization (FAO)
- Inter-American Development Bank
- International Fund for Agricultural Development (IFAD)
- OPEC Fund for International Development
- United Nations Development Programme (UNDP)
- United Nations Environment Programme (UNEP)
- World Bank

**PRIVATE, NON-PROFIT, AND AUTONOMOUS INSTITUTIONS**

- Arab Authority for Agricultural Investment and Development
- Ford Foundation
- International Development Research Centre
- W.K. Kellogg Foundation
- Kuwait Fund for Development
- Rockefeller Foundation
- Saudi Fund for Development
- Swedish Agency for Research Cooperation with Developing Countries

**BILATERAL ASSISTANCE**

- Australia
- Belgium
- Canada
- Denmark
- France
- Germany
- Ireland
- Japan
- The Netherlands
- New Zealand
- Norway
- Sweden
- Switzerland
- United Kingdom
- United States of America **

* Source: (ll)

** USAID has 2 Regional Offices and 33 Country Missions in Sub-Saharan Africa.

## REFERENCES


USAID Planning Mission. 1985. Creation of an African Regional Pest Management R & D Network (PESTNET) for Integrated Control of Livestock and Plant Pests and Diseases.

ICIPE. 1985. Proceedings, Planning Workshop on the African Regional Pest Management R & D Network (PESTNET) for Integrated Control of Crop and Livestock Pests. Sponsored by United States Agency for International Development (USAID) REDSO/ESA and United National Development Programme (UNDP), and Technical Cooperation among Developing Countries (TCDC). 6-8 October, 1985.

FAO/WHO. 1982. Nutritional Status, Daily Calorie Consumption Per Capita and Percent of Requirement, reprinted from N.Y. Sunday Times, June 1, 1986. pg. E3.

FAO. 1984. FAO Food Balance Sheets, 1979-81 Average. Rome.

Population Reference Bureau, Inc. 1985. 1985 World Population Data Sheet. 2213 M. St. N.W. Washington, D.C.

USAID. 1983. CDA presentation given by Dr. David Schaer to ADO (Agricultural Development Officer) Conference Harare, 1983.

USAID AFRICA BUREAU. 1986. Discussions, by phone, with Bureau Chief K. Prussner on networks in Africa. February, 1986.

Plucknett, Donald L. and Smith, Nigel J.H. 1984. Networking International Agricultural Research. Science. 225:989-993.

CGIAR. 1983 Report of the Consultative Group and the International Agricultural Research it Supports. Consultative Group on International Agricultural Research, World Bank, Washington, D.C.

Nairobi Cluster. 1981. 'Memorandum of Understanding' Document signed by 12 signatory institutes engaged on research into animal diseases, their vectors, and their impact on animal productivity. 17 September 1981. Nairobi, Kenya.

Odhiambo, Thomas R. 1985. Proposal for Planning Workshop on African Regional Pest Management R & D Network (PESTNET) for Integrated Control of Crop and Livestock Pests. Letter to REDSO/ESA Director John W. Koehring, 25 June 1985.

USAID Africa Bureau Cable, Unclassified. 1986. Strategic Plan for African Agricultural Research, Meetings in July, 1986. Brussels. Focus on Networks in Africa.

Smalley, M.E. 1984. The African Regional Postgraduate Programme in Insect Science (ARPPIS). ICIPE, Nairobi, Kenya.

IADS. 1982. Agricultural Assistance Sources. Fourth Edition. International Agricultural Development Service. 1611 North Kent Street, Arlington, VA.

Hanlon, Joseph. 1984. SADCC: Progress, Projects, Prospects. The Economist Intelligence Unit. Spec. Rpt. No. 182.

# PART III

## PRESENTATION OF ICIPE PROGRAMMES
## OUTREACH AND TRAINING
## CROP PESTS
## BIOLOGICAL CONTROL
## LIVESTOCK TICKS
## TSETSE
## SOCIAL SCIENCES

## OUTREACH AND TRAINING PROGRAMMES

By

C.P.F. De Lima, M.E. Smalley, L.O. Abe, J.F. Omange

### Introduction

Although ICIPE has been conducting short group training courses since 1977 the extension of these efforts to higher level long term training was only started in 1983 with the postgraduate programme. Collaborative Research and Development was initiated in 1984 to facilitate further testing and development of integrated pest and vector management strategies at the national level through national programmes as well as at regional and international levels. The development of an African Regional Pest Management Research and Development Network as one aspect for such collaborative work is seen as a major step forward in the sharing of the continent's scarce scientific material and manpower resources for the development of pest and vector management strategies to reduce hunger, malnutrition and disease.

### OUTREACH PROGRAMMES

These are essentially interactive programmes that take results, ideas and techniques from their origin to new areas. The origin of these new techniques may be the ICIPE or other collaborating institutions. There are three outreach programmes: PESTNET, CORD and FAMESA.

1. **PESTNET:** - The African Regional Pest Management Research and Development Network for Integrated Control of Crop and Livestock Pests.

   This is a new programme that was initiated at the ICIPE, beginning with two study missions in July 1985 and a Planning Workshop in October 1985 when major areas of technology exchange were decided on between the ICIPE and country scientists - Burundi, Kenya, Somalia, Tanzania and Uganda. At the Implementation Meeting today we have attendance or positive response from a further six countries in East and Southern Africa. PESTNET has four main objectives: (a) To identify pest problems which are considered economically important by the national programmes. (b) To provide facilities for multi-locational testing of the network pest management ideas in varying ecological zones. (c) To provide training and strengthening of scientific leadership in pest management in collaborating countries. (d) To provide a multi-way flow of information and technology through the exchange of scientists between the network institutions and through the establishment of a pestnet Newsletter and other publications.

2. **CORD - Collaborative Research and Development**

   This is a programme under which ICIPE scientists work bi-laterally with national programmes, the International Agricultural Research Institutes, scientists and centres for advanced research in the developed countries to use advanced technologies in solving major pest problems in developing countries. Examples of bi-lateral agreements with national countries are those between the ICIPE and Kenya, Ivory Coast, Somalia and Uganda and pipeline agreements between Rwanda, Zaire and Burundi.

   Major collaborative work continues at IRRI, IITA and ILRAD. Further work is planned with ICRISAT, ILCA, CIMMYT and IAEA.

   There are strong linkages between the ICIPE and UNDP, FAO, UNEP, ABN, IUBS and the EEC.

   Examples of collaborative work with advanced international laboratories include those at the CSIRO (Australia) and the Universities of Neuchatel (Switzerland), Sussex (UK) and Maine (USA).

3. **FAMESA - Financial and Administrative Management of Research Projects in Eastern and Southern Africa**

   FAMESA is a reseach and development management training network through which national programmes in agriculture, health, industry and energy can acquire research management concepts and skills appropriate to the achievements of their goals for national development.

   FAMESA's activities are in four major areas: (a) **Research:** Assessing the needs of national research and development (R&D) institutes and establishment of a documentation service. (b) **Curriculum Development:** This involves the study and conduct of training seminars in five main areas:

   - R&D Institute (RDI) - Client Relationships
   - RDI Management Information Systems
   - RDI Project Planning, Monitoring and Control
   - RDI Personnel Management
   - RDI Financial and Administrative Management

   (c) Development of other training materials - management manuals, case studies and texts. (d) National Training Workshops to implement training courses for R & D managers using the manuals already developed.

An essential feature of FAMESA programmes is the major use of national R & D managers in all the above aspects of the programme with a maximum of one or two external consultants.

### TRAINING PROGRAMMES

1. **ARPPIS** - The African Regional Postgraduate Programme in Insect Science is a collaborative training network between the ICIPE and, at present, 11 African Universities. It was established in 1983. The rationale behind ARPPIS is that through cooperation, facilities and expertise can be shared. Several Universities of Africa have a long tradition of academic achievement and therefore provide the academic environment and mechanisms for degree studies but some lack the facilities for modern advanced research. The ICIPE, on the other hand, has the facilities for research and supervision of higher degree studies, but is not a University. By collaborating, the ICIPE and the Universities have formulated a new and innovative approach to postgraduate education.

A. The Ph.D. Programme This is a 3year revolving programme which admits upto 8 students each year. The students audit a compulsory 6-month semester of coursework to bring them to a common high level knowledge of the subject matter. This is followed by a 24-month period for research and a final 6 months for the preparation of a thesis. Each student is registered at an ARPPIS participating University. During the 3 years students are required to present seminars at their registering University, and in turn, University supervisors visit the research sites of the students.

ARPPIS therefore offers training to African scientists, in Africa, on the pest problems of the continent. During the past 3 years 31 students from 9 African countries have participated in ARPPIS. the 1983 class completed their studies in February 1986. Already one student has been awarded his Ph.D. degree, 3 more have submitted their theses and the remaining 4 are writing and will submit shortly. It can therefore be claimed that this bold new experiment involving a close working relationship between an international research centre and universities is effective.

We have also realised that ARPPIS must make a major effort to support its graduates and enable them to establish their own careers. Unless this is done the effort of training insect scientists through the formal 3-year programme of ARPPIS will be largely lost. An ARPPIS Scientific Network is therefore being instituted which will provide training, the preparation of research proposals and budgets, will grant postdoctoral awards to encourage active research in the crucial years after training, will fund limited travel within the ARPPIS network and to workshops and conferences, and will provide the facilities for the publication of scientific results and the preparation of visual aids for graduates who are University teachers. The whole ARPPIS family will be supported by a quarterly Newsletter, the ARPPIS News, which will be the medium for communication between all members of ARPPIS, the students, graduates, universities, donor agencies and the ICIPE.

B. **The M.Sc. Programme**

At present ARPPIS does not include training for the Masters degree because of logistical and funding constraints within ARPPIS and because when the programme was established there were effective masters programmes in entomology offered by several African Universities. Unfortunately, many of the programmes are no longer effective and ARPPIS has recently instituted a major review of its role in training for the masters degree.

It is likely that ARPPIS will seek linkages with PESTNET in providing for this degree. ARPPIS foresees many potential linkages with PESTNET, both to provide opportunities to training scientists for research and leadership in national programmes but also, through its Scientific Network, to foster and encourage a productive research career by well trained scientists in PESTNET collaborative research programmes.

2. **INTERNATIONAL PROGRAMMES FOR SHORT-TERM TRAINING IN INSECT SCIENCE**

A. THE INTEGRATED PEST MANAGEMENT (IPM) COURSES

(a) **International Group Training Course on Components Essential for Ecologically Sound Pest and Vector Management Systems**

This course is conducted every year at the ICIPE, Nairobi in June/July or August for practitioners drawn from the Tropical Developing World. The trainees are expected to be people who will be occupied in their own institutions with the management of pests and vectors with full awareness of the effect of management techniques on the quality of the environment. Emphasis is placed during the course on the demonstration of new technologies in insect population management and on an ecologically sound approach to pest and vector management in developing countries.

The course has been held every year since it was inaugurated in 1977 except for 1983 when shortage of funding led to its postponement to 1984. UNEP sponsored the course for the first six years. So far 215 participants from 36 countries of the tropical developing world, with emphasis on Africa, have benefited from the course. The 1986 course in the series is planned for 10th to 29th August. It is sponsored by the International Development Research Centre (IDRC) and the ICIPE.

(b) **Training for Self-Reliance in Ecological Pest management in the Tropics (Phase I - Africa)**

This series was inaugurated in 1985. It is an IPM course similar to the first and catering for the same kind of practitioner. The major contrast from the first course is that it emphasizes a regional approach to the training of pest managers. At the momement the course is based in the West African region. For example, last year 25 participants were drawn from Ghana, Liberia, Sierra Leone and English speaking Cameroon. It was conducted in English. This year's course will cater for Senegal, Guinea, Bourkina Faso, Togo and French speaking Cameroon. It will be conducted in French. Lecturers to last year's course were mainly drawn from the West Africa region with a few representatives from the ICIPE. This was deliberate. It is planned that ICIPE will emphasize local recrutment of lecturers from the region as a way of developing selfsufficiency in instructors within the regions for the group training courses. We are going to adopt this approach for the Nairobi based IPM course as well.

B. SPECIALIZED COURSES

(a) **International Group Training Course on Insect Growth, Development and Behaviour**

Between 10 and 20 participants drawn from all over the world, with emphasis on the tropical world, are eligible to participate in this series. The course is

offered at the ICIPE every other year on a specialised topic in the area of insect growth, development and behaviour. The third course in the series, which is planned for 1987 will be on Insect Endocrinology.

The course is aimed at deepening the understanding of participants in their area of speciality, offer them up-to-date practical methodologies in the subject matter and bring them into contact with experts in the area of their interest.

(b) **ICIPE/EEC Courses on the Management of Vectors for the Control of Trypanosomiasis and East Coast Fever in Livestock Production**

This course series has been restricted to the participation of nationals from Kenya, Sudan and Zambia, the three countries that endorsed the ICIPE grant application to the European Economic Community (EEC) for support on field oriented research and training on the control of tsetse and livestock ticks. Two courses have already been held in this series: the first on Tsetse Management and the second on Tick Management. A practical course on both Tick and Tsetse Management will be held from June 28 to July 28, 1986.

Negotiations have been carried out with the donors for the continuation of the course series and their broadening to cover more countries in the region. The courses that have been conducted so far have proved to be popular.

(c) **Joint ICIPE/Pharmacia Regional Course on Biochemical Separation and Molecular Biological Techniques**

This is a new five-day course to be held at ICIPE from 813 September 1986 in 1986 in Nairobi. Scientists from Pharmacia Biotechnology International, Uppsala, Sweden and ICIPE will conduct at the course.

The course will cater for approximately 20 participants drawn from the East and Central African Region. It will cover both theory and practice in the broad areas of:

Column chromatography - gel filtration, ionexchange, chormatofocusing, hydrophobic interaction and affinity techniques, fast protein liquid chromatography (FPLC) with practical work on manual and automated FPLC.

Electrophoresis - polyacrylamide gel electrophoresis (PAGE), isoelectic focusing (IEF) with practicals on PAGE gradiant gels and electrophoretic titration curves.

Molecular biology with practical work on restriction enzyme digestion of DNA, electrophoresis and hybridization with radiolabelled probe.

(d) **African Regional Training Course for the Use and Safe Handling of Radioactivity in Insect Sciences**

The course, which is sponsored by the International Atomic Energy Agency, IAEA, will be mounted annually, starting in 1986 for scientists and senior technicians wanting to establish, use and manage radioisotope and radiation laboratories for research targeted on arthropods in their own institutes. The course lasts approximately two weeks and will be open to 10 participants at any one time.

C. **INTERNATIONAL ICIPE BASED TRAINING**

ICIPE provides in-service training to technical staff from national programmes for periods ranging from a few weeks to a few months.

The mechanism through which this training operates is through a visiting scientists scheme. There are three types of visiting scientists; Research Consultants; Scientists-in-Residence and Research Associates. A scientist under these various schemes takes up residence at ICIPE for a short period to work on areas of common priority to his country and ICIPE. Recently an effort has been made to accommodate Research Technicians within ICIPE programmes for specialised development of their skills in insect science.

D. **POSTDOCTORAL FELLOWSHIP PROGRAMME**

These fellowships are available to newly graduated Ph.D. candidates and are awarded on a highly competitive world-wide basis. At present a maximum of 15 postdoctoral research fellows are expected to be in residence at ICIPE at any one time. The appointments are normally for a period of 1-2 years.

## CROP PESTS RESEARCH AT THE ICIPE FOR THE PESTNET

By

K.N. Saxena

The primary goal of the Crop Pests Research Programme (CPRP) at the ICIPE is to develop strategies for the management of key insect pests of crops by methods which are: (a) enviromentally safe, and (b) technically as well as economically feasible for the resource-poor, small-scale farmers in Africa and developing tropics. To achieve this goal, research is being carried out under 4 section of the CPRP: Bionomics and Applied Ecology (BAE), Plant Resistance to Insect Pests (PRIP), Biological Control (BC) and Insect Mass Rearing Technology Unit (IMRT).

The target crops and insect pests currently under investigation include: **Sorghum and Maize:** Stem borers *(Chilo partellus, Busseola fusca, Eldna saccharina, Sesamia calamistis);* sorghum shootfly, *Atherigona soccata,* **Cowpea:** Pod borer, *Maruca testulalis.*

The components that have been under development thus far belong to the following categories:

1. **Plant resistance** to target pests aimed at evaluating and developing pest-resistant maize, sorghum and cowpea cultivars for cultivation by the farmers.
2. **Intercropping** host-nonhost plant species and different cultivars of maize, sorghum and cowpea in selected combinations to reduce the borer attack and consequent yield losses.
3. **Behavioural manipulation of the borers,** particularly for monitoring their populations and interfering with colonisation of plants as adjunct to direct pest control tactics.

4. **Biological control,** utilising selected parasitoids and pathogens, as a component of the borer management system.

The output of the CPRP appropriate for the PESTNET may be considered under two categories:

1. **Methodologies,** developed or standardised at the ICIPE for generating information on various pest management components, that can be adopted as such or modified and adopted for generating information in different PESTNET zones.
2. Information generated or strategies developed which can be applied as such or after modification in different PESTNET zones.

The **methodologies** which can be utilised for the PESTNET activities include those for:

1. Evaluation of maize and sorghum germplasm/ cultivars for resistance to the stem borers, using the parameters and their measurement techniques developed/standardised at the ICIPE.
2. Measurement of the pest's responses to plants for elucidating mechanisms of their resistance to the insects.
3. Assessment of crop losses in sorghum, maize and cowpea caused by their respective borers.
4. Culture of selected biocontrol agents.
5. Mass rearing of the target pests by simple methods.

The highlights of the most significant information generated at the ICIPE are given below:

1. The magnitude of grain yield losses caused by the borers in sorghum, maize and cowpea has been established and, sorghum, has been found to decrease with the advance of plant age at the time of infestation.
2. A number of cultivars of these crops have been identified as resistant to the borers; some factors governing their resistance have been elucidated.
3. Intercropping combinations which are quite effective in keeping the borer attack and yield loss down have been identified.
4. The mode of utilising certain promising bio-control agents, particularly the pathogen Nosema, in the borer management programmes has been demonstrated.

