Africa Bureau

Locust/Grasshopper Strategy Paper

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AFRICA BUREAU LOCUST/GRASSHOPPER STRATEGY PAPER

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I. INTRODUCTION

A. Purpose of the Strategy

Agricultural production in sub-Saharan Africa continues to lag behind other regions in the world. Indeed, per capita food production is declining as a result of stagnation in the agricultural and related sectors, coupled with burgeoning population growth.

The Bureau for Africa's overall strategy for agricultural and rural development in the region is spelled out in the Africa Bureau Food Sector Assistance Strategy Paper of October, 1981.

This paper spells out the Bureau's strategy for dealing with one of the most serious exogenous factors adversely affecting agricultural production: the cyclically recurring infestations of locusts and grasshoppers, which can result in significant crop losses and periodically lead to plague and famine conditions in many parts of Africa.

B. Statement of the Problem

Locusts and grasshoppers have plagued Africa throughout recorded history, but major infestations are cyclical: they generally follow the return of the rains after an extended period of drought. Thus, the severe drought of the early 1980s was followed by normal, or above normal, rains in most of Africa in 1985 and 1986, and 1986 also saw the emergence of major locust/grasshopper infestations. Indeed, the 1986 infestation was unusually severe because it involved the rare appearance in the same year of all four major species of locusts, plus numerous species of grasshoppers.

The international campaign to control the problem in 1986--though very ad hoc--was generally successful. Major infestations occurred in eleven countries, and minor infestations were reported in nine others. The survey and control operations that were mounted by host governments, regional organizations, and the donor community managed to avert serious crop losses in all but a few areas of the continent.

However, the problem has been brought under control only temporarily. Given the recent good rains, the relatively late initiation of control activities in 1986, and heavy egg laying by several generations of adult locusts in the latter half of 1986, infestations in 1987 could well exceed 1986 levels. Unless control activities in 1987 are mounted early and effectively, the same cycle could again cause major infestations in 1988 and beyond. Further, it is a problem which can recur at any time in the future if preventive measures are not taken.

Given recent advances in control technologies and the success of the 1986 campaign in preventing an infestation of plague

proportions, it should be possible to reassert normal control over these pests within the next three years. These experiences should also lead to the introduction of better permanent control measures for future use.

C. Scope of the Strategy

This paper spells out the Africa Bureau's strategy for dealing with sub-Saharan Africa's locust/grasshopper problems over the short, medium, and long term. It is based on the proposition that, given the cyclical nature of major infestations, actions taken during the first 24-30 months are critical to both: (a) the containment of the initial emergency, and (b) the establishment of a program for long-term control and management of the pests.

Thus, the primary purpose of this strategy is to provide a framework for the provision of A.I.D. assistance in averting or reducing crop damage over the short and medium-term. In the present case, this means the period between now and mid-1989--the time by which present infestation levels can be reduced to normal levels. This strategy calls for:

-- Building upon the major survey and control activities undertaken (and lessons learned) by host countries and donors in 1986 (and the future); and

-- Expanding and enhancing those activities in the coming months in order to:

a. provide early warning through monitoring of potential pest problems in individual countries (and specific areas in those countries);

b. establish standards and criteria for determining when and where to apply strategies for control of the pest;

c. provide needed resources (technical, financial, and material) for timely and efficient (and cost effective) pest survey and control activities, that fully take U.S. environmental concerns and legislation into account;

d. support adaptive research needed to take advantage of recent advances in pest identification, survey, early warning, and control technologies;

e. train and develop a host country human resource base that can help to reassert and, subsequently, maintain control of the threat posed by locusts and grasshoppers; and

f. encourage neighboring countries to plan and agree on cross border control operations.

This paper also focuses on the role of complementary long-term programs, e.g., integrated pest management (IPM), which require support in many African countries for the foreseeable future. These programs are addressed in terms of: (a) the contribution which they too can make in getting Africa through the current crisis; and (b) their continuing importance in dealing with the locust/grasshopper problem, which the region experiences even in "normal" times.

II. THE MAJOR LOCUST AND GRASSHOPPER SPECIES

Although Africa is plagued by many different species of migratory pests, locust and grasshoppers are one of the most serious recurring threats to agricultural production. Thus they are singled out for primary attention in this Strategy Paper. There are four major species of locust and one major specie of grasshopper in sub-Saharan Africa:

-- The brown locust, which is the most resistant to desiccation, is primarily found in South Africa and southern Namibia; however, it forms swarms that threaten the other countries of southern Africa;

-- The red locust, which has only one generation per year, is found in the east African countries; but, if left uncontrolled, it can also affect southern Africa;

-- The desert locust, which is potentially one of the most dangerous species because it has the ability to swarm and move rapidly across the entire African continent, from Mauritania to Ethiopia, as well as to the Middle East and India;

-- The African migratory locust, which has its primary breeding ground in the Niger River area, but has attacked nearly all of sub-Saharan Africa upon occasion; and

-- The Senegalese grasshopper, which is found in a band from West Africa across to the Horn.