The above methodologies and information would serve as the base for ICIPE's participation in the PESTNET activities with reference to crop pests in the participating countries.

## BIOLOGICAL CONTROL OF CROP BORER PESTS

By

W.A. Otieno

There is a wide range of natural enemies which attack insects, some of which cause spectacular population reductions, while others subtly affect population size through host debilitation. These organisms (pathogens, parasites and predators) are often rather host specific, and offer great promise in this approach to pest control. Accordingly, the Biological Control Programme at the ICIPE is organized to undertake Research and Development activities to enhance successful exploitation of biocontrol agents for pest management.

Significant progress has been made towards the development of these organisms for eventual use of these organisms for pest management. In field studies and Mbita Point and its environs, several pathogens and parasites have been isolated and characterized as natural mortality factors against key pests such as *chilo partellus, Busseola fusea* and *Maruca testulalis* which attack maize, sorghum and cowpea crops.

(a) **Pathogens:**

*Nematode* - a rhabditoid nematode, causing a natural mortality of up to 31% against the cereal stem borers has been discovered. Because of their ability to seek and destroy the target insect pest, it is thought that nematodes have particular promise as biocontrol agents against the borer pests. Studies have led to mass production of the nematode for pilot scale field trials.

*Fungus* - taxonomic identification of the fungus palces in the genus, *Reauveria* sp., a group of fungi known to hold much potential as microbial insecticide against soil pests. Several target pests *(chilo pantellus, Busseola fusca* and *Maruca testulalis)* are susceptible to the fungus; with 100% mortality recorded against test insects within 5 days under laboratory conditions. Screenhouse experiments resulted into 86% mortality against the rice pest, *Maliarpha separatella* upon spraying with fungal spores of *Beautemta* sp.

*Protozoa* - Experiments have demonstrated that foliar apphzation of *Nosema* reduced crops damage by 67.5% at 13 days after inoculation and 87.5% at 24 days after inoculation when plots infested with the stalk-borer and treated with *Nosema* were compared to those infested and treated with distilled water only. The formation of the "dead hearts" was reduced by 60% at 24 days after - 2 - inoculation, and the proportion of plants having fully formed heads at harvest was increased by 80% over that on the control plots.

(b) **Parasitoids:**

Several parasitoids have been found to be relatively of common incidence:

Pupal parasitoids - *Dentichasmius busseolae* Heinrich (Ichaneumonidae) *and Pediobius furvus* (Gah.) (Eulophidae). Under field conditions up to 39% parasitism has been recorded.

Egg parasitoids - *Trichogramma* sp. (Trichogrammatidae) and *Telenomus* sp (Scelionidae).

Larval parasitoids - *Apanteles Sesemiaé* cam. (Braconidae)

*Pediobius furvus* is a gregarious pupal endoparasitoid which completes a life cycle of 22 days at 24°C, 60%RH. The female lives for about 8 days and produces a mena of 81 progeny (sex ratio 1 male: 3 females). About 9% parasitism was recorded in the field with up to 400 progeny emerging per host pupa.

The life cycle of Trichogramma is complete in 8 days at 28°C. The female produces up to 70 progeny; and up to 100% parasitism was recorded under laboratory conditions.

## LIVESTOCK TICKS RESEARCH PROGRAMME

by

P.B. Capstick

Recent developments in tick borne disease control have made possible the use of other methods of controlling ticks than the frequent application of acaricides, and the programme goal is to examine and define these alternatives to produce cost effective tick control regimens that utilise much reduced or zero application of acaricides. The programme does no research on tick borne disease, but of course these are so prevalent and inextricably interwoven with tick control that they cannot be ignored, and there is extensive collaboration with institutes working in tick borne disease. The main research areas of the programme are: i) The immunological control of ticks ii) Reduced field use of acaricides iii) Ecological studies iv) Assessment of breed resistance.

**Immunological Control of Ticks**

There have been successful demostrations of the induction of immune responses in cattle and rabbits which produce deleterious effects on feeding ticks of *Boophilus, Rhipicephalus* and *Dermacentor* species. These effects have been obtained with crude extracts of various tick stadia or selected internal organs. The programme studies are concentrating on the identification and isolation of individual protein antigens, or subunits of these antigens, from various internal organs. The next stage will be the preparation of these antigens in sufficient quantity to allow their use in "vaccines" so that specific anti-tick effects can be ascribed to each protein.

Our work is proceeding only with *Rhipicephalus appendiculatus* material. When the concept is proven for this tick species, the principles and methods evolved will be used to produce similar "vaccines" against *Boophilus* and *Amblyomma* species.

**Reduced Acaricide Useage**

Scientific studies in this concept started in Australia as a means of controlling *Babesia* infections transmitted by *Boophilus microplus*. This led to the concept of posture spelling and subsequently to *Boophilus* population modelling and the prediction of the effects of reduced dipping on disease incidence and the population dynamics of *B. microplus*.

These concepts have evolved into models that are able to predict the optimal use of acaricides in productivity terms. They have been mainly applied to one host ticks, but a three host tick model exists and needs evaluation and validation in an African context.

There are three main possibilities for reduced acaricide regimens: a) **Opportunitic Dipping** - which is the practise of dipping when stock is mustered for other purposes e.g. vaccination. This method is inefficient and can lead to heavy productivity and disease losses. b)

b) **Strategic Dipping** - Using the tick population model it is possible to predict the effect of reduced regular dipping schedules on the tick population. The model is climate driven because of the close correlation that exists between the rate of tick development, temperature and humidity. It seems theoretically possible that dipping once a week for 2-3 months a year could result in the reduction of tick populations to 10% of their natural level, given efficient tick borne disease control as a first necessity.

The necessary tick development data, climatic data, and tick survival data is being generated by the programme so that these can be used in the T3HOST model and used to design strategic regimens for different sites in Kenya. These individual regimens will then be validated in the following areas: a) **Rusinga Island** - Resource poor very small farms. Unimproved East African Zebu cattle. No tick control currently practised. ECF present. Seasonal rainfall, overgrazing. b) **Intona Ranch** - Well managed ranching situation. Regular all year round rainfall. Beef production. All tick borne diseases present. 2-3 times weekly dipping. c) **Mariakani** - Small farmer situation. Distinct seasonal rainfall. Tick borne diseases all present. Milk production main output from Bos indicus/Bos taurus cross animals. d) **Threshold Dipping** - This type of reduced dipping has not been assessed in East Africa. The basic principle is that animals are only dipped when the number of ticks on the host reaches a predetermined level. The method is used in some crop pest control regimens. For use in cattle it is necessary to determine the threshold level in a mixed tick infestation situation and the eventual effect on the tick population of the host. The method is amenable to model predictions.

Preliminary studies in a ranching situation have been carried out and will be expanded at Intona and Mariakani.

**Ecological Studies**

These are presently concentrated on *Amblyomma variegatum* in collaboration with the University of Neuchatel. This species has become more important as the principal vector of *Cowdriosis* in cattle and sheep. Studies on the host finding mechanism, pheromone action for field trapping and survival/development data are currently underway. Survival/development data will be developed at Rusinga Island, Intona Ranch and KARI, Muguga.

Smaller studies on the development/survival of *R. appendiculatus* are being carried out at three different ecological sites in Kenya. This data will be used to replace very old data currently in the T3HOST model. Productivity losses due to mixed *R. appendiculatus* and other species in the field in several bovine breeds and crosses are being assessed in the field. Assessment of Breed Resistance Few studies have been carried out on techniques suitable for assessing breed resistance in Africa. Studies have been extensive in Australia where only a single one host tick is involved. Studies to develop methods of assessing resistance in mixed tick species infestations are planned to start this year. If successful the methods developed will be applied to several East African breeds and crosses.

In the future when the research programme comes to completion the results should provide a firm basis for tick control regimens that can be integrated with disease control regimens and farming systems to develop effective pest management systems. In the short term the use of the T3HOST model will enable immediate savings in

acaricide useage to the benefit of the agricultural economy and ecology.

## LOW COST APPROACH TO TSETSE CONTROL

By

L.H. Otieno

The most widely used methods in the manangement of trypanosomiasis include game elimination, fencing, limited bush clearing, spraying of persistent insecticides and chemotherapy. These measures have got their own drawbacks and have in fact not produced a permanent solution to trypanasomiasis problem. Besides, environmentalists have voiced their concern about some of these measures in view of their adverse effect on the environment. It is for this reason why attention is now being turned towards more environmentally acceptable control strategies. There is also need to consider relatively low cost, but effective control measures which can be used by the local community on a continuing basis. In this way the affected community can use these devices as and when necessary.

Some of the objectives of the ICIPE's Tsetse Research Programme are to develop an integrated tsetse control based on the use of tsetse traps in combination with new potent attactants, the use of tsetse pathogens and also to understand in depth the dynamics of tsetse population. This approach will allow us to achieve a long lasting solution to tsetse and trypanosomiasis problem in the most cost effective way.

**Tsetse trapping**

Traps initially designed for tsetse population sampling have been found to be effective means of controlling tsetse by means of catching out the flies from their habitats. A combination of visual and olfactory attractants have been found to attract flies to traps. In our interest to find out what attracted tsetse to natural preferred hosts, we have demonstrated that, besides sight, odours emanating from the host animals play a very important part in attracting mainly hungry flies to come and feed. We have shown that buffalo urine incorporated into a standard biconical trap attracts *Glossina pallidipes* in very large numbers. Our studies which have included the screening of a variety of chemical natural products found to be good tsetse attractants has revealed that buffalo urine contains a very potent tsetse attractant.

A blend of seven simple phenolic compounds has been shown to be largely responsible for the attraction. Cow urine dispensed with acetone has also been found to produce substantial increase in tsetse trap catches.

These compounds are cheap and are likely to revolutionize tsetse control attempts in the near future.

**Tsetse population suppression**

We intend to use odour baited traps rather than insecticidesimpregranated targets to control tsetse. With traps, there is no need to use insecticides which are costly and must be bought using the scarce foreign exchange.

When traps are used the local people can see the tsetse trapped and eventually killed. This encourages them to take active part in using the traps and therefore persuading them to be involved in control operation becomes an easy task.

Plans are underway to carry out a tsetse piolot control operation in Nguruman (Rift Valley) in collaboration with Kenya Government. The total area to be covered is a *G. pallidipes* belt approximately 1000 Km2. The main fly concentration covers an area of 100 Km2. The suppression exercise is to commence at a time when the population is about to experience high mortality from adverse climatic conditions. This, in combination with known trapping mortality, should suppress the population to zero within a predictable time period.

## ICIPE SOCIAL SCIENCES INTERFACE WITH INTEGRATED PEST MANAGEMENT

By

Ochola Pala Okeyo

### INTRODUCTION

1. Until recently agricultural research institutions have, with few exceptions taken as their primary focus the improvement of cultivars, livestock and farm mechanization without paying due attention to the complexity of the environment in which the application of agricultural technology occurs and the explanatory value of socioeconomic variables for farm investment and technology adoption behaviour. Such factors as the structure of access to land, information and inputs, farm labour constraints as well as gender roles and heterogeneity among farmers are some of the crucial factors affecting how farmers decide to adopt 'carefully' designed technological packages.
2. Farm households make agricultural investment ecisions based upon a careful assessment of risk, labour constraints and resource base. Availability, quantity, and quality of factors of production affect the way they prioritize their time inputs into agriculture and determine their resource commitments to the range of activities necessitated by the farming system and level of technology. Moreover perceived profitability of agricultural innovation has implications for economic motivation and farm investment behaviour of household members separately and together. Therefore farmers' risk minimizing strategies must be seen as crucial for understanding their technology adoption choices and should guide technology design. These strategies are based on farmers endogenous knowledge base which may or may not coincide with the scientists knowledge base and/or technology development interests. It is important that biological scientists designing technology in specific 'areas' such as pest management and control discover this knowledge base and find practical ways of interfacing with and improving it.
3. The introduction of new techniques or inputs in one sphere, such as the cultivation of maize should not be viewed in isolation from other activities related to subsistence and nutrition. For example, improved maize yields may lead to a fall-off in the production of other crops, such as sorghum, millets and indigenous vegetables, which previously contri-

buted to the balance of the household diet. Thus increases in "productivity" within the farm household need to be assessed within a wider framework which encompasses its nutritional needs, and the access of its various members to cash incomes. Scepticism is therefore called for concerning suggested innovations and agricultural packages which focus exclusively on a single type of agricultural packages which focus exclusively on a single type of agricultural activity or commodity and which presupposes dramatic improvements in the living standards of rural households without anticipating how these innovations will be incorporated into the household economy.

4. The role of social science in crop and livestock pest research is to develop a better understanding of the environment in which technology application at the farm level and to reorient technology development taking these conditions into account.

**ICIPE'S MANDATE AND THE NEED FOR SOCIAL SCIENCE RESOURCES**

5. The International Centre of Insect Physiology and Ecology (ICIPE) is a research organization with the mandate to increase food production in the tropical work (especially Africa) through the development of improved technology and appropriate scientific information and their application to the solution of food problems.

6. With reference to Africa the ICIPE places emphasis on the development of biological and cultural pest management technologies for several reasons among them the fact that a majority of the farmers in most African countries have small holdings and may not have adequate resources or technical know-how for using pesticides or other control methods.

7. Some of the work already conducted to date at the ICIPE has generated methodologies and components of technology which can now be applied to manage selected livestock and crop pests. The ICIPE is thus turning its attention to an examination of the role that social science could play in addressing the dontextual question - i.e. the environment in which technology is to be applied. The rationale for a social science interface with the biological sciences at the ICIPE is therefore to enhance the applicability of IPM technologies, currently available, to farmers' technical needs, constraints and knowledge gaps.

8. By social science I refer to that group of disciplines concerned with observing and analysing cultural practices, (e.g. anthropology, sociology, social psychology etc), principles of social organisation and ideology in order to understand and systematize knowledge about how and why people do what they do and assess prospects for change.

9. At the institutional level it is important to recognize that: (i) science and technology are concrete results of human endeavour to grasp, for purposes of the more efficient management, his productive and reproductive structure and process as well as those relating to organisms and elements inimical to or supportive of human survival while at the same time making significant increases in the quality of that survival; (ii) the interface between technical "laboratory" research, information, farmer's knowledge base, resource levels and priorities has often been a major bottleneck in linking scientific progress and social practice. (iii) science and technology may exacerbate the conditions of certain groups, societies and regions by distorting their power and capacity vis-a-vis other groups to determine their application and access to the benefits that accrue from them; (iv) in order to achieve interface objectives investment of resources will be needed to develop techniques and procedures which will be sensitive to the perspectives and needs of proposed users of Integrated Pest Management (IPM) technology - the resource poor farmers.

10. Consequently one of the major concerns of national and international agricultural institutions should be develop institutional capabilities for social analysis to enable them to generate practical responses to farmers' needs constraints given the present advances in IPM research and technology development and assess the impact of technology already in use.

11. PESTNET will need a built-in mechanism to facilitate the interface and provide a service in retraining scientists working in crop and livestock research to appreciate the role of social science in technology generation and application.

12. The resource implications of this process are many; but from a practical point of view the following are key:
(a) PESTNET will need to bring in senior social scientists working in the field of agriculture and rural development in order to encourage the type of dialogue suggested here; (b) post-graduate training of biological scientists in social science approaches, concepts and methodology, and vice versa. Perhaps the ICIPE could try a test case with two or three postgraduate students parallel to or within the ambit of the ARPPIS; (c) because in the initial stages this collaborative effort is indeed an experiment in multidisciplinarity between the biological and social sciences there is a need to identify support for the interface activities as part of the PESTNET budget to cater for this type of training.

13. In linking the goals of social science to pest management research and technology development emphasis should be placed in the following areas: (a) analysis of possible sources of acceptance or resistance to new/improved technologies or their components; (b) appraisal of processes of technology adoption to discover whether subsistence farmers will adopt whole packages or only components and the time frame required for technology transfer to take root; (c) iden-

tification of subsistence farmers model of agricultural production, pest management and resources available for investment in farm technological change; (d) analysis of forces of change (historical and contemporary) and socioeconomic factors which shape farmers' capacity and opportunities for technology adoption and receptivity to new or improved IPM packages; (e) incorporating social science consideration in the setting of basic research priorities in crop and livestock research which will be sensitive to farmer's circumstances knowledge base and capacity to adopt recommended practices and IPM technology.

14. In order to chieve these objectives two key issues will need to be addressed: (a) the substantive adjustments at the institutional level needed to facilitate the interface between biological research programmes, social science considerations; and (b) resources required to develop the institutional capabilities to facilitate that needed substantive adjustment.
15. At the substantive level an opportunity is needed to create a perceptual readiness on the part of the biological scientists to develop techniques for incorporating socioeconomic variables in their universe of measurement and methodologies for selecting options for technology development. For the implementation of PESTNET it is necessary for national programmes to develop a strategy in which farmer knowledge base and circumstances could become central in suggesting options and directions for technology development and application.
16. The question needs to be raised within the PESTNET initiative as to how basic crop and livestock research results find their application to meet the institutional goal whether it is improving productivity, health or nutritional status of the resource-poor farmers. Few research programmes in these areas have incorporated an awareness needs to be enlarged and operationalised in a sustained manner within this important scientific network.

# PART IV

## COUNTRY PAPERS

**BURUNDI**

**KENYA**

**RWANDA**

**SOMALIA**

**SUDAN**

**TANZANIA**

**UGANDA**

**ZAMBIA**

**ZIMBABWE**

## BURUNDI CROP PESTS

By

Pascal Ndayiragije

Agriculture is the mainstay of Burundi's economy. It provides food and revenue for a rapidly increasing human population. Unfortunately the crop yield is decreasing due especially to the pests and diseases both in the field and in storage. Burundi Ministry of Agriculture and Livestock places great emphasis on research in pest management in order to reduce the attacks of pests and therefore to contribute to increasing food production.

The major pest problems on the main cash and food crops is presented in this paper.

### A. CASH CROPS

**Coffee**

A major pest throughout Burundi on arabica coffee is Antestia bug *(Antestiopsis orbitalis ghesquierei)*. It is not a pest of robusta coffee.

Burundi Institute of Agricultural Sciences developed a research programme on this pest in order to identify the best insecticide to use against this insect according to its ecology. Chemical control is done by spraying with fenthion 3% sp. in July and August (two treatments separated by three weeks) with a rate of 12g per tree. The yield losses caused by this bug is estimated to be 30%. Some borers attack stems and berries of coffee plants, both arabica coffee and robusta coffee. These are:

1. The white coffee borer, *Anthores leuconotus.*
2. The black borer *Apate monochus.*
3. The coffee berry borer *Hypothenomus hampei.*

The borers are generally of monor economic importance. Lace bug *(Habrochila* sp), soft green scale (Cocus viridis), brown scale *(Saissetia coffee)*, white waxy scale *(Cercoplastes* sp), striped white scale *(Ferrisia virgata)* are recorded on both arabica coffee and robusta coffee as minor pests.

Some leaf eaters attack coffee in Burundi. These are:

1. *Cephenodes hylas.*
2. *Epicampoptera* sp.
3. *Parasa vivida.*

The data on crop losses caused by these insects are not well known. The leaf miner *Leucoptera coma* sometimes attacks coffee in Burundi.

**Tea**

*Helopeltis orophila* attacks tea in Burundi. In trials, Fenitrothion insecticide is used to control this insect. *Toxoptera amantii* and *altica* sp attack tea, but the damages are not serious.

**Cotton**

In Burundi, cotton is suffering from several pests. These are:

1. Cotton aphid *(Aphis gossypii)*
2. Mite *Hemitarsonemus latus*

These are controlled by spraying prophenophos or triazophos. These insecticides control also the cotton bugs like *Lygus vasseleni, Dysdercus sp and Oxycarenus hylinipennis.* This insecticide spray starts early February to June when the cotton is ripened. Other pests are:

1. The African bollworm *(Heliothis armigera).*
2. The spiny bollworm *(Earias biplaga* and *Earias insulana).*
3. The pink bollworm *(Cryptoplebia leucotreta).*

These insects are controlled by using the pyrethroids *(cypermetrin* and *dethametrin).*

**Sugarcane**

*Eldana saccharina,* the sugarcane stalk borer attacks this crop in Burundi. Other borers that attack sugarcane include the pink stalk borer, Sesamia sp., and the maize stalk borer *Busseola fusca.* Their economic importance is not known as no research is being carried out on their control. The mealybug *(Saccharicoccus sacchari)* is attacking the crop.

### B. FOOD CROPS

**Maize**

A research programme on stalk borers of maize has been carried out by ISABU in order to identify the different stalk borers attacking maize and sorghum in Burundi and determine chemical control measures required. The stalk borers are Busseola fusca, *Sesamia* sp. and *Eldana saccharina.* These pests reduce 12-15 percent of yield in Moso (South-East of Burundi) and the early planting dates are less attacked than the late ones. In the highland, where *Sesamia* and *Busseola are abundant, the losses are more than 50%. The insecticide used is fenitrothion sp. 3% by spraying 8-15 kg/ha. The ecology of the planthopper Cicadulina* spp. which transmits streak disease of maize in Burundi is also being studied.

**Banana**

The banana weevil, *Cosmopolites sordidus* is a serious pest on some banana varieties in some areas of Burundi. No control is done in the field.

**Sorghum**

Other than the borers already mentioned on maize, sorghum in Burundi is suffering from *Atherigona soccota* attack. The losses are not well known. *Aphis sacchari* is feeding on sorghum as a minor pest.

*Sitotroga cerealella, Cryptoplebia leucotreta, Cerynea* sp., *Heliothis armigera, Eldana saccharina* are the panicles pest of attack sorghum panicles.

**Wheat**

In Burundi, wheat is not suffering from many pests. *Sitobium* sp, *Busseola fusca, Laphygma exempta* and *Epilachna* sp. attack this crop as minor pests.

**Rice**

Stem borers which attack rice in Burundi are *Eldana saccharina* and *Sesamia calamistis.* The stalk-eyed borer *(Diopsis macrophthalma)* and Locris rubra are also found on rice. These insects are not, up to day, considered as major pests of rice in Burundi.

**Bean**

In the field, *Maruca testulalis, Aphis fabae,* and *Ophiomyia phoseoli* attack the bean. Sometimes, Aphis fabae and *Ophiomyia phaseoli* cause a serious damage to this crop. A biological control programme for aphid is being developed by ISABU while a chemical control programme against bean fly is undertaken in trails. Striped bean weevil *(Alcidodes* sp) is recorded on bean as minor pest.

**Sweet potato**

Sweet potato is suffers from the attacks of some insects and mites. These are *Mysus persicae and Bemesia tabaci* which together transmit the virus to this crop. The screening of resistant cultivars is the research programme of ISABU. *Acraca acerata* is an important pest for this plant in some seasons and the attacks occur in early dry seasons. Fenitrothion is an effective insecticide to control this pest. The Burundi Institute of Agronomic Sciences advise the farmers to plant early in November-December in order to avoid heavy fields losses because the crops mature before the caterpillar attacks. No research programme is settled for this pest.

Two species of sweet potato weevils damage this crop in Burundi. These are *Cylas puncticollis* and *Cylas formicarius*. Screening resistant cultivars is the research subject of Burundi Institute of Agronomic Sciences. *Aceria* sp. is recorded on sweet potato as a minor pest.

**Cassava**

Seasonally, especially in the dry season, *Zonocerus variegatus* cause heavy yield losses of cassava. The farmers use fenitrothion or fenthion as an effective insecticide to control this grasshopper.

Cassava green mite, *Monoychellus* sp., is the principal pest of cassava in dry season. A research programme on this pest was started in 1983 to include work on yield loss, data on planing time and an exhaustive list of local predators. These results are 30% as yield losses, the best planting time is January-February and the local predators are: *Amblyticus fustus, Iphiseius degenerans, Stethouvs* sp. and *Oligota* sp. As these local predators are not able to regulate the CGM population, the objective of ISABU is to develop a biological control programme by introducing the effective predators from South America. This programme is carried out with IITA and CIBC. The cassava mealybug is not yet recorded in Burundi.

**Post-harvest Insect Pests**

The most serious insect pests attacking stored products in Burundi are:

Maize and rice weevils, *Sitophilus zeamais* and S.oryzae.

Red flour beetles *Tribolium* sp.; *Dinoderus* sp.; Angoumois grain moth, *Sitotroga cerealella,* which attacks cereal grains.

Maize borer *Rhizopertha dominica;* Larger grain borer, *Prostephanus truncatus,* which invaded Burundi recently is spreading in the country is causing heavy damage. It attacks maize, sorghum, dry tubers of cassava, groundnuts. Bean Bruchid *Acanthoscelides obtectus* and *Zabrotes subfasciatus.* Both pesticides and integrated approach are being used to reduce infestation.

**Migratory Insects**

**Armyworm**

The armyworm, *Spodoptera exempta,* attacks seasonly and is a serious pest on cereal crops and pasture, causing widespread damage when the insecticide spraying is not done at the beginning of the outbreak. Fenitrothion is the effective insecticide and many phenomene traps are scattered in the different regions of Burundi in order to survey the early outbreak of armyworm.

**Red Locust**

Recently, (May 1986) *Nomadocris septemfasciata,* invaded Burundi coming from Tanzania but didn't cause any damage. The inhabitants acted effectively to remove this pest by crying and throwing stones at the swarms. Now we are surveying hatching in the infested areas.

## REPORT ON TICK CONTROL IN BURUNDI

By

J. Niyongabo

This report is a follow-up to the one I presented here at ICIPE in October 1985, during the PESTNET Planning Workshop.

I. Currently, in Burundi, with regard to tick control, we are going through the 2nd phase, which is the operational phase - that is application of results obtained in: - ecological studies of ticks in Burundi - epizootiological studies of tick-borne diseases - analysis of the effect of dipwashes to ticks - inventory of functional and non-functional dipping tanks in the field.

To carry out this phase which can be called the "pilot phase", we have chosen one of the Provinces in the Country. In this Province, the work programme has been set out as follows: - Repairing of dipwashes where necessary - To calibrate all the dipping-tanks in the Province and determine their capacity - Identify extension themes for technicians, nursing officers and their assistants as well as the dipwash guards - Identify areas for installation of spraying channel (corridors), that is where the number of animals does not justify the installation of dipping tanks.

Finally, after establishing how often the dipping tanks are frequented, and their efficacy, we will see if it is necessary to involve the farmers in the coast of acaricides. Later, the integrated control method could be demonstrated in different Provinces of the country.

In conclusion, our strategic method of control has the objective of controlling ticks while at the same time safeguarding animals from disease and economizing through dipping for 3 to 4 months during the engorgement period of females, instead of dipping the animals twice a week throughout the year.

II. In addition to this, tick control programme, the veterinary laboratory in Bujumbura carries out immunisation against tickborne diseases, including theirleriosis, in collaboration with ILRAD.

III. Immunisation against ticks, however, will be another complementary, and efficient method. It appears to us that ICIPE has already started research towards this immunisation, and if so, we might request for permission to participate in the programme which would greatly contribute to the development of our livestock industry.

IV. **Training:**

We would wish to have, or rather train the following people:

1. Two veterinary doctors with specialisation in immunology
2. Two veterinary doctors (ecologists)
3. Two veterinary technicians qualified in the area of testing ticks for resistance to different acaricides
4. Two veterinary technicians qualified in the area of physiology.

## CROP PESTS IN KENYA

By
W.W. Wapakala

### INTRODUCTION

Agriculture is the mainstay of Kenya's economy. It provides food and revenue for a rapidly increasing human population. However, only 20% of the total land can be exploited for arable agriculture at the prevailing level of technology and resources. It is evident, therefore, that for the country to be self-sufficient in food, all high and medium- potential land should be fully exploited. Among the constraints to increased food production are food losses attributed to pests and diseases both in the field and in storage. In order to ensure that farmers' efforts are not wasted through pest damage the Ministry of Agriculture and Livestock Development places great emphasis on research in pest management as an integral part of food production.

### GENERAL INSECT PEST PROBLEMS

The country experiences pest problems on most major cash and food crops and on the rangelands, the most important being armyworm, *Spodoptera exempta,* quelea birds, and desert locusts and related grasshoppers. Other pests of crops are:

1. Soil pests, e.g., chafer grubs and cutworms.
2. Soil and foliage feeders, including borers, sucking pests, miners and defoliators.
3. Fruit feeders such as borers and fruit flies.
4. Stored-product pests which are mainly borers.

Of special significance is the armyworm which occurs sporadically with devastating losses to cereals and rangeland such as were experienced in 1984. This attack was only brought under control through great expenditure on pesticides and control campaigns. A recent threat to stored products is the larger grain borer, *Prostephanus truncatus,* which is encroaching the southern border with Tanzania. There is evidence that this new pest is potentially more destructive to stored grain than the conventional pests. It is also known to attack cassava. Efforts are under way to prevent the pest spreading to the high-potential grain-growing areas of Kenya.

The Government has given high priority to research and monitoring of the pests of major crops. Crops borers, which are major contributors to food losses, have been singled out as an area of research by ICIPE.

### CROP BORERS

Crop borers of economic importance belong to two insect orders, namely:

1. Coleoptera - beetles, weevils.
2. Lepidoptera - moths and butterflies.

A small number belong to the order Diptera.

The following is a brief account of borers presented on a crop basis.

**Cash Crops**

**Coffee:** Several borers attack the stems and berries of the coffee plant. These are:

1. The white coffee borer, *Anthores leuconatus* Pascoe. The larvae bore into the coffee tree stems.
2. The black borer Apate monachus F. Adults bore into stems from bottom to top. The pest is of minor economic importance.
3. The yellow-headed borer, *Dirphya nigricornis* Oliver. The larvae of the pest tunnel into branches. This borer is receiving attention at the Coffeee Research Station, Ruiru.
4. The coffee berry borer *Hypothenemus hampei.* This is a common borer in coffee. Adults and larvae bore into the berries. Control measures include use of insecticides, particularly Folidol and Dipterex.

**Cotton**

1. The African bollworm (formerly American bollworm), *Heliothis armigera.* This is a very important cotton pest. Its control has received considerable attention by the research services. The larvae bore into cotton bolls, destroying the lint.
2. The spiny bollworm, *Earias* sp. The larvae bore into flowers and cotton bolls. Research into its control continues, but currently the infestation can be controlled by the use of pesticides, e.g., Carbaryl.
3. The pink bollworm, *Pectinophora gossypiella.* Larvae bore into the flowers and bolls.

**Sugarcane**

*Eldana saccharina,* the sugarcane stalk borer occasionally occurs in the coastal area around Ramisi. The larvae bore into cane stems. Other borers that may attack sugarcane include the pink stalk borer, Sesamia calamistis, the maize stalk borer, *Busseola fusca,* and the spotted stalk borer, *Chilo partellus.* These have not gained economic importance, hence no research is being carried out on their control.

**Food crops**

**Maize:** The major borers of maize are the maize stalk borer, *Busseola fusca* (the larvae bore into stems and ears); the pink stalk borer, *Sesamia calamistis,* the spotted stalk borer, *Chilo partellus,* and occasionally false codling moth larvae attack maize ears, especially in western Kenya.

**Rice:** Several borers attack rice stems. These include the pink stalk borer, *Sesamia calamistis,* and the white rice borer, Maliarpha separatella.

**Sweet potato:** Several weevil and moth larvae attack sweek potato vines and tubers. The sweet potato weevil, *Cylas puncticollis,* the striped sweet potato weevil, *Akidodes dentipes,* and the sweet potato chewing moth, *Synanthedon dasysceles,* are among the common pests.

**Pulse Crops:** Numerous borers are known to attack the pods and stems of pulses, e.g. the African bollworm, the bean podfly, *Maruca* podborer, the bean stalk borer, the pea pod borer, and the striped bean weevil. some of these are also known to attack horticultural crops, e.g., the African bollworm.

### HORTICULTURAL CROPS

**Citrus:** A major borer of citrus fruits is the false codling moth, *Crytophlebia leucotreta* Meyrick.

*Mangoes:* Several pests attack mangoes, among them the mango seed weevil, *Sternochetus mangiferae.*

**Cashews:** The larvae of the cashew weevil, *Mecocorynus poripes,* attack stems and branches and tunnel under the bark and may kill trees.

**Coconut:** The Rhinocerous beetle, *Oryctes monoceros* is a major pest of coconut. Occasionally it

has economic importance on this crop at the coast, necessitating control measures.

**Bananas:** The banana weevil, Cosmopolites sordidus, attacks the pseudo-stems. In severe cases the stems fall over.

**STORED PRODUCTS**

Several weevils and moth larvae attack stored grains and legumes. Prominent among these are cowpea bruchids, bean bruchids, maize weevils, the red flour beetle, the rice weevil, Angoumois grain moth, the tropical warehouse moth and the greater grain borer - already referred to above.

## TICKS AND THEIR IMPORTANCE IN KENYA

By

S. Chema

**Introduction**

As an entity, tick-borne diseases constitute one of the greatest impediments of livestock production in Kenya. Important diseases of which ticks are vectors include Theileriosis, Cowdriosis, Anaplasmosis and Babesiosis. Because of their importance, tick diseases are tackled by a number of research institutions in Kenya. Each institution attempts to research on a specific problem and an attempt is made, as far as possible, to avoid duplication of effort. Some of the laboratories working on ticks and tick-borne diseases are national institutions including the Veterinary Research Laboratory, Kabete, the Veterinary Laboratory at Muguga and the Veterinary Faculty at the University of Nairobi; where others are international - International Laboratory for Research on Animal Diseases (ILRAD) and International Centre for Insect Physiology and Ecology (ICIPE).

**Research Coordination**

Coordination of the research effort on ticks and tickborne diseases is done through the Nairobi Cluster which also co- ordinates research on Tsetse and Trypanosomiasis. Research on ticks is one part of a broad, integrated approach to controlling tick-borne diseases.

The main laboratories involved in tick control research are the Veterinary Research Laboratory, Kabete which concentrates its efforts on acaricide research and ICIPE which is directing its research efforts towards understanding tsetse ecololgy and physiology, the final aim being to control them without relying too much on acaricides.

The Muguga Laboratory pioneered research on immunization against Theileriosis using both tick homogenates as well as culture derived organisms. Aspects of this work especially at the molecular level is being done at ILRAD.

Although the different Laboratories have different mandates, they are all collaborating in a multiple site joint project to investigate survival of *R. appendiculatus* as well as theileria in them under different ecological zones in Kenya.

**The Role of PESTNET in the Control of Tick-Borne Diseases**

It was agreed in previous discussions that PESTNET will only be concerned with the control of ticks and will leave the disease aspects to others. The expectations in Kenya are that the non-chemical control of ticks research which has just started, and for which ICIPE is the lead institution within the Cluster, will be expanded in Kenya and initiated elsewhere in the region. It is hoped that results obtained in multiple sites will provide insights into the best way of controlling ticks. It is realised that, in the foreseeable future, reliance will continue to be placed on acaricides. With the progress that is being made in the control of theileriosis using drugs and experimental vaccines, it may be possible to relax the intensity of acaricide use where this disease is the main threat.

Under such conditions, it may be possible to consider strategic dipping. It is intended to continue research already initiated on Cowdriosis and also to intensify work aimed at improving available vaccines against Babesia and Anaplasma. Success in these directions will make strategic dipping even more feasible. Continuing research aimed at immunising animals against ticks which has been initiated at ICIPE will, it is hoped, provide yet another way of controlling tick-borne diseases.