Annex A provides more detailed information on each of these five species. In normal years, one or more of these species may appear; the appearance of all five species in the same year is extremely rare. However, all five did appear in substantial numbers in 1986; and all are expected to show up again for at least the next two years.

III. ACTIVITIES AND FUNDING RESPONSIBILITIES

A. Program Responsibility

The primary responsibility for treating these periodic locust/grasshopper infestations resides with the African host countries in which they occur: initially with individual farmers, and then, during unusually severe infestations, with host country

governments. All African countries have some governmental organization (typically, a Plant Protection Division in the Ministry of Agriculture) with responsibility for dealing with locusts and grasshoppers. Nevertheless, often these host country organizations are unable to cope with major (unusually heavy) infestations. Consequently, many African governments are members of regional organizations, e.g., the Desert Locust Control Organization (DLCO) in East Africa and the Regional Organization to Combat Birds and Locusts (OCLALAV) in the Sahel, which were established to bring special skills and resources to bear when major infestations occur.

However, the African states have not been paying their membership dues, and, in some cases, donors are supporting these regional organizations. In addition, too often these regional organizations have proven to be ineffective in coping with infestations of potential plague proportions. Thus, international organizations like the UN's Food and Agriculture Organization (FAO) and the bilateral donors have stepped in with ad hoc resources and assistance. This was the case in 1986, and it appears that the same kind of special assistance (over and above their normal development assistance) will be required of the FAO and bilateral donors for at least the next two years.

B. A.I.D.'s Operational Authorities

When A.I.D. becomes seriously involved in addressing Africa's locust/grasshopper problems, operational responsibility is divided among several internal units.

1. Short-Term: The Office of U.S. Foreign Disaster Assistance (OFDA) has the authority and responsibility to apply its resources to:

-- pest emergency situations in a host country (up to 90 days in duration) when a "disaster" has been declared by the U.S. Ambassador to that country, i.e., when a determination is made that the situation poses a serious threat to the economy and requires resources beyond those available to that country;

-- the mitigation of potential disaster situations, i.e., to take preventative measures where there is a known or predictable disaster threat; and

-- recovery and rehabilitation activities (90 to 180 days) designed to prevent secondary disaster effects.

2. Medium Term: The Bureau for Africa has the authority and responsibility for using its regularly appropriated resources (DA, ESF, and Local currency) to:

-- implement non-disaster project activities required to put immediate pest emergency situations back under control; and

-- restore a positive milieu for the implementation of normal, longer-term development initiatives, vis a vis pest control programs responding to immediate threats.

3. Long-Term: Recognizing that the current African pest infestation represents, in large part, the failure of national and regional institutions to deal with day to day and abnormal pest management situations, the Bureau for Africa--and A.I.D.'s central Bureau for Science and Technology--have the responsibility and authority to use their resources to support developmental activities on a regional or bilateral basis, designed to improve the capabilities and capacities of these institutions. These activities may include long-term IPM programs covering all forms of pests (e.g., army worms, rats, quelea birds, etc.), in addition to locusts and grasshoppers.

Table 1 (page 6) illustrates how specific activities can be funded and managed over the short, medium and long-term.

C. Donor Collaboration

There is a wide array of bilateral donors, international and regional organizations, and private and voluntary agencies who are working on the locust/grasshopper problem. Many of these have had extensive experience in working with African countries on the control of the pest, and their approaches to the problem are varied. Moreover, they all have a unique contribution to make to its resolution.

In this context, it is A.I.D.'s policy to give high priority to the support of inter-organizational networking. Clearly, all points of view, and the data they represent, contribute to the thorough analysis of the problem, as well as to the development of a workable resolution to it. However, A.I.D. has a responsibility to take actions that may differ from those resulting from such collaborative efforts, if A.I.D. feels that the networking process has not generated an adequate response.