It is obvious that the amount of work needing to be done is such that a single institution will not be able to do it on its own, and the participation of scientists throughout the region will enhance chances of success.

## THE CONTROL OF LIVESTOCK TICKS IN RWANDA

By

Boniface Rushigajiki

I. INTRODUCTION:

**LIVESTOCK IN RWANDA**

1.1 Some data:

-Cattle : ±750,000

- Small ruminants: 1,500,000 (mainly goats)
- Pigs: less than 100,000

1.2 CHARACTERISTICS OF CATTLE

Breeds: -

Ankole: local breed (watusi), represents + 90%. The breed is naturally a poor productive one. Other breeds are: Ankole x Sahiwal Ankole x Jersey Ankole x Sahiwal x Jersey Holstein Friesian and Brown Swiss have been recently introduced. They are in experimentation to be crossed with the local breed.

1.3 Characteristics of Livestock

Rural traditional type: 90%

No big farms, except some governmental stations.

1.4 Pathology

Tick-borne diseases and intestinal infections are the most common.

**II THE CONTROL OF TICKS**

**1. Importance of Ticks and Tick-borne Diseases**

At the present time, tick-borne diseases may be considered as the major constraint to development of cattle production. They are responsible for 5-10% mortality in young cattle in rural livestock, 50 to 100% in exotic and

crossed breeds. Direct effects of ticks may be more important in rural zones, as they create a chronical debilitating state in cattle, which is accompanied by a reduction of productivity and may slow growing.

The ticks recorded in Rwanda are:

- Rhipicephalus appendiculatus: 90% of ticks
- *Boophilus decoloratus:* 6-8%
- *Amblyomma reariepatum*
- *Phipicephalus evertsi*
- *Rhipicephalus compositus.*

*The two important ticks, Rhipicephalus appendiculetus* and *Boophilus decoloratus,* nearly have the seame distribution.

The tick-borne - diseases diagnosed are

Theileriosis due to *T. parva* (E.C.F.)
Anaplasmosis
Babesiosis
Toxicosis due to ticks is unknown but perhaps exists

**2. Control Methods**

2.1. The control of ticks: background

To control ticks, a network of dipping-tanks was established since 1952. Around 1961, an important change occured in the distribution of cattle in different livestock areas; some of the dipping-tanks became sub-used, many of them became damaged and were never set up again.

The control of ticks consisted in the use of acaricides in those dips which were still in good state, but regular treatment was not done.

The Government of Rwanda, having decided to reduce the important livestock losses due to ticks and tick-borne diseases, requested the UNDP, to help in sending specialised staff, funds and materials. The project began in 1975 and finished in 1981.

The Project accomplished a lot of actions:

- Tick ecology studies
- Map of different ticks distribution
- Epizootiology and tick-borne diseases
- Use of acaricides: analysis of dip solutions and
  -calibrating of dips
- Constructing of new dips and repairing damaged dips
- trials on economic aspects and evaluations.

2.2. The control of ticks: present activities:

When the UNDP/FAO project finished, the tick control service continued to operate, but without staff and especially without funds. Two years later, the service was integrated to the new "National Veterinary Laboratory" which is based at RUBIRIZI near Kigali.

Before the end of the project, four groups were created, to keep the control of ticks in the four principal zones of the country; for the moment we have none. Half the Technicians are now in other jobs, funds fell from 24,000,000 Fr. to 4,000,000. Logistics are not in existent. Thus, all the activities are going very slowly, and some disappeared; i.e, constructing and repairing of dips.

Actually 20% of the 175 dipping tanks function normally. The remaining 80% are partly useless because they are badly damaged and partly because the very low density of cattle doesn't allow an efficient use.

It is the reason why we try now to create many spraying centres. The aim is to have one spraying centre by sector (a sectior is a subdivision of ("commune"). The control consist especially in the use of a acaricides. The acaricide commonly used is DELNAV DFF, but cases of resistance to DELNAV DFF appeared in *Amblyomma* sp. Steladone CIBA seems to be efficient combat this.

The control of tick-borne diseases is made by using Terramycin against ECF and anaplasmosis, and Berenil against babesiosis. There are also trials to experiment Halotuginone and clexon.

The manufacture of the vaccine against ECF, which started before the end of the project, is an interesting activity, but we cannot produce more than 1,000 doses per year, and the cost of vaccine is too high (1000Fr.).

2.3 Production of ECF vaccine: the vaccine might be less expensive, because we are now able to produce liquid Nitrogen (since April 1986). We hope to produce 50,000 doses per year.

Technical staff: propositions have been made to the government.

Funds: a request has been made to rehabilitate the service.

Relations with specialised institutes. Since 1984, we have contacts with ILRAD and we send technicians there for periods from 1 to 6 months.

2.4 The importance of a regional pest management research and development network (pestnet).

In developing cooperation with specialised institutes, we are now very interested in the implementation of a regional pest management research and development network (pestnet): from this, we hope to make an effective cooperation in exchanging information. That exchange will enable us to judge our methodologies, to compare our experiments and results with those from other countries which have similar problems, and, especially, to know the progress in the matter.

Cooperation in exchanging information: The exchange of information will enable us to judge our methodologies, to compare our experiments and results with those from other countries which have similar problems, and, especially, to know the progress achieved.

## STATUS OF CROP AND LIVESTOCK PESTS IN SOMALIA*

By
A.N. Alio

### INTRODUCTION

According to the current Somalia's five year development plan, top priority is given to increasing the agricultural productivity. To achieve this objective, Somalia expects to accelerate growth in production by increasing the productivity of its crop and livestock sectors, and by reducing the effects of production constraints. Recog-

nized as major production constraints include insufficient technical information, inadequate production technology, scarce trained manpower and inadequate provisions of physical tools of production.

The need for improved technology to increase crop production is specifically mentioned in the 5 year development plan. Due recognition and importance is accorded to the generation and adaption of production technology and its application; hence the emphasis on research and training.

**DEVELOPMENT POLICY AND PLANS:**

The main agricultural policy of Somalia is to achieve self sufficiency in food. The national objectives are to increase the agricultural productivity of both crops and livestock sectors. In crop sector it seeks to increase the production of sorghum, maize, oil seeds, sugarcane, fruits, vegetables, cotton and rice. Annual growth rate of 6.2% in the value of crop agriculture is the target. Research emphasis will include, among others, improved production practices. The government is commited to improved agricultural research facilities. Donorfunded projects are addressing that goal, with emphasis on training and upgrading skills of Somalia nationals.

**Agriculture: Crops**

Although a large population (about 60%) is engaged in nomadic pastoralism, cultivated crops supply the larger part of the livelihood for the majority of Somalis. The two main crop production systems are the rainfed and the irrigated. About 14% of the total population is engaged in rainfed agriculture on approximately 540,000 ha. of land. Irrigation farming along the Juba and Shabelle rivers covers approximately 160,000 ha. of which 110,000 is flood irrigated while the rest is under controlled irrigation. Work is on progress to improve the irrigation system in both valleys, particularly in the Shabelle.

One of the constraints to increase food production is the crop protection aspect. In several cases surveys were completed while in others they are still being worked out.

In this presentation I shall limit myself to the insect pests of the major cereals in Somalia: Maize, sorghum and rice.

Maize is mainly produced under irrigation; with a very low percentage under dryland. Farming sorghum is completely under dryland while rice production is grown under the paddy conditions.

There are several insect pests common to the three crops. The most important are the stalk borers. Research is being carried on their life cycle and bionomics and preliminary information has been obtained. The two major species are *Chilo partellus* and *Sesamia cretica,* with the former being the more important in maize and sorghum. It is thought that the *C. partellus* was introduced in Somalia in the early fifties. Unfortunately the parasites and predators are absent so that this spotted stalkborer has had an extensive distribution.

The control measures agains this pest are being worked out by several workers. The emphasis is on the use of chemical insecticides (granules, wettable powders and emulsifiable concentrates). It has been established that Basudin 10G placed in the whorl of the sorghum or maize at the rate of 1kg ai/ha gives good results. Furadan is also used at sowing time to give protection against stem borers for 5-6 weeks.

It is desirable to develop certain cultural practices that would be cheaper to the farmer and safer in comparison with chemical insecticides.

**Trap crops:** Where forage sorghum is used to trap the insects away from the grain sorghum is based on the idea that insect will prefer lush and actively growing plant to the slower ones. This practice has been tried at BONKA during the Deyr (first rainy) season of 1985 but this experiment failed. It is being tried with modified design during the current Gu (second rainy) season.

**Sanitation:** The stalks of sorghum and maize should be collected and burned, although *stover* is used as a feed for livestock and also as roofing material. Moreover the ratoons left by the farmers contribute to the maintenance of the insect population.

It has been found that collecting the stalks and building stooks is reducing the emergence of insects. Only the ones in the stalks on the top emerge, although we cannot, at this stage, give an explanation for this phenomenon.

**Biological Control:** This is a very specialized field that needs much attention. It is proposed to carry research on parasites, predators and pathogens. Such research is out of ARI's capabilities and it is highly desirable to have the cooperation with ICIPE.

On lower status are the *Heliothis armigera* and related Lepidopterous pests such as mites and aphids. In these cases the current research consists the use of chemicals Cypermethrin and Azodrin respectively.

**Leguminous Crops:** Cowpea and mungbean constitute the major leguminous crops of the drylands; while Phaseolus beans and peas are the minor ones. The insects attacking these crops are as follows:

| | | |
|---|---|---|
| Bruchid | Treated with | Malathion |
| Maruca pod/borer | " " " | Endosulfan |
| Coreid bugs and | " " " | Chemicals are |
| Spittle bugs | " " " | being tried |

**The Oil Crops**

Safflower has been proven to be promising in the dryland areas in view of its light oil content and resistance to drought. *Heliothis* Larvae and some related lepidopterous species cause damage to the oil. Cypermethrin is being tried. Sesame is a very important oil crop and three species of lepidopterous pests attack it. The growing tip, the stem and the roots are bored into. In addition the pods are also attacked. Different chemicals are being tested.

In the commercial field the following crops are attached by pests:

1. Vegetables:

   Tomato: Lepidopterous insects causing damage to the berry, white fly transmitting the curly top virus.

*Dr. A.K. Nur presented a special paper on biology and control of *Chilo partellus which is not included in these Proceedings but will be published in the first issue of the pestnet newsletter.*

Onions: Attacked by thrips
Turnips, Swisschard and other leafy vegetables: aphids and leaf eaters.

2. Citrus fruits: attacked by soft brown scale.
3. Banana: Nematode.
4. Flies transmitting virus disease.
5. Sugarcane: Stalkborer, mites, aphids and striga.
6. Cotton: a) Aphis gossypii on leaves b) *Heliothis armigera* and *Earias insulana* on flowering bolls. c) *Oxycarenus hayalinaipennnis, Dysdercus fasciatus on first bolls open.*

**Institutions:**

The Agricultural Research Institute, the Faculty of Agric. Science and some other donor funded paragovernmental projects are undertaking the research in entomology. But capabilities being limited much needs to be done. The capacity and the ability of the above mentioned organizations can be upgraded. Certain needs are to be urgently met.

**Training of the personnel:**

Most of technical personnel are in need of training in:

1. English as means of communication.
2. Field of interest: Middle level trainees are needed with bright personnel at the top.

Training should cover:
Intergrated Pest Management (IPM)
Cultural Control Other aspects are:

1. Retraining the trained personnel.
   To retain the personnel it is needed to create a suitable atmosphere for work and to create incentives.
2. Type of training
   Plant protection
   Seed storage
   Plant quarantine
   Insect taxonomy
   The institutes that could offer these training programmes of 4-10 months duration include ICRISAT, IITA, CIMMYT, ICIPE, Tropical Development Research Institute (U.K.) and Food and Feed Grain Institute of Kansas State University.
3. Supplies
4. Equipment
5. Information: We attach very high importance to this item and would like to be included in any regional information dessemination network.

**Conclusion**

The Somali Government welcomes the idea and the initiative taken to put up a Regional Pest Network and will participate to ensure its sucessful establishement and operation.

## TSETSE PROBLEM IN SOMALIA

**Tsetse Distribution**

The tsetse-fly belts of the Shabeelle and Jubba Valleys are separate from the tsetse infestations of Ethiopia and eastern Kenya. To the south there is a 60 km. wide tsetsefree corridor between the limits of the Jubba/ Dhesheeg Waamo fly belt and the Baddana river outlier of the East African coastal fly belt, the latter extending across the Kenya border into the Somalia coastal hinterland.

The isolation of the riverine fly belts of Somalia makes possible the use of highly selective and ecologically neutral methods of tsetse control aiming at the total eradication of tsetse from the Jubba and Shabeelle valleys.

**Direct Effects of Tsetse Infestation**

In the absence of human trypanosomiasis in Somalia the direct constraints imposed by tsetse infestation relate to livestock. About 28% of the cattle population and 11% to 12% of the camel, sheep and goat populations of southern Somalia are regularly exposed to tsetse fly. Moreover, because of drought incidence larger populations are periodically exposed.

The human population in the rural areas of southern Somalia is divided between settled riverine crop farmers, transhumant farmers associated with both the riverine and non-riverine areas, and nomadic pastoralists. Of the cattle regularly exposed to tsetse, very few are owned by the settled riverine farmers, 30 to 50% by the riverine transhumant farmers, 30% by the nonriverine transhumant farmers and 20 to 30% by the nomadic pastoralists.

Milk is the most valuable product of cattle and camel herds, followed by meat. No use is made of draught animals for ploughing within the project area though they are widely used for haulage.

Bovine typanosomiasis is the most important cattle disease in the riverine areas. Sheep and goats are affected by trypanosomiasis though losses are not great. Camels are considered to be sensitive to both the nuisance of biting flies and to trypanosomiasis, and camel owners avoid tsetse infested areas whenever possible.

The direct effects of typanosomiasis on livestock include mortality, morbidity and the consequent reduction in livestock productivity, and the necessity for expenditure on trypanocidal drugs.

**Indirect Effects of Tsetse Infestation**

Indirect effects include suboptimal use of land resources and constraints upon the types of rural production systems that have been developed. As a corollary, one beneficial effect is a degree of preservation of faunal and floral resources from the destruction that could have accompanied more intensive cropping or pastoral exploitation of the areas at present heavily infested.

**Benefits of Tsetse Eradication to Livestock Production**

Direct quantifiable benefits to livestock production include improved survival, increased productivity and savings in trypanocidal drug costs.

Indirect unquantifiable benefits include improved use of land resources especially riverine rangeland, intensification of stock production systems, greater integration of stock and cropping and increased opportunities for land settlement and other forms of development.

## THE ENVIRONMENTAL IMPACT OF SPRAYING OPERATIONS AND TSETSE FLY ERADICATION

Spraying operations and tsetse fly eradication are likely to affect various resources and occupations in the riverine zone, including range-land, bee-keeping, fishing and wildlife.

**Rangeland**

While the immediate effects of tsetse eradication by

nonresidual insecticide applications on non-target animals are comparatively trivial, the subsequent longer term effects on the grazing resource may be more damaging, especially where intensive agricultural development and human settlement also proceed unchecked.

The vegetation of some parts of Somalia has suffered extreme degradation due to overpopulation and overgrazing. Classical desertification, with progressive loss of vegetation cover and soil, can already be found in the project area, especially in the drier parts of Hiiraan and Gedo Regions. More commonly, in some of the rangelands away from the settled areas the trend has been one of bush encroachment, possibly as a result of a reduction in the incidence of fire due to overgrazing.

In addition to these trends, tsetse eradication will lead to some changes in the patterns of use of riverine rangeland. It is likely that Livestock will use the previously tsetse infested rangelands more intensively and for longer periods in dthe dry seasons than at present. Changes in riverine rangeland vegetation will thus also occur and unrestricted over-use could resudlt in degradation, especially if stock remain to graze in the rainy seasons. There are several reasons to expect, however, that the use of riverine rangelands will remain mainly seasonal and that present patterns of movement of animals will largely be maintained. It will nevertheless be an important part of any rangeland management package for these areas that changes in riverine rangeland vegetation are closely monitored and sensitive areas are protected from over-use.

**Bee-keeping**

Honey bees *(Apis mellifera)* are the only livestock kept by many settled riverine farmers, especially in the remoter areas. From a survey of 407 men in 48 villages we estimate that there are over 3,000 bee-keepers in the Jubba and Shabeelle Valleys owning 84,000 hives, and producing 300 m.t. of honey in an average year. Total production is worth over 13 million Somali Shillings and about half is sold. 68% is produced in the Jubba Valley and 93% of the hives are found in areas of riverine forest and thicket. Despite a strong economic incentive to produce honey for sale, bee-keeping may be declining due to the rapid clearance of riverine forest for cultivation and the increasing theft of honey with settlement.

Tsetse eradication will enable greater use of the riverine zone by pastoralists and thus contribute to the decline of beekeeping.

Spraying operations put beekeeping at tisk, particularly when residual deposits are applied. Five of the 15 colonies under observation at Balcad disappeared when the area was treated with dieldrin at rates of 110-1570/ha. Aerosol drift sprays of endosulfan also had adverse effects. The 1983 operation caused hyperactivity and killed worker bees at two experimental hives, and several beekeepers from villages in the Balcad area complained that spraying had caused hive desertion. The 1984 operation caused hyperactivity at some colonies but there was no proof that it caused hive desertion of mortality, and only one village blamed losses on spraying.
Economic losses in the sprayed area were estimated to lie between Nil and 321,000/, and were probably less than half the maximum.

The risk to bees can be minimised by (i) not applying residual deposits to flowering shrubs or trees or close to hives, and (ii) not applying aerosol drift sprays after sunrise and at more than 24g of endosulfan/ha.

**Fishing**

Nomadic Somalis have a contemptuous regard for people who eat fish, but for many non stock-owning residents of the riverine zone fish are the main source of animal protein.

A survey of 406 man in 48 villages along the Jubba and Shabeele rivers found that 62% had eaten fish in the previous year and half of these had eaten it in the previous 23 days. 37% had fished in the previous year. Generally fishing is a subsistence activity, often done by children, but surpluses are sometimes sold locally. Greater commericialisation is evident in the towns but there is only one large operation, a cooperative of 75 fishermen working on the Shabeelle near Qoryooley, which sells fish to traders from the surrounding villages. Food fish are usually over 25 cm long, the most important species being *Clarias gariepinus, Bagrus* spp. and *Futropius depressirostris.*

## THE MAJOR LIVESTOCK PEST PROBLEMS IN SUDAN

By

O.N. Osman

**Introduction**

Livestock in the Sudan is estimated at 16 million cattle 22 million sheep, 13 million goats and 2.5 million camels. Most of the livestock is under the nomadic pastoral sector. Sudanese livestock satisfies local needs for meat and produces an export surplus which forms about 15% of the foreign currency earnings. About 88% of the milk needs were satisfied.

60% of the total area of the Sudan was suitable pastoral land before the recent drought. Agricultural and animal beef industry encouraged the growth of livestock farming. This livestock in many areas of the country is under variable risk of tickborne diseases and trypanosomiasis.

**Livestock Ticks.** About 64 tick species are identified in the Sudan but few of them bear economical significance. The vectors of *Thieleria annulata* were identified throughout the country. In local breeds the disease causes morbidity and increases herd susceptibility to other diseases. *Hyalomma a. anatolitium* and *H. a. thalavatum H. sufipes* and *H.trimcatum* were the cardidate vectors. *Thileria mutans,* a milder form is transmitted by *Amblyommna* species.

*Amblyomma lepidium* and *A. vanegatium* were recognized in the south and central Sudan and they transmit Heartwater disease to sheep, goats and cattle and rarely camels. The disease is recognized in the East Central and the south.

The cattle babesiosis caused by *Babesia bigemma* and *B. bovis* are transmitted by *Boophilas anulatus* and *B. decoloratus* the disease causes mortalities in both local and exotic breeds. The sheep babesiasis *B. ovis is sus-*

*pected to be transmitted by Rhipicephalus evertsi* and *Hyalomma anatolicum* spp.

Anaplasmosis disease is also common in the central and south Sudan yet the candidate vector is not yet identified.

Besides the indicated disease problems caused by the ixodid ticks in ruminant livestock, the argasid tick *Argas persicus* is the greatest ectoparastic problem which faces the developing poultry industry in the country. Once established *A. persicus* infestation is not easy to control. Besides lower egg productivity, this ectoparasite transmits avain spirochoetosis which is a serious disease.

Under the pastoral nomadic sector tick problems were limited by ecological as well as host factors. But under the livestock farming where there are cattle of foreign breeds or improved local breeds tick infestation problems are more serious. The establishment of highly infested foci is encouraged by both host susceptibility as well as the favourable environmental conditions. Inside the farms *Hyalomma anatolium* and *Rhipicephalus evertsi* have been established and the *Boophilus* and *Amblyomma* species created an infested linear belt north of their known ecological belt.

Research efforts were directed to the study of biological and ecological characteristics of the vector species. However, more research emphasis was given to the study of these factors under livestock farming conditions. In the Gezira Project, livestock farms exist in close proximity to cotton blocks, and cotton fields were frequently sprayed with insecticides to control pests. The possibility that such an insecticide pressure may affect the tick biology in the area is under investigation. At the same time experiments to examine the susceptibility of ticks to these insecticides is being carried out in the laboratory together with studies of reproduction behaviour of these ticks at sublethal insecticide exposure.

**Tsetse and Trypanosomiasis**

In about 50% of the total area of the country is under trypanosomiasis challenge. The tsetse transmitted trypanosomes occur in an area of about 95 thousand square kilometres adjoining the main African belt, linear expansions and pockets.

Outside the tsetse belt the mechanical transmission of *T. vivar* and *T. evantsi* occurs in wide areas of the West Central and Eastern parts.

Research and control attempts of the tsetse and the disease dated back to the early twenties and no substantial results were achieved.

Recent attempts though faced with serious shortages of funds, focus on surveys of apparent densities, using available techniques and tsetse infestation rates. A great concern is also given to the investigation of the role of mechanical vectors.

## FOOD CROP PESTS IN SUDAN

By

Y H.A. Farrag

Crop pests in Sudan are diverse. Cotton as the main cash crop in Sudan received most of the attention. Intensive research was conducted concerning cotton pest including the white fly *Bemesia tabaci,* the American Bollworm *Heliothis armigra* and the cotton jassid. All these research activities are financed through national as well international sources.

Crops other than cotton received less attention. In recent years the production of food crops has increased significantly in Sudan. The problem of food shortage created by the drought conditions facing Sudan, among other African countries, makes the Sudan move towards the production of more food crops which also means more consideration to be given to the pests problem in food crops.

Food crops which are grown in Sudan in both irrigated and rain fed schemes are sorghum, millet, wheat, ground nuts, sesame, beans and horticultural crops.

**SORGHUM**

Sorghum is considered to be the main food for Sudanese. A large area is cultivated with sorghum in the irrigated as well as the rain fed schemes and traditional farms. The draught conditions during the year before last resulted in a severe sorghum shortage. The pests attacking sorghum in Sudan are:

1. The desert locust *Schistocerca gregaria* is a major pest controlled through Desert Locust Control Organisation (DLCO).
2. The African migratory locust *Locusta migratoria migratorioides* is a serious pest which caused serious damage last year.
3. The shield bug, *Agonoscelis versicolor* and the green bug *Nezara viridula.*
4. The stem borers *Sesamia critica* and *Chilo partellus.* Research work is going on now concerning these two spp. which include screening for resistant varieties.
5. The shoot fly.
6. The sorghum midge.

Last season (1985/86) was a very good rainy season but was a bad pest control season. Because all the crops were attacked with many pests. Even the American bollworm did considerable damage to sorghum. As a result of this and of the severe food shortage more emphasis was put on the need for more research on pests attacking food crops. More research is needed in the areas of surveying, forecasting, damage assessment and economic thresholds in addition to the need for ecologically sound means of control.

**SESAME**

Sesame is usually attacked by a very serious bug *Elasmolomus sordidus.* This pest usually attacks sesame seeds after cutting and stacked for drying. Sesame is also attacked by the sesame web worm.

**WHEAT**

Wheat is attacked by the aphid *Myzus persicae.*

**GROUNDNUTS**

There are no serious pests on groundnuts but occasional pests are termites and white grubs.

## LIVESTOCK PESTS RESEARCH IN TANZANIA

C.S. Tarimo

Tanzania has an estimated livestock population of about 13 million head of cattle, 5.5 million goatrs, 3.6 million

sheep, 250,000 pigs and 25 million chicks. About 99% of this livestock is owned by peasant farmers and is composed of mainly unimproved indigenous stock. For most of these farmers, wealth is still assessed by livestock numbers owned. There is a large area of land which could be highly productive livestock area but animal diseases spread by livestock pests are a major constraint in the development of the livestock industry.

## MAJOR LIVESTOCK PESTS

The major pests of livestock in Tanzania are ticks and tsetse flies. Ticks recorded include *Rhipicephalus appendiculatus, Rhipicephalus evertsi, Boophilus decoloratus, Boophilus microplus, Amblyoma variegatum, Amblyoma lepidum,* and *Hyaloma rufipes.*

Ticks and the diseases they transmit greatly limit the development of the livestock industry in Tanzania. East Coast Fever which is transmitted by ticks is considered the most important livestock disease in Tanzania. Although vaccination and chemotherapy have been used, these have not proved very successful in eliminating tickborne diseases. The most favoured tick control technique has been the use of acaricides through dipping or spraying. The first cattle dip in Tanzania was built in 1907 and is still in use. This is probably the oldest cattle dip in East Africa. At present there is a network of cattle dips throughout the country which cater for livestock dipping regularly.

## LIVESTOCK PESTS RESEARCH

Livestock research in Tanzania started in 1905 when the Germans established a Veterinary Research Centre at Mpwapwa. This centre operated the cattle dip which was constructed in 1907 for the control of livestock ticks. The station was taken over the British after the First World War and a Veterinary Pathology was also set up. The initial activities of the Station included research in rinderpest and trypanosomiasis, but breeding, nutrition, and animal husbandry were added to the activities of the centre as time progressed. The station became a Livestock Breeding Station in the 1950's when the Veterinary Science and Animal Husbandry Division was moved to Dar es Salaam to become the Central Veterinary Laboratory. The Livestock Breeding Station grew into a Research and Training Institute and eventually into a Livestock Production Research Institute while the Central Veterinary Laboratory became the Animal Diseases Research Institute. The Livestock Production Research Institute, Mpwapwa, and the Animal Diseases Research Institute, Dar es Salaam, were administered by government ministries upto 1981 when the Tanzania Livestock Research Organization (TALIRO) became operational and took over these institutes.

### Ecology

Tick research concentrated on surveys which provided information on the species of ticks prevalent in the country, their hosts, and geographical distribution. Physiography, vegetation and rainfall in the surveyed areas were also assessed, and brief notes on the disease transmission by each species were given. Studies on the geographical distribution and seasonal infection rates of different tick species by *Theileria parva* were established and indicated that apart from *Rhipicephalus appendiculatus* other tick species play no part in the transmission of East Coast Fever.

Studies on the life cycle of *R. appendiculatus* and the movement patterns of the tick on domestic animals provided information that established seasonal patterns of *R. appendiculatus* and other tick species. Consequently dipping strategies were suggested.

Research on aspects of pasture ecology of *R. appendiculatus* in relation to the different East Coast Fever zones and the possibility of using such ecological findings to achieve biological control of the tick has been undertaken.

### Acaricide resistance

Studies to establish baseline data for organochlorine acaricides and the resistance status of different tick species has been carried out in most parts of Tanzania. Testing of different acaricide formulations indicated that these formulations were effective against most of the tick species but some strains have developed resistance to Toxaphene.

## STATUS OF LIVESTOCK PESTS RESEARCH

Tick research is carried out by the Animal Diseases Research Institute, Dar es Salaam, and the Veterinary Investigation Centres at Arusha, Iringa, Mpwapwa, Mtwara, Mwanza, and Tabora. The institute and centres are located in such a way that they serve the whole country.

### Current Research Activities

1. Tick surveys and identification of different tick species prevailing in Tanzania.
2. Monitoring of acaricide resistance towards organochlorine acaricides.
3. Establishment of baseline data for organophosphorus acaricides.
4. Routine dipwash analysis to maintain the right strength.
5. Tick breeding for identification.
6. General surveillance on the incidence of tickborne diseases in Tanzania.

### Future priorities

**Ecology:**

1. To continue with tick surveys and identify the different tick species prevailing in Tanzania.
2. To confirm the strict seasonality of *R. appendiculatus* in the Southern Highlands Zone.
3. To monitor, regularly, infestation levels of *R. appendiculatus* in marginal zones, either when abnormally wet years occur, or when destocking policies create favourable dryseason pastures.
4. To provide experimental evidence of the unsuitability of sites in marginal zones for *R. appendiculatus.*
5. To determine the seasons of successful tick multiplication in areas where adults feed throughout the year.
6. To recommend tick control areas based on these results.
7. To observe the occurrence of tick-borne diseases in relation to tick burden.
8. To assess the management of dips in relation to the disease situation.

9. To carry out tick surveys in wildlife and study the role of the ticks on livestock diseases.

**Acaricide resistance:**

1. To continue monitoring acaricide resistance to organochlorine acaricides, and recommend changes to organophosphorus acaricides, where necessary.
2. After establishment of baseline data for organophosphorus acaricides, monitoring of resistance to these acaricides will be initiated.

General surveillance on the incidence of tick borne diseases in Tanzania:

1. To study the epizootiology of East Coast Fever in areas previously free from the disease and where *R. appendiculatus* has not been observed.
2. Field survey of Theileria infections in *R. appendiculatus.*
3. To study the pathogenecity of *T. velifera* and *T. taurotragi* in livestock.
4. To study the significance of carrier state in East Coast Fever re-infection.
5. To carry out East Coast Fever immunization trials.

**TRAINING REQUIREMENTS**

Training facilities exist in Tanzania for the training of dip attendants, dip analysts and technicians. Technicians receive certificates or diplomas in animal health, animal production, or veterinary laboratory technology. The Universities offer undergraduate training in veterinary medicine or animal science. Facilities for postgraduate training in entomology or insect science are not readily available at the University of Dar es Salaam or the Sokoine University of Agriculture. Tanzania requires training facilities for personnel to handle livestock ticks research and tsetse research. Facilities available at the ICIPE in the ARPPIS Programme are badly needed for training of staff from the Tanzania Livestock Research Organization.

**SUGGESTIONS FOR INCLUSION IN PESTNET**

**Tsetse flies**

About 60% of the total area of Tanzania is tsetse infested. The seven species infesting this area can serve as vectors of both human and animal trypanosomiasis. Tsetse flies are therefore considered important pests of livestock, and the possibility of including tsetse flies in the PESTNET should be given serious consideration.

**Master of Science Degree Training**

There is lack of training facilities for M.Sc. degree level in insect science in Tanzania. It is suggested that training facilities that will be in the PESTNET should include training for M.Sc. degrees.

## LIVESTOCK PESTS IN UGANDA

**By**

**Professor Okot Bwangamoi**

With respect to animal pests, no new advances have been accrued since the last report made at the Pestnet Planning Workshop in October 1985. The major ticks of economic importance are in the genera of *Rhipicephalus, Boophilus, Hyalomma* and *Amblyomma,* but *R. appendiculatus,* the vector of East Coast Fever is the top culprit. The usual control measures of spraying or dipping with acaricides is practiced by farmers but problems arise because sometimes acaricides cannot be obtained in the open market. Secondly, when acaricides are available, their costs are probihitive to many farmers. This has led many farmers to dilute their dipwashes beyond the recommended level. It was found that 75% of dipwash samples received at the Animal Health Research Centre were below strength. This practice has led to tick resistance against Delnav in Ankole, Western Uganda. The extent of the problem is still being investigated.

The other attendant problem is the maintenance of dips. Most dips have broken down and although IFAD has provided funds for the rehabilitation of the dips, other administrative problems have cropped up to obstruct work.

Because of the high cost of constructing a dip and the difficulty of maintaining it, it was considered necessary to try other alternatives. It is therefore planned to carry out field tests with pour-on acaricides such as BAYTICOL.

It is regrettable that work on the taxonomy of ticks which was done by Professor Mathses in Uganda in 1966 has so far not been published and if the manuscripts cannot be found, it may eventually be necessary to request PESTNET to fund a project to determine the species of ticks which occur in Uganda, their host range and geographical distribution.

Tsetse flies which had been pushed to a small corner near Lake Edward, by 1970 have again invaded wider grounds. The result has been epidemics of sleeping sickness in the Eastern Region of the country and serious loss of livestock through nagana. Work on this fly is conducted at UTRO in Tororo and it is necessary that a representative of that institute be invited to attend PESTNET meetings.

As far as training of staff in the fields of Ticks and Tsetse flies is concerned, Uganda is fortunate in having many qualified scientists. However, the constraints of funds have made many of them grow rusty. They would therefore benefit greatly by attending refresher courses and paying short working visits (up to 4 months) to ICIPE or other institutions where active and useful work is going on.

## LIVESTOCK TICKS IN ZAMBIA

*By*

*P.G. Sinyanywe*

**Past Research (up to 1980)**

Several extensive studies on the distribution and host relationships of ticks have been carried out by the National Council for Scientific Research (N.C.S.R.) and the Department of Veterinary and Tsetse Control Services (D.V.T.C.S.). Most of this work has been summarized in a monograph by N.C.S.R. Scientists which is presently being considered for publication. A second volume on the Taxonomy of Zambian ticks has been completed by N.C.S.R. scientists and is being published with assistance form an American University. A consi-

derable amount of data on tick-borne diseases has been accumulated in D.V.T.C.S. and N.C.S.R. and annual reports.

**Present Research (1980-86)**

The newly established Central Veterinary Research Institute (C.V.R.I.) at Balmoral, near Lusaka, has been involved in collaborative research on tick ecology with assistance from UNDP/FAO and FAO/DANIDA.

**Achievements todate include:**

1. A 2-year study of the phenology of ticks on cattle in central, southern and western Zambia.
2. A 3-year study on the development and survival of instars of *A. variegatum, B. decoloratus* and *R. appendiculatus.*
3. The development and application of an Intradermal test to assess host resistance to ticks in indigenous cattle.
4. An evaluation of the species integrity and ecology of *R. appendiculatus.* and *R. zambeziensis.*
5. A biosystematic revision of some species in the *Rhipecephalus* genus.

Most of the above work is now being prepared for scientific publication. Collaborative D.V.T.C.S. field station at Lutale was implemented in 1982 to assess the impact of ticks on productivity. This project is expected to continue until 1988 and includes several components:

1. The impact of ticks on LWG.
2. The impact of ticks on milk production, calving intervals and overall herd productivity.
3. An assessment of various tick control strategies such as novel acaricides (Ivermectin, Ear-Tags and Pour-Ons) and their strategic application.

Project herds and locally owned traditional herds are used for these studies. The main objective is to provide a sound economical basis for rational tick-control. Extension activities are also being implemented.

**Amblyomma variegatum Studies**

A national graduate student (Ph.D.) is now implementing a 3- year study on the biology and ecology of *Amblyomma variegatum.* This work will be carried out in part at the C.V.R.I. and in part at Lutale and will include aspects of:

1. Seasonality of all stages on cattle.
2. Development and survival in different habitats (Dambos and woodlands).
3. Host-resistance and potential immunization procedures.
4. Biology of the reproductive synchronization mechanisms (i.e. diapause).

**Training**

**Eastern Province Studies**

A 3-year programme of field investigations is being undertaken jointly by the Belgian bilateral agency and the D.V.T.C.S.