IV. ACTION PLANS AND PROGRAM DEVELOPMENT

A. Donor Coordination Committees

As noted previously, primary responsibility for treating pest infestations resides with the farmers and governments of the African countries in which they occur. Should external intervention be appropriate and requested, any assistance provided must be approved by the host country. To assure that operations during the 1986 locust/grasshopper campaign were sensitive to these responsibilities, Donor Coordinating Committees (sometimes called Country or Donor Steering Committees) were established in almost every country to which external donor assistance was provided. These Committees provided a useful forum for the exchange of technical and

TABLE 1

RESPONSIBILITY FOR RESOURCE INPUTS
FOR LOCUST/GRASSHOPPER CONTROL 1987/88

Input	Short-Term OFDA	Medium-Term AFR/OEO	Long-Term AFR/TR & S&T
Assessment Teams			
Technical	Y	Y	Y
Survey	Y	Y	Y
Evaluation	Y	Y	Y
Guidelines/Standards	N	Y	Y
Pesticides			
Emergency	Y	Y	N
Pre-positioned	Y	Y	Y
Testing	N	Y	Y
Radios			
Emergency	Y	Y	N
Pre-positioned	Y	Y	Y
Training			
Long-Term	N	N	Y
Short-Term	Y	Y	Y
Vehicles	N	Y	Y
Aircraft	N	N	Y
Equipment (sprayers, clothing, repairs, etc.)	Y	Y	Y
Aerial Spray Services	Y	Y	Y
Environmental Assessments	N	Y	Y
Environmental Research	N	Y	Y
Early Warning Research	N	Y	Y
Inter. Conferences	Y	Y	N
Entomological Research	N	Y	Y
Institution Building			
Host Country	N	Y	Y
Regional	N	Y	Y
Permanent Construction	N	Y	Y

N = No, Y = Yes

financial information, as well as a mechanism for developing a coordinated response between the donors and host countries. In some cases, the local FAO representative chaired these Committees. In others, they were chaired by the host country or one of the bilateral donors.

B. A.I.D. Operational Strategy

A.I.D. supports the continued operation of the Donor Coordinating Committees. The form of organization and leadership is immaterial; the important point is that there must be an in-country group established which enables all involved donors to coordinate their resources in response to the jointly perceived pest problem. A.I.D. resources should generally be provided in response to Country plans approved by the Donor Coordinating Committees and representing the policy of the host government. These programs should be forwarded to the FAO, the international organization charged with coordinating world-wide responses to the locust/grasshopper problem, as the basis for issuance of an appeal for donor support. The FAO's technical review of these programs is not required. A.I.D. may elect to respond in a manner that differs from that recommended in a Country Plan, if requested to do so by a host country.

In order to receive A.I.D. resources, USAID Missions with an actual or potential locust/grasshopper problem should prepare their own local Action Plans. These Plans should consider the requirements identified in the Country Plans of the Donor Coordinating Committees, and propose initiatives for A.I.D. funding, over the short-, medium- and long-term. AID/W will review these Plans for adherence to policy guidelines, establish priorities among competing demands, and allocate appropriate resources within available funds.

V. CONTROL STRATEGIES

A. Pest Quantification

Because a wide variety of species contribute to Africa's locust/grasshopper threat, difficulty has been experienced in defining the level of infestation that constitutes a bona fide threat and selecting appropriate control methods. Further, the level of the threat posed is influenced by the proximity of the pest to crop or range lands requiring protection. Control strategies should be based upon indicative guidelines developed by the FAO, DLCO, and the French organization PRIFAS. Table 2 (page 8) provides A.I.D. guidelines for quantifying the threshold levels at which specific types of interventions will be undertaken to meet pest infestations.

B. Control Techniques

The techniques for dealing with locust/grasshopper pest threats

PEST POPULATION THRESHOLD GUIDELINES
A Managers Guide on When to Act

	Location			
	Croplands			Rangeland and Unutilized Land
Species	Seedlings (Under 7 cm)	Vegetative Stages	Ear Emergence to Harvest	
Locusts	6-10/sq. m. or gregarious	10/sq. m. or gregarious	10/sq. m. or gregarious	Any gregarious forms, bands of hoppers or swarms of adults, or populations of 10 adults/sq. m. or higher when conditions are favorable, i.e., green vegetatior adequate rainfall for breeding, etc.
O.senegalensis	6-10/sq. m.	15-20/sq. m.	10-15/sq. m.	Early in the season if vegetation is drying and movement to crops seems imminent; 20/sq. m.
Other Grasshoppers	6-10/sq. m.	15-20/sq. m.	10-15/sq. m.	Early in the season on rangeland, 20/sq. m., or if forage production is low and over-grazing is likely; Only at extreme levels on unused land, e.g,. desertification.

These guidelines are for adults or large hoppers. For small hoppers (1st-3rd instars), thresholds would be roughly 2-3 times these numbers.

Other factors affecting control thresholds include the susceptibility of a particular crop to a specific insect species, differing sizes of the species, the value or importance of the crop to be protected, the abundance of the vegetation for feeding (especially in rangeland/unutilized land), and the resources available for treatment.

and outbreaks, in an IPM conceptual framework, are divided into four groups:

-- cultural and varietal, which include crop rotation and the planting of different varieties or non-traditional crops that resist locust/grasshopper infestation;

-- mechanical, which includes flooding ditches with water around crops, or burying and burning pests;

-- biological, which includes the introduction, preservation, and augmentation of pathogenes, parasites, or predators that affect pests; and

-- chemical, which is the use of approved chemical compounds and pesticides to kill the pests.