This project is studying the epidemiology and control as E.C.F. and the ecology and control of its main vectors, *R. appendiculatus* and *R. zambeziensis.*

**General Diagnostic Unit**

At the C.V.R.I., the tick ecology, protozoology and acaricide laboratories support the field services through identification and diagnostic services, monitoring acaricide resistance and dip wash analysis.

**RESEARCH ON TICK-BORNE (LIVESTOCK PESTS) DISEASE IN ZAMBIA**

Although tick-borne diseases have been recognized for a long time as a major constraint to cattle production, systematic research on the causal organisms and their overall effects on the contribution to livestock production started only in 1980.

In the past, in collaboration with the tick ecology and epidemiology units, research on tick-borne diseases, by the protozoology unit has concentrated on:

1. Surveys to determine the distribution and importance of various tick-borne diseases;
2. Isolation of *Anaplasma* spp., *Babesia* spp., *Theileria* spp. and *Cowdria ruminantium* from various areas of Zambia;
3. Laboratory studies to characterise these organisms, using both *in vivo,* in vitro and serological studies;
4. Examining effects of chemotherapeutic agents on the various tick-borne agents in the country.

Currently, the emphasis is on: assessing use of various immunogens in the control of malignant theileriosis, anaplasmosis, babesiosis and heartwater.

In the future it is planned to extend those procedures found useful in protecting cattle against tick-borne diseases and monitoring productivity of such immunized cattle. Efforts to assess efficacy of other possible chemotherapeutic agents will continue.

**Training**

Emphasis is being laid in training Entomologists to M.Sc. and Ph.D. levels in order to cope up with current scientific trends.

## CROP PESTS IN ZAMBIA

By

M.L. Kabuswe

In the past, research work on the crop pests in Zambia was mainly concentrated on the major pests of cotton due to the prime importance of the cotton crop in the economy of the country. However the steady increase of the population and the necessity to improve the nutrition of the people has resulted in an increased amount of attention being given to food crops such as cereals, oil crops and vegetables. Our present knowledge of the pests of the whole country is rather scanty in the absence of thorough investigations of the fauna of remote areas.

The outstanding economic importance of crop pests in Zambia is demonstrated briefly on cotton, maize, wheat, tobacco, cassava, citrus, grain legumes, sorghum, millet and vegetables.

The major cotton pests are American bollworm *(Heliothis armigera* Hb) spiny bollworm, *(Earias* spp.) red bollworm *(Diparopsis castanea),* Cotton Aphid *(Aphis gossypii)* Jassids *(Empoasca* spp.) Cotton stainer *(Dysdercus* spp.) Red spider mite *(Tetranynchus* sp.) and Termites *(Microtermes* sp. and *Hodotermes mos-*

*sambicus)*. Research work on these pests has been concentrated on the Testing of insecticides.

Maize is the main subsistence crop in Zambia. Over Zambia in general, underground pests of maize are of particular importance to farmers. In some areas and in certain seasons these pests become limiting factors in maize production and may reduce stands of maize by as much as 80 percent, thus greatly reducing the grain potential per acre. The major pests of seedling maize are maize rootworm *(Buphonella murina* Gerst.) and "fat John" *(Dereodus recticollis)*. Cutworms (Agrotis spp.) are a spasmodically serious pest of maize, following certain types of crop rotation and farm practices. Wireworms *(Psammodes* spp.) become a nuisance on sandy soils but are never of major importance. Lepidopterous borers *(Sesamia calamistis, Chilo* sp. and *Busseola fusca)* fell maize plants by weakening the main stem. Sporadic outbreaks of army worm *(Spodoptera exempta)* occur in years with particularly favourable conditions for the reproduction of the pests. Termites *(Macrotermes* sp.) have become a serious pest in recent years for small scale farmers where monoculture is frequently practiced. Maize streak virus transmitted by the leaf hoppers of the genus *Cicadulina is causing concern. Serious infections have been confined to early planted irrigated maize. New varieties of maize are now being screened for resistance to streak virus.*

*Cassava is after maize a widely grown subsistence staple especially in low rainfall areas. The serious threat to cassava production posed by the mealy bug (Phenacoccus* spp.) and green spider mite *(Mononychellus* sp.) was first reported in 1981 and recent surveys have confirmed the presence of these pests in 5 of the 9 provinces of Zambia. IITA has been contracted to carry out a biological control programme by aerial releases of natural enemies reared at IITA reseach centre.

Beans are among the most popular leguminous crops used as food in Zambia. The bean stem-fly *(Melanagromyza* spp.) is a real menace against the cultivation of these crops in Zambia. New varieties are being screened for torelance or resistance against this pest. Other notable pests of beans include red spider mite *(Tetranynchus* sp.), the bollworm *(Heliothis armigera)*, the pentatomid *(Nezara viridula)* and the bean aphid *(Aphis fabae)* the vector of bean common mosaic virus.

Sorghum and millet were reported to have been wiped out by the Armoured crickets *(Acanthoplus speiseri)* in the southern part of the country last year. The first report of a severe outbreak was received in 1975. There is urgent need for ecological studies of the pest before it spreads to other parts of the country.

Wheat production which is gradually on the increase is threatened by the American bollworm *(H.armigera)*, and occasionally by Army worms and termites *(Microtemites* sp.). Occasional insect pests of wheat include the edible grasshoppers *(Homorocoryphys* spp.). White grub lavae *(Eulepeda* spp.) and the stalk borer *(Sesamia cretica)*. Research work is being conducted with funds and expertise form Belgium Development Co-operation to find varieties resistant to the major diseases on rainfed wheat caused by *Helminthosporium stativum, Fusarium qraminearum, Puccinia graminis, Puccinia recondita and Xanthomonas campestris*. Irrigated wheat suffers from diseases caused by *Puccinia* sp. and *Erysiophe graminis (powdery mildew)*.

Tobacco is an important foreign exchange earner grown over six thousand hectares of land. This crop grown mainly by commercial farmers is attacked by soil pests, namely, nematodes *(Meloidogyne javanica)* false wireworms (lavae of various species of Tenebrionid beetles such as *Psammodes* sp.) and white grubs (scarabaeid beetle) lavae are known to be an important cause of plant death in the period immediately following transplanting. Cutworms (mainly *Agrotis segestum)* frequently cause severe losses through chewing the stem of transplants at soil level. Flowers of tobacco plants are occasionally attacked by American bollworm *(H. armigera)*.

*Vegetables included in research programmes in Zambia are cabbage, tomato, potato and okra. Cabbage is mainly attacked by Diamond-back moth (Plutella xylostella)*. Two species of parasites of this pest, the larval parasite *(Apanteles plutellae)* and the pupal parasite *(Thyraella collaris)* are being successfully used for the control of the pest. Potatoes are attacked by potato tuber moth *(Phthorimaea operculella)*. The two exotic species of tuber moth parasites, the egg parasite *(Capidosoma koehleri)* and the larval parasite *(Bracon greeni)* have been mass reared and subsequently released in various parts of the country. These parasites have established themselves very well in all release sites. Tomatoes are mainly attacked by American bollworm *(H.armigera)* the leafworm *(Spodoptera littoralis)* and red spider mite *(Tetranynchus* sp.). Leaf spot disease caused by *Alternaria solani* and Fusarium oxysporum usually result in substantial yield losses.

Citrus is widely grown throught Zambia both privately and on a commercialscale. The major pests of citrus are Red scale *(Aonidiella auranti)* soft brown scale *(Coccus hesperidum)*, black citrus aphid *(Toxopteria citricidus)* false codling moth *(Arqyroplole Leucotreta)* and citrus Psylla *Spanioza erytreae)*.

Investations on the effect of insecticides on pests have been carried out in various parts of the country although Zambia does not have a pesticide Registration scheme. At the present time insecticides can be put on the market with any claims which the manufacturers like to make printed on their labels. The purchaser has no protection other than the reputation of the manufacturer. This is a clearly undesirable but testing insecticides and verifying the truth of statements about their efficacy is a big task. It is, however, one which will have to be faced in the future and facilities for testing will have to be developed.

Routine work on biological control of potato tuber moth, Diamond back moth, red spider and russet mites, fruit flies and American bollworm has been continued for many years. The beneficial natural enemies of these pests were mass reared and subsequently released in the infested areas. The releases are summarised in Table 1.

The following are the main biological control projects which are being carried out in Zambia.

1. Potato tuber moth on potatoes.
2. Diamondback moth on crucifers.
3. Red spider and russet mites on tomatoes.
4. American bollworm on tomatoes and maize.
5. Red scale on citrus.
6. Fruit flies on cucurbits.

**TABLE 1. Summary of Biological Control activities in Crop Pests**

| No. | Parasite/Predator | Host Parasitism | |
|---|---|---|---|
| 1. | *Capidosoma koehleri* | Potato tuber moth egg | 80-90 |
| 2. | *Bracon greeni* | " " " (larva) | 60% |
| 3. | *Apanteles plutellae* | Diamond back moth (larva) | 40-70% |
| 4. | *Thyraella collaris* | " " " (pupa) | 10% |
| 5. | *Phytoseiulus persimilies* | Red spider and Russet-(mite) | - |
| 6. | *Trichogramatodea armigera* | American bollworm (egg) | - |
| 7. | *Apanteles ruficrus* | " " " (larva) | - |
| 8. | *Opius longicandatus* | Fruit flies (Dacus spp) | 5% |
| 9. | *Aphytis spp.* | Citrus red scale | - |

## RESUME OF THE PRESENT STATE OF RESEARCH CAPABILITY AND PROGRAMMES ON LIVESTOCK TICKS AT THE NATIONAL COUNCIL FOR SCIENTIFIC RESEARCH LIVESTOCK AND PEST RESEARCH CENTRE IN ZAMBIA

By

D.M. Wanchinga

### A. ORGANIZATION AND INFRASTRUCTURE

The present research activities on livestock ticks at the NCSR/LPRC is sub-divided into the following sub-programmes: I. Tick Ecology/Colonization II. Tick Toxicology III. Tick Taxonomy IV. Disease Diagnostics. Each of these subprogrammes has adequate laboratory space with fairly well developed laboratory infrastructure relevant to its activities. However, each sub-programme is continuously working towards the strengthening of its resources through local and external funding.

**B. Research Projects**

The projected major research project of the Programme is the multidisciplinary project which aims at studying the impact of tick infestation alongside other constraints affecting livestock production in the traditional sector. We are now at the implementation stage of the project. However, individual sub-programmes have their own on-going projects as follows:

I. **Tick Ecology/Colonisation** (a) Prior to 1983/84, the major thrust of the tick research programme had been the epizootiology of Theileriosis. The sub-programme is carrying out ecological studies on its major vectors in an effort to explain the observed field distribution patterns of the tick vectors. (b) Several species of ticks are maintained in the central rearing laboratory, and biological data is maintained on each species. II. *Tick Toxicology.* The sub-programme is actively involved in two major projects: (a) The identification of local plants with acaricidal potential with a view to develop acaricides. (b) The mechanisms of tick resistance are being studied. (c) Routine testing of acaricides used in the country. III. **Tick Taxonomy.** The subprogramme is involved in the routine identification of ticks and is currently preparing a monograph of Zambian ticks. The sub-programme is also reviewing the taxonomic status of some tick species described in Zambia. The work is being carried out in conjunction with other specialists within and outside the country. IV. **Disease Diagnostics** Prior to 1983/84 this sub-programme was the nucleus of the research programme on the epizootiology of theileriosis. Since the shelving of this project, for financial reasons, the section has been involved only in routine diagnosis of tick-borne diseases.

C. **Other Projected Activities.** The tick research programme (Tick Ecology) is planning to embark on other research projects, such as the effects of supplementary feeding (with conventional feeds and traditional crop by-products) on tick infestation levels and on the use of tick-derived vaccines for tick control.

Possible Areas of Co-operation The tick research programme has potential for cooperating with other organisations in its overall activities. These areas include research on natural products, tick resistance for tick control, and in the training of core and supporting staff and in other related areas.

**D. Personnel**

| Name of Researcher | Qualification/ Discipline | Nationality |
|---|---|---|
| Dr. D.M. Wanchinga | B.Sc., Dip. An. Man., M.Sc., Ph.D. (Tick Ecology) | Zambian (Head) |
| Dr. F.P. Zulu | B.Sc., Ph.D (Tick Taxonomy) | Zambian |
| Dr. J.C. Purakal | B.Sc.,M.Sc., Ph.D. (Tick Toxicology) | Indian |
| Mr. C.K. Kaposhi | B.Sc., M.Sc., DIC. (Tick Toxicology) | Zambian |
| Mr. F. Mwangala | B.Sc., M.Sc. DIC. (Tick Toxicology) | Zambian |
| Mr. G.C. Nhandu | B.Sc. (Tick Ecology) | Zambian |
| Mr. J.B. Mulile | B.Sc., M.Sc., DIC (Tick Ecology) | Zambian |
| Dr. M. Khondowe | B.V.Sc. (Disease Diagnostic) | Zambian |

There are also several supporting staff trained upto technician's certificate level. They are all local staff.

## STATUS OF LIVESTOCK PEST RESEARCH, RESEARCH PRIORITIES AND TRAINING REQUIREMENTS IN ZIMBABWE

By

W.N. Madzima

### I. Introduction

There are 5.6 million cattle in Zimbabwe of which about 2 million are owned by the commercial farming sector and the rest by the communal farmers. Goats number approximately one million, sheep 0.3 million and pigs 0.07 million and these are almost equally distributed between commercial and communal farmers.

The major cattle breeds in the commercial farming sector in descending numerical order are the Brahman, Simmentaler, Hereford, Aberdeen Angus, Africander, Sussex, Mashona, Tuli and Nkoni among beef types and Holstein, Jersey, and Guernsey among dairy types. The dairy breeds total about 100,000 head and nearly all are

in the commercial herd. The communally owned herd is nearly all of the Zebù/Sanga types of which three major indigenous beef breeds have been established through selection namely Mashona, Tuli and Nkoni breeds. Cattle are kept under a variety of management regimes throughout the country according to agro-ecological conditions except for the extreme northern and north-western parts of the country which is tsetse-infected. Altogether approximately 55,OOO square kilometers of land is infested and approximately O.3 million cattle live in tsetseinfested country in the northeastern part of the country.

**II LIVESTOCK PESTS**

(a) Ticks:

In Zimbabwe there are known to be nine species of soft ticks of which only two are of importance to man, namely; the fowl tampan *(Argas walkerae)* and the warthog tampan *(Ornithodoros moubata)* which carries African swine fever. As a result commercial pig production in Zimbabwe is restricted to areas where warthogs do not occur.

52 species of hard ticks have so far been identified. Only a few of these are of economic importance. The most important are the brown ear tick *(Rhipicephalus appendiculatus)* which transimits theileriosis, the bout tick *(Amblyomma hebreaum)* which transmits heartwater disease and the blue tick *(Boophilus decoloratus)*, which transmits babesiosis (redwater) and anaplasmosis (gallsickness). The Asian blue tick *(Boophilus microplus)*, occurs in neighbouring Mozambique and is potentially of importance as a vector of Asian babesiosis but is not established in Zimbabwe at present. The lowveld brown ear tick *(Rhipicephalus zambeziensis)* transmits buffalo theileriosis (corridor disease) to cattle. The redlegged tick *(Ripicephalus evertsi)* occurs commonly in equines. The red-legged tick, the glossy brown tick *(R. simus)* and bout-legged tick *(Hyalomma rufipes)* are fairly common on cattle and have all been implicated in the transmission of anaplasmosis. Another bout-legged *(Hyalomma truncatum)* is responsible for the condition of "sweating sickness" in calves caused by a toxin. The immature stages of the bout tick and the brown ear tick also bite man and frequently transmits African tick-bite fever to people.

Since 1914 dipping of cattle for the control of ticks has been compulsory. According to our legislation cattle must be dipped in an approved acaricide once every 7 days during 8 months of the year from November to June and once every 14 days during the remaining 4 months from July to October. These dipping regimes have been rigorously enforced over the last 7O years and were largely responsible for the low incidence of tickborne diseases in Zimbabwe and the eradication of classical East Coast Fever in 1954. The effectiveness of our tick control was demonstrated in a dramatic way between 1976 and 1979 when as a result of the disruption of dipping at the height of the Liberation War about 1 million cattle died mainly from tick-borne diseases.

There are in all approximately 7,000 dipping facilities in Zimbabwe of which 2,200 dip-tanks are in communal areas and are operated by Government and the remaining 4,000 plus dip-tanks and spray-races are in the commercial farming sector and are operated privately with Government providing supervisory and advisory services. The cost of dipping in the procurement of acaricide alone is approximately Zim $ 10 million in foreign currency. If operating costs are added to this figure it becomes very clear that tick control constitutes a very significant fraction of the cost of livestock production. This realization has led Government to direct research towards more economical methods of controlling ticks and tick-borne diseases. In this regard research is under way into the development of vaccines against theiloriosis and cowdriosis and the improvement of those against babesiosis and anaplasmosis. Other experiments are in progress to assess the effect of ticks without disease on cattle production and productivity. These two research approaches will hopefully eventually enable the adoption of a system of control based on a sufficient level of immunity (naturally or artificially acquired) against tick-borne diseases and less frequent dipping to keep tick numbers below a certain economic threshold but allowing livestock exposure to ticks and the development of enzootic stability.

(b) Tsetse Fly:

The two species of tsetsefly in Zimbabwe are *Glossina morsitans* and *G. pallidipes*. Potentially nearly half of the country provides a suitable habitat for the tsetse-fly but to date only about 14% of the country (55,000 sq. km.) is still infected mainly in the sparsely populated north-western, northern and north-eastern parts of the country, however nearly 0.3 million cattle are in these areas and bovine trypanosomias *(Trypanosoma congolense* and *I. vivax)* are a major problem. Every year a total of 120,000 blood smears are taken at monthly cattle inspections in these areas and on average 60,000 treatments are given using curative or prophylactic drugs. Human trypanosomiasis is almost non-existant except for a few cases witnessed in some years on the border with our northern neighbour.

Since 1982 approximately 10,000 square km. is sprayed against tsetse-fly every year of which about 8,000 sq. km. is groundsprayed using 4% DDT and 2,000 sq. km. is aerially sprayed using fixed-wing aircraft with endosulphan. Recently new methods of control have been developed using the artificial odours of actone and octenol as attractants in combination with insecticide-impregnated targets distributed at a density of 4 per sq. km. have shown this method of tsetse control as a viable future option and one with minimal environmental detrimental effects. Thus research in Zimbabwe is presently concentrating in improving the effectiveness of the odourbaits and the adaptation of the targets in field tsetse control. Further research is aimed at perfecting the methods of aerial spraying using fixedwing aircraft in rugged terrain.

**III PRIORITIES OF LIVESTOCK PEST RESEARCH**

**Tick Research**

1. To determine what tick species occur in Zimbabwe and their hosts, distributions and disease associations.

This work was started in 1975 and is now nearing completion.

2. To study the seasonal occurrence and population dynamics of economically important tick species. For most species adequate data are now available. The only important species that require a lot more work are *Amblyomma hebraeum* and *A variegatum*.

3. To study the survival, development and behaviour of economically important tick species under field conditions. Considerable work has been done in the highveld but this needs to be extended to the lowveld.

4. To study the role of alternate wild hosts in maintaining tick populations on cattle ranches. A research programme on this is fairly advanced.

5. To investigate tick problems in wildlife reserves and to devise methods of biological control.

6. To study host resistance to the major economically important tick species. Laboratory studies on *Boophilus* spp, *A. hebraeum* and *Rhipicephalus appendiculatus* have been undertaken. Field studies as part of the project on the economics of tick control, are underway at present in respect of *A. herraeum* and *R. appendiculatus*

7. To determine production losses in cattle caused by *Rhipicephalus appendiculatus* and *Amblyomma hebraeum*. Work on the effects on liveweight gain has been completed and data on the effects on mild production and calf growth are currently being recorded. This is the major research project being undertaken by the Tick Research Unit at present.

8. To produce computer models using available information on tick ecology, breed resistance and production losses caused by ticks. These will be used to simulate control strategies so as to determine the most effective and economic strategies for use in the field.

9. To undertake serological surveys to determine the distributions and extent of enzootic stability of economically important tick-borne diseases of cattle. This has been done for *Babesia bigemina, B. bovis, Anaplasma marginale* and the *Theileria parva* group but not *Cowdria ruminantium* due to the lack of a serological test for this disease. It is hoped that a serological test will be established in the near future by a heartwater project (USAID) underway.

10. To obtain more detailed information on the epidemiology of tick-borne diseases so as to develop epidemiological models for use in planning disease control strategies. Work on the epidemiology of *Theileria* spp is currently in progress.

11. To study tick resistance to acaricides in Zimbabwe to see if this is a significant problem.

12. To isolate and test field strains of theileriosis for use in the immunization with treatment method and trials with Clexon and Hallufuginon.

13. To conduct immunization trials with candidate strains of the heartwater organism.

**TSETSE RESEARCH**

1. To research into and test odour-baits for the surveying and the eradication of tsetse-fly through the use of traps and insecticide-impregnated targets, respectively.

2. To adapt and improve fixed-wing aerial spraying techniques in rough terrain.

3. To eradicate the tsetse-fly from the country by a combination of methods with the least effect on the ecosystem.

**IV TRAINING**

To upgrade the level of expertise of those officers in posts through short-term and/or M.Sc. courses.

Perhaps later when the staff situation has improved:

To train specialist tick ecologist(s) through a Ph.D programme with however not more than a total period of one year spent outside Zimbabwe. Preferably the programme would be on local problems and under some local supervision as both facilities, infrastructure and supervisors are adequately available.

We hope to beneft from PESTNET in the exchange of information and rely on ICIPE for basic research in host resistance and shall be interested in the field testing of their findings. We look forward to the implementation of the training programme as manpower is a major constraint in our programmes.

## RESEARCH PRIORITIES IN FOOD CROP PESTS IN ZIMBABWE

By

S.Z. Sithole

**1. INTRODUCTION**

The main staple grain cereal in Zimbabwe is maize with sorghum, pearl millet and finger millet playing a very small part. Sorghum and millets are important subsistence crops in the rural areas where precipitation is both meagre and unreliable, a condition which is not favourable to maize production. Increased urbanization has made wheat and rice become important food crops and this is a reflection of changes in food consumption pattern. Apart from cereal crops other food crops include such grain legumes as groundnuts, edible beans and cowpea, and vegetables. These food crops are attacked by different insect pests with consequential heavy losses in yields.

Research into the control of crops pests is being carried out by such Zimbabwean Institutions as:

1. The Department of Research and Specialist Services, Ministry of Lands, Agriculture and Rural Resettlement.
2. The Faculty of Agriculture, University of Zimbabwe.
3. Non-governmental organizations including agrochemical companies.

Prior to independence, crop protection research activities were more or less confined to the commercial sector of the Zimbabwe's agricultural systems as very little was done to protect crops against pests in the rural farming sector. During the past five years of Zimbabwe's independence, crop protection activities (by the Plant Protection Research Institute in Harare) were extended to reach the rural farmer and more information on the crop pest situation is fast-accumulating in the Department of Research and Specialist Services.

**2. SETTING UP OF RESEARCH PRIORITIES**

The Agricultural Research Council of Zimbabwe

plays an important advisory role in the setting up of research priorities and planning of activities but the Department of Research and Specialist Services carries out the responsibility of undertaking its research and programme planning. Prior to independence research priorities in the Department of Research and Specialist Services were based on the recommendations of the technical committee and commodity sub-committees of the Agricultural Research Council; extension Services personnel attached to the Department articulated research priorities; agro-ecological zones dictated what research was to be done; and export index values. At present, research priority criteria are based on Government objectives in relation to Agricultural activities including:

1. Achieving and maintaining food self-sufficiency and regional food security;
2. Integration of commercial and rural agricultural sectors.
3. Promoting balance in agricultural development in the SADCC, Region.
4. Maintaining agriculture as a major foreign exchange earner.
5. Increasing land productivity in all forms of agriculture.
6. Acceleration of the rate at which levels of absolute poverty in the rural areas are reduced coupled with the standard of living of the rural population.

3. **Insect Pests of Maize and Sorghum**

Check lists of insect species feeding on maize and grain sorghum are depicted in tables 1 and 2 respectively. The tables show incidences of the various insect pests in different ecological zones surveyed by the Plant Protection Research Institute during the 1984/85 cropping season. At present, research priorities involving the use of pheromones insecticides and cultural practices in control strategies are given to the stemborer complex (comprising *Busseola fusca, Chilo partellus* and *Sesamia calamistis),* termites *(Microtermes* spp and *Macrotermes* spp.), leaf hopper *(Cicadulina mbila),* white grubs *(Eulepida mashona)* and armoured crickets *(Acanthoplus* spp. and *Enyaliopsis* spp.)

4. **Insect Pests of Pearl Millet**

Pearl millet is attacked by relatively few insect pests (Table 3). Although armoured crickets rank first in economic importance, they are an irregular pest of pearl millet and research into their control is by and large restricted to insecticidal control.

5. **Insect Pests of Groundnuts**

A number of insects attack groundnuts in the field (Table 4) including *Hilda patruelis, Aphis craccivora,* termites and whitegrubs. *Hilda patruelis* ranks first in economic importance and current research into its control involves chemical and cultural methodologies together with the use of resistant cultivars in a multilocational trial. Loss in yield can be as high as 70% in cases of high *Hilda* infestation.

6. It is the general practice for cowpea and beans to be intercropped with other crops such as cereal in the rural sector of Zimbabwe's agricultural systems. Cowpea and beans are subject to attacks by blister beetles, *Mylabris* spp., pod-sucking bugs, *Acanthomyia* spp., *Anoplocemis curvipes,* white fly, *Bemesia tabaci;* leafhopper, *Empoasca* sp; beanfly, *Melangromyza phaseoli* and *Aphis craccivora.*

*At present research is being conducted into the control of the bean-stem maggot by chemicals and hilling up around plants to minimise losses which can range from 50 to 100%.*

7. **Insects Pests of Irish Potato**

Several insects feed on the Irish potato but control research activities at the present moment lay emphasis of the chemical, cultural and biological control of the potato tuber moth *(Phthorimae operculella).* The effect of parasites such as *Copidosoma koechleri* and *Apanteles subandinus* and hilling around the plants on the tuber moth infestation are currently being investigated together with insecticidal application.

8. **Insect Pests of Vegetables**

Insects attacking cabbage include the webworm *(Hellula undalis),* diamondback moth *(Plutella xylostella)* and the cabbage aphid *(Brevicoryne brassicae).* Current research activities are concentrating on the chemical and cultural control methodologies of these cabbage pests. The red spider mite *(Tetranychus* spp) and the tomato Russet mite *(Tetranychus frater)* are the most important insect pests of tomatoes and their control is a matter of priority in tomato entomology.

9. **Stored Products**

Cereals and legumes occupy a strategic position on the agricultural economy of Zimbabwe and several insects are known to attack them both in the field and in store (Table 5). Research into the methodologies of controlling these pests is seriously exercuted in the drive to achieve and maintain food self sufficiency in Zimbabwe and food security in the SADC region.

**Table 5. Insect Pest of Stored Products in Order of Importance**

| Pest | Commodity |
|---|---|
| *Sitophilus zeamais* | Maize, sorghum, pearl millet and finger millet. |
| *Sitotroga cerealella* | Cereals |
| *Tribolium* spp | Cereals |
| *Ephestia* (Cadra) | Cereals |
| *Cautella* spp | Cereals |
| *Bruchids* | cowpea, beans. |

## TRAINING

Zimbabwe stands to gain from participation in the ICIPE's Training programme especially in relation to developing manpower in food crop entomology, interaction with scientists of ICIPE and other international scientists. Accordingly, Zimbabwe's position regarding training at ICIPE is crystall clear particularly as participation would bring newly developed methodologies, technologies and their feasibility testing under local conditions. Flexibility in some terms of reference of the ARPPIS Programme would facilitate Zimbabwe's full participation in the training programme.

The Plant Protection Research Insitute would like its professional personnel trained at ICIPE in the following areas:

1. Higher level Training - M.Sc. and Ph.D. in some entomological aspects relevant to Zimbabwe and

on the provision that research is carried out in Zimbabwe.

2. Training in the methodologies pertaining to the establishment of threshhold level of pest populations. This is necessary as a background information to the successful implementation of an integrated pest management programme in the rural sector of Zimbabwe's agricultural systems. Training in this aspect is required on a short term basis.

3. Training in methodologies in the areas of Insect pest taxonomy, mass rearing and general pest management strategies at technician and technical assistant levels (technical support levels) and if possible one place be reserved for Zimbabwe on yearly basis until it is deemed unnecessary by the policy makers.

TABLE 1. **Insect Pests of Maize.** The incidence and severity of damage estimated are designated by a score between zero and ten (0, no incidence; 1 - 2, very low incidence; 3 - 4, low incidence; 5 - 6, intermediate incidence; 7 - 8, high incidence, 9 - 10, very high incidence). Roman numerals indicate Farming Regions.

| INSECT PEST | | INCIDENCE AND SEVERITY OF DAMAGE SCORE | | | | | ECONOMIC IMPORTANCE |
|---|---|---|---|---|---|---|---|
| COMMON NAME | SCIENTIFIC NAME | I | II | III | IV | V | RANK |
| Maize stalk borer | *Busseola fusca* | 4 | 5 | 4 | 3 | 3 | 2 |
| Spotted stem borer | *Chilo partellus* | 4 | 5 | 4 | 3 | 3 | 2 |
| Pink stem borer | *Sesamia calamistis* | 4 | 5 | 4 | 3 | 3 | 2 |
| Termites | *Macrotermes spp.* | | | | | | |
| | *Hodotermes mossambicus* | 2 | 3 | 3 | 4 | 4 | 3 |
| Leaf hopper (streak vector) | *Cicadulina mbila8* | 4 | 2 | 0 | 0 | 4 | |
| American bollworm | *Heliothis armigera* | 0 | 1 | 1 | 0 | 0 | 11 |
| Elegant grasshopper | *Zonocerus elegans* | 2 | 2 | 2 | 3 | 3 | 6 |
| White grubs | e.g. *Eulepida mashona* | 2 | 3 | 2 | 1 | 1 | 10 |
| Maize aphid | *Rhopalosiphum maidis* | 3 | 3 | 4 | 2 | 2 | 5 |
| Blister beetles | *Mylabris sp.* | 1 | 1 | 1 | 1 | 1 | 9 |
| Cutworms | *Agrotis spp.* | 3 | 2 | 3 | 2 | 1 | 8 |
| Snout beetles | e.g. *Systates spp* | 3 | 3 | 2 | 2 | 1 | 7 |
| Armoured crickets | *Acanthoplus spp* | . | 3 | 4 | 4 | 6 | 9 |
| | *Enyaliopsis spp.* | | | | | | |

TABLE 2. Insect Pests of Sorghum. The incidence and severity of damage estimated are designated by a score between zero and ten (0, no incidence; 1 - 2, very low incidence; 3 - 4, low incidence; 5 - 6, intermediate incidence; 7 - 8, high incidence, 9 - 10, very high incidence). Roman numerals indicate Farming Regions.

| INSECT PEST | | INCIDENCE AND SEVERITY OF DAMAGE SCORE | | | | | ECONOMIC IMPORTANCE |
|---|---|---|---|---|---|---|---|
| COMMON NAME | SCIENTIFIC NAME | I | II | III | IV | V | RANK |
| Maize stalk borer | *Busseola fusca4* | 3 | 3 | 4 | 5 | 1 | |
| Spotted stem borer | *Chilo partellus* | 4 | 3 | 3 | 4 | 5 | 1 |
| Pink stem borer | *Sesamia calamistis* | 4 | 3 | 3 | 4 | 5 | 1 |
| Termites | *Macroterms spp.* | | | | | | |
| *Hodoterms mossambicus* | 0 | 2 | 1 | 1 | 2 | 14 | |
| American bollworm | *Heliothis armigera* | 0 | 0 | 0 | 3 | 3 | 13 |
| Elegant grasshopper | *Zonocerus elegans* | 0 | 0 | 1 | 4 | 4 | 10 |
| Armoured crickets | *Acanthoplus spp.* | | | | | | |
| | *Enyaliopsis spp.* | 0 | 0 | 1 | 5 | 9 | 4 |
| Maize aphid | *Rhopalosiphum maidis* | 2 | 3 | 3 | 4 | 4 | 3 |
| Sorghum aphid | *Aphis sorghi* | 3 | 3 | 3 | 4 | 4 | 2 |
| Shoot fly | *Atherigona soccata* | 0 | 2 | 2 | 2 | 3 | 9 |
| Green stink bug | *Nezara viridula* | 1 | 1 | 1 | 3 | 3 | 8 |
| Cotton stainers | *Dysdercus spp.* | 0 | 1 | 1 | 3 | 3 | 11 |
| Sorghum midge | *Contarinia sorghicola* | 0 | 3 | 2 | 2 | 3 | 7 |
| Coreid bugs | *Anoplocnemis curvipes* | 0 | 4 | 1 | 3 | 3 | 6 |
| Grasshoppers | *Cataloipus cognatus* | 0 | 0 | 0 | 2 | 3 | 9 |
| | *Pycnodictya kilosana* | 0 | 0 | 0 | 1 | 2 | 18 |
| | *Oedoleus sp.* | 0 | 0 | 0 | 1 | 2 | 17 |
| | *Lobosceliana loboscelis* | *0* | *0* | *0* | *1* | *2* | *16* |
| | *Gastrimargas crassipes* | 0 | 0 | 0 | 1 | 2 | 15 |

**TABLE 3. Insect Pests of Pearl Millet.** The incidence and severity of damage estimated are designated by a score between zero and ten (0, no incidence; 1 - 2, very low incidence; 3 - 4, low incidence; 5 -6, intermediate incidence; 7 - 8, high incidence, 9 - 10, very high incidence). Roman numerals indicate Farming Regions.

| INSECT PEST | | INCIDENCE AND SEVERITY OF DAMAGE SCORE | | | | | ECONOMIC IMPORTANCE |
|---|---|---|---|---|---|---|---|
| COMMON NAME | SCIENTIFIC NAME | I | II | III | IV | V | RANK |
| Stem borers | *Busseola fusca* | 0 | 2 | 2 | 3 | 3 | |
| | *Sesamia calamistis* | | | | | | |
| | *Chilo partellus* | | | | | | |
| Maize aphid | *Rhopalosiphum maidis* | 0 | 0 | 2 | 3 | 3 | 3 |
| Sorghum aphid | *Melanaphis sacchari* | 0 | 0 | 2 | 3 | 3 | 4 |
| Termites | *Macrotermes spp.* | 0 | 0 | 3 | 2 | 2 | 5 |
| | *Hodotermes mossambicus* | | | | | | |
| Elegant grasshopper | *Zonocerus elegans* | 0 | 0 | 2 | 2 | 2 | 7 |
| Green stink bug | *Nezara viridula* | 0 | 0 | 1 | 1 | 1 | 8 |
| Blister beetles | *Mylabris spp.* | 0 | 0 | 0 | 1 | 1 | 10 |
| American bollworm | *Heliothis armigera* | 0 | 0 | 0 | 1 | 1 | 6 |
| Amoured crickets | *Acanthoplus spp.* | 0 | 0 | 0 | 3 | 9 | 1 |
| | *Enyaliopsis spp.* | | | | | | |
| Cotton stainer | *Dysdercus sp.* | 0 | 0 | 1 | 1 | 1 | 9 |

*TABLE 4.* **Insect Pests of Groundnuts.** The incidence and severity of damage estimated are designated by a score between zero and ten (0, no incidence; 1 - 2, very low incidence; 3 - 4, low incidence; 5 -6, intermediate incidence; 7 - 8, high incidence, 9 - 10, very high incidence). Roman numerals indicate Farming Regions.

| INSECT PEST | | INCIDENCE AND SEVERITY OF DAMAGE SCORE | | | | | ECONOMIC IMPORTANCE |
|---|---|---|---|---|---|---|---|
| COMMON NAME | SCIENTIFIC NAME | I | II | III | IV | V | RANK |
| Groundnut aphid | *Aphis craccivora* | 2 | 2 | 2 | 2 | 1 | 4 |
| Groundnut hopper | *Hilda patruelis* | 3 | 4 | 3 | 2 | 2 | 1 |
| Termites | *Macrotermes spp.* | 2 | 3 | 3 | 3 | 3 | 4 |
| | *Hodotermes mossambicus* | | | | | | |
| Coreid bugs (tip wilters) | *Anoplocnemis curvipes* | 1 | 2 | 3 | 1 | 2 | 5 |
| Grasshopper | *Crytacanthacris aeruginosa* | 2 | 1 | 2 | 1 | 1 | 7 |
| White grubs | *Eulepida mashona* | 1 | 3 | 2 | 2 | 1 | 5 |
| Blister beetles | *Mylabris spp.* | 3 | 4 | 3 | 2 | 1 | 3 |
| Elegant grasshopper | *Zonocerus elegans* | 2 | 2 | 2 | 1 | 7 | |
| Long-horned grasshoppers | *Cryptostephanus sp.* | 1 | 2 | 1 | 0 | 1 | 10 |
| Leaf hoppers | *Empoasca spp.* | 1 | 0 | 2 | 2 | 2 | 7 |
| Green stink bug | *Nezara viridula* | 1 | 1 | 1 | 1 | 1 | 11 |

# PART V
# ANNEXES

## PROGRAMME OF THE MEETING
## COMPOSITION OF THE MEETING
## LIST OF PARTICIPANTS AND ADDRESSES

# PROGRAMME

**SUNDAY, 22 June 1986**

| | |
|---|---|
| | Arrival and Registration |
| 1830—2030 | Reception |

**MONDAY, 23 JUNE 1986**

| | |
|---|---|
| 0800—0845 | Registration of participants **(Reception Area)** |
| | **First Plenary Session (Conference Hall)** |
| 0900—0915 | Welcome address by Professor Thomas R. Odhiambo Director, ICIPE **(Conference Hall)** |
| | Introduction of Chairman for PESTNET Implementation meeting |
| 0915—0930 | Overview of PESTNET: The rationale and need for a crop and livestock pest network in Africa (Dr. Paul Lippold) |
| 0930—0945 | Review of Pestnet Mission report visit to countries in East, Central and Southern Africa (Dr. J.J. Ondieki) |
| 0945—1000 | Discussion |
| 1000—1015 | GROUP PHOTOGRAPH |
| 1015—1045 | TEA/COFFEE BREAK |
| | **Second Plenary Session (Conference Hall)** |
| **1045—1235** | **Country Papers** |

| | |
|---|---|
| Burundi | 1045 |
| Ethiopia | 1055 |
| Kenya | 1105 |
| Malawi | 1115 |
| Rwanda | 1125 |
| Somalia | 1135 |
| Sudan | 1145 |
| Tanzania | 1155 |
| Uganda | 1205 |
| Zambia | 1215 |
| Zimbabwe | 1225 |

| | |
|---|---|
| 1235—1400 | LUNCH BREAK |
| 1400—1445 | Discussion on Common Regional Pest Problems arising from country papers |
| 1445—1515 | TEA/COFFEE BREAK |
| | **Third Plenary Session (Conference Hall)** |
| **1515—1630** | **Presentation of Relevant ICIPE Programmes** |
| 1515—1535 | Outreach and Training (Dr. C.P.F. De Lima, Dr. M.E. Smalley and Mr. J.F. Omange) |
| 1535—1545 | Crop Pests (Professor K.N. Saxena) |
| 1545—1555 | Biological Control (Dr. M. Odindo) |
| 1555—1605 | Livestock Ticks Research (Dr. P.B. Capstick) |
| 1605—1615 | Tsetse research (Dr. L.H. Otieno) |
| 1615—1630 | Social Science in Crop and Livestock Pest Research — Dr. Pala Okeyo |
| 1630—1700 | Discussion |
| | **Evening Programme for Invited Guests Only** |
| 1800—1900 | Pre-dinner refreshments and video on ICIPE |
| 1900—1915 | Address by Guest of Honour: Hon. W.M.A. Saina, Assistant Minister for Agriculture and Livestock Development |
| 1915—2100 | DINNER |

**TUESDAY, 24 JUNE 1986**

0845—1045 Chairman of PESTNET Implementation meeting to discuss functioning and distribution of work among 2 working groups.

**2 Working Group Sessions**

To run concurrently

**Group 1**

**Organization and Linkages for PESTNET**

Chairman — Member State
Participating Countries — 1 member each
Rapporteurs — Dr. Omolo, Dr. Pala Okeyo and Ms. Mary Bugembe

Venue — **(Board Room)**

**Group 2**

**Extent of Cooperation and Work Plans for Research, Training, Information and Documentation**

Chairman — Member State
Participating Countries — 1 member each

Rapporteurs

**Research**
Dr. L.H. Otieno, Dr. P. Capstick, Prof. K.N. Saxena

**Training**
Mr. J. Omange, Dr. M.F. Smalley

**Information**
Mr. L. Okola, Mr. J. Omange

**Documentation**
Mr. L. Okola, Dr. M.F. Smalley

Venue — **Conference Hall**

1045—1115 TEA/COFFEE BREAK

1115—1230 Rapporteurs of Groups Summarise the discussions and obtain general agreement from each group for typing in draft.

(Typing to be done during lunch break and copies made available to participants)

1230—1400 LUNCH BREAK

**Plenary Session for Reports from Working Groups**

**General Meeting**

Venue — **Conference Hall**

1400—1430 Presentation of Working Group 1 by Group Chairman

1430—1445 Discussion and Ammendment for final draft

1445—1515 Presentation of Working Group 2 by Group Chairman

1515—1530 Discussions and Ammendments for final draft

1530—1600 TEA/COFFEE BREAK

1600—1730 **Financing and Funding Arrangements for PESTNET**

Co-Chairmen — Donor (USAID/UNDP) and member states
Participating Countries — All Members
Rapporteurs (Miss Mary Bugembe, Dr. Z.M. Nyiira)

Venue — Conference Hall

1730—1815 Rapporteurs summary on the discussions for typing

1815—1900 Final draft typing of all discussions (Photocopies for all participants to study)

**WEDNESDAY 25 JUNE 1986**

**Plenary Session for Plan of Action**

0830—0900 Chairman's address on progress achieved

0900—0930 Submission of draft report on Financing and Funding Arrangements for PESTNET

0930—1015 Discussions and Ammendments for final Draft

1015—1030 TEA/COFFEE BREAK

1030—1230 Discussion and Formulation of a Plan of Action (Dr. Smalley, Miss Mary Bugembe)
(Typing of Plan of Action)

1230—1400 LUNCH BREAK

**Final Plenary Session**

1400—1500 Circulation of Plan of Action and Discussion of necessary Ammendments.
(Final typing and circulation)

1500—1530 TEA/COFFEE BREAK

1530—1600 Chairman's Overall Summary of Meeting and Adoption of Plan of Action

1600—1610 Farewell address, Director, ICIPE

**THURSDAY, 26 JUNE 1986**

0900—1200 Visit to ICIPE for interested participants (Please register at Reception Desk by 1400 hours on Wednesday, 25 June 1986)

**Afternoon** Departure of Delegates at leisure.

COMPOSITION OF THE 2 SUB-GROUPS

ANNEX 2

**GROUP 1**

**ORGANIZATION AND LINKAGES FOR PESTNET**

**Chairman:** Dr. Wanchinga (Zambia)

| NAME | COUNTRY |
|---|---|
| 1. Dr. Pascal Ndayiragije | Burundi |
| 2. Dr. Boniface Rushigajiki | Rwanda |
| 3. Dr. A. Alio | Somalia |
| 4. Dr. Hassan A. Farag | Sudan |
| 5. Dr. G.H. Semuguruka | Tanzania |
| 6. Dr. S.Z. Sithole | Zimbabwe |
| 7. Dr. W.W. Wapakala Kenya | |
| 8. Dr. P. Lippold | USAID/IITA |

**RAPPORTEUS:** Dr. E. Omolo, Dr. Pala A. Okeyo and Ms. Mary H. Bugembe

**GROUP 2**

**EXTENT OF COOPERATION AND WORK PLANS FOR RESEARCH, TRAINING INFORMATION AND DOCUMENTATION**

**Chairman:** Professor O. Bwangamoi (Uganda)

| NAME | COUNTRY |
|---|---|
| 1. Dr. Niyongabo Joseph | Burundi |
| 2. Dr. Joel K. Koske (for Dr. S. Chema) | Kenya |
| 3. Dr. A.F. Nur | Somalia |
| 4. Dr. O. Osman | Sudan |
| 5. Dr. C.S. Tarimo | Tanzania |
| 6. Dr. P.G. Sinyangwe | Zambia |
| 7. Dr. M.L. Kabuswe | Zambia |
| 8. Dr. W.N. Madzima | Zimbabwe |

**RAPPORTEURS:** Dr. L.O. Otieno, Dr. P. Capstick, Professor K.N. Saxena, Mr. J. O. Omange, Dr. M.E. Smalley, Mr. L. Okola

## LIST OF PARTICIPANTS
## PESTNET IMPLEMENTATION MEETING
## Nairobi, 22nd to 26th June 1986

**(a) COUNTRY REPRESENTATIVES**
**NAME AND ADDRESS**

Mr. John J. Ondieki
Deputy Director of Research
Ministry of Agriculture and Livestock Development
P.O. Box 30028 Nairobi, Kenya.

Dr. A. Alio Director
Agricultural Research Institute
Ministry of Agriculture
P.O. Box 24 Mogadishu, Somalia.

Dr. Osman M. Osman
Under Secretary
Ministry of Agriculture and Irrigation
P.O. Box 8067 KHARTOUM, Sudan

Dr. C.S. Tarimo
Director of Research and Planning
Tanzania Livestock Research Organization
P.O. Box 6910 DAR ES SALAAM, Tanzania.

Dr. C. Farah Nur
Director
Department of Plant Protection
Ministry of Agriculture
P.O. Box 412
MOGADISHU, Somalia.

Dr. D.M. Wanchinga
Senior Scientific Officer
National Council for Scientific Research
P.O. Box 49 CHILANGA, Zambia.

Dr. W.N. Madzima
Deputy Director of Veterinary Services
Ministry of Lands, Agriculture and Rural Resettlement
P.O. Box 8012, CAUSEWAY
HARARE, Zimbabwe.

Dr. Pascal Ndayiragije
Deputy Director-General
ISAB B.P. 795
BUJUMBURA Burundi.

Dr. Hassan Ali Farag
Entomologist
Gezira Agricultural Research Station
P.O. Box 261
WAD MEDANI, Sudan.

Dr. M.L. Kabuswe
Veterinary Research Services
P.O. Box 50291
LUSAKA, Zambia.

Dr. P.G. Sinyangwe
Veterinary Research Services
P.O. Box 50291
LUSAKA, Zambia.

Mr. S.Z. Sithole
Ministry of Agriculture
P.O. Box 8100 Causeway
HARARE, Zimbabwe.

Dr. Geoffrey H. Semuguruka
Director of Research
Tanzania Agricultural Research Organization
P.O. Box 9761
DAR ES SALAAM, Tanzania.

Dr. Boniface Rushigajiki
Head, Animal Health Division
Ministry of Agriculture, Livestock and Forests
P.O. Box 621
KIGALI, Rwanda.

Dr. Joel Kipngeno Koske
Chief Veterinary Investigation Officer
Veterinary Research Laboratory
P.O. Box KABETE, Kenya.

Mr. William W. Wapakala
Director of Research
Ministry of Agriculture and Livestock Development
P.O. Box 30028
NAIROBI, Kenya.

Dr. S. Chema
Chief Veterinary Research Officer
Veterinary Department & Livestock Development
P.O. KABETE, Kenya.

Professor Okot Bwangamoi
Director of Veterinary Research Services
Animal Health Research Centre
P.O. Box 24
ENTEBBE, Uganda.

Dr. Joseph Niyongabo
Directeur du Laboratoire Veterinaire
BUJUMBURA, Burundi.

Mrs. Grace N.W. Thitai
Ag. Science Secretary
National Council of Science and Technology
P.O. Box 30623
NAIROBI, Kenya.

(b) **DONORS**

Dr. Paul Lippold
USAID/IITA Agricultural Research Liaison Officer
IITA
Oyoo Road, P.M.B. 5320
IBADAN, Nigeria.

Dr. Anthony F.E. Palmer
Regional Maize Agronomist - Eastern Africa
CIMMYT
c/o P.O. Box 25171
NAIROBI, Kenya.

Dr. Achola Pala Okeyo
Scientist-in-Residence
ICIPE/Rockefeller Foundation
P.O. Box 30772
NAIROBI, Kenya.

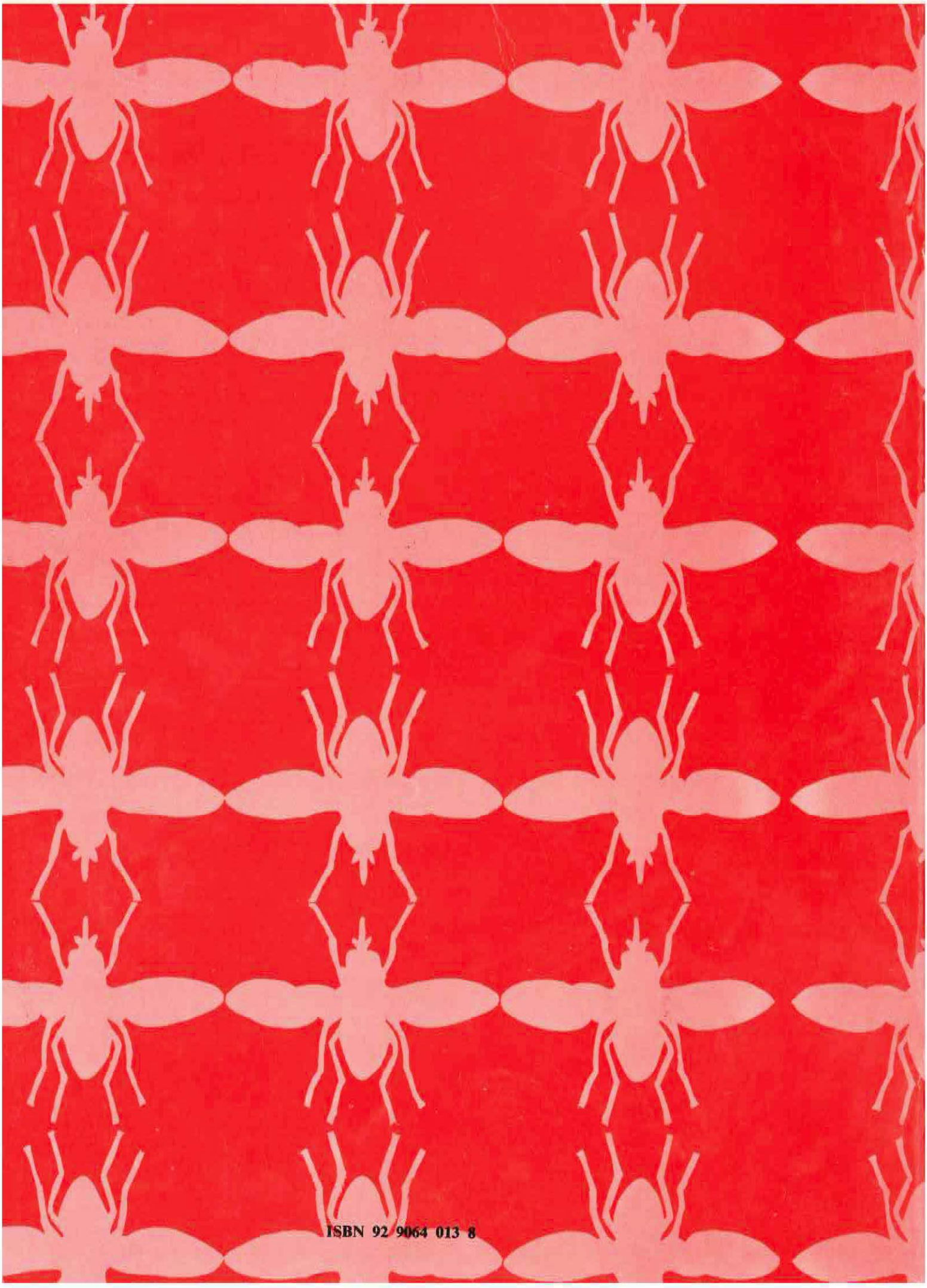
Ms. Mary Racelis
Regional Director
UNICEF Eastern and Southern Africa Regional Office
P.O. Box 44145
NAIROBI, Kenya.

Dr. Richard H. Markham
Commonwealth Institute of Biological
Control (CAB International)
P.O. Box 30148 NAIROBI, Kenya.

Dr. Halidou Ouedraogo
Economic Affairs Officer
UNECA
P.O. Box 3001
ADDIS ABABA, Ethiopia.

(c) **ICIPE STAFF**

Professor Thomas R. Odhiambo, Director
Mr. L. Okola
Dr. L.H. Otieno
Dr. P.B. Capstick
Professor K.N. Saxena
Dr. K.V. Seshu Reddy
Dr. Zerubabel M. Nyiira
Dr. Julio J. De Castro
Dr. Robin M. Newson
Dr. Michael E. Smalley
Dr. R.S. Ochieng
Dr. James K.O. Ampofo
Dr. John B. Kaddu
Dr. C.P.F. De Lima
Dr. W.A. Otieno
Mr. J.F. Omange
Miss Mary H. Bugembe
Mrs. Julie K. Eyobo



ISBN 92 9064 013 8