The first three are more appropriate for preventing major infestations because they require extended time periods to organize and become effective. Chemical techniques are especially useful for reasserting control after a pest outbreak has occurred, because they can be applied relatively quickly and produce rapid control results.

A.I.D. resources are available for activities using any of the four groups of techniques. During emergency situations, the emphasis, of necessity, will be placed upon chemical techniques, i.e., pesticides. However, to the extent that time permits, cultural, mechanical, and biological techniques are to be preferred, because they significantly reduce ecological problems.

A.I.D. will devote special attention immediately to research concerned with cultural, mechanical, and biological techniques for preventing major infestations.

Regardless of the control technique employed, recent experience shows that there is a need for improved operational communications and logistic support. Data attains value in direct relationship to the speed and effectiveness of its communication to those who can act upon it; further, experience has demonstrated that the efficiency of an intervention is directly affected by the calibre of the logistic support provided to it. The experience of the 1986 campaign provides good insight into how improvement can be made in both of these areas.

C. Locational Strategy

Expert opinion varies on the issue of where locust/grasshopper pests should be controlled. Some experts believe that protection and control should be exerted only when the pests are attacking crops. Others believe that range lands should be protected in areas where livestock production is an important element of the agricultural sector. The subject becomes even

more complicated when the concept of carrying out preventive measures in uncultivated or unused areas is introduced. The application of economic analyses to these various approaches is difficult; it is hard to attribute values to losses prevented, when the extent of these losses cannot be determined with any degree of accuracy.

For A.I.D. purposes, resources may be used to combat the pest at any location which is deemed practicable in order to:

-- protect livestock, forest, and crop lands (food and cash, subsistence and commercial); and/or

-- enable the pest to be controlled, or to be returned to control after a major outbreak.

D. Institutional Development

Consequent of the long history of the locust/grasshopper problem, a variety of attempts has been made to address it, including the creation of pest-specific national and regional institutions. For a variety of programmatic and funding reasons, too often these have failed to be effective. Sometimes, the alertness of these institutions to the problem, and their ability to respond in an emergency, has been blunted by the long periods between pest outbreaks, i.e, during non-emergency periods, locust/grasshopper resources and preventive operations tend to be shunted aside in favor of other, more pressing priorities.

A.I.D. will provide medium-term bilateral resources for host country institutional development from Africa Bureau regional or country program funds in those cases when USAID Action Plans demonstrate that marginal inputs will leverage significant responses to the pest problem. This policy will also apply to the provision of assistance to regional organizations, with the additional requirement that these organizations cover all of their operating (overhead) expenses from member contributions, i.e., A.I.D. support will only be provided for clearly identified programmatic (operational) activities.

A.I.D. longer-term support for institution building will follow the normal process for project development, i.e., USAID preparation of bilateral project proposals for funding under normal country program levels.

VI. EARLY WARNING AND PEST SURVEILLANCE

As noted in Section I.B, there is a strong correlation between climatic conditions conducive to agricultural production and those that support locust/grasshopper infestations. The same conditions which provide the soil moisture required for the hatching of pest eggs also permit germination and growth of the plant life required for the feeding of the pests. This is a

normal state of affairs; it becomes a problem only when the amount of egg laying has gotten out of control and climatic conditions permit abnormally large numbers of hatchlings to survive.

The correlation of these climatic conditions also provides an opportunity, among others, to obtain an early warning that a pest infestation may occur. Other opportunities for early warning come from surveys of egg pods, detection of the pests while they are in hopper bands and immature, surveys of magnitude from the prior year, etc. In all cases, early information and data relating to the identity of the concerned species, where they are, their state of development, and the magnitude of their presence is essential. Fortunately, recent technological advances now provide new and expanded opportunities for pest surveillance.

A. Satellite Technology

Imagery, in a variety of forms, is now available to measure rainfall and vegetation production, and, thereby, identify areas conducive to crop production--as well as pest breeding. Although it is yet to be tested, a process has been identified by which it may be possible to use satellite imagery to detect and measure the presence of pest infestations--using vegetative indices to measure biomass, and provide this information through maps on a timely basis. A.I.D. will fund priority research activities in the field of satellite imagery in order to take advantage of the early warning opportunities such technologies offer. A.I.D. will also support the development of ground-truthing data systems, which are required to improve the predictive capability of satellite early warning systems. In addition, A.I.D. will support project activities, e.g., AGRHYMET, that seek to make operational satellite technologies available to African institutions.

B. Computer-Based Programming

Satellite technology makes extensive use of computer-based models. But models also exist that are based on alternative resource inputs, or are strongly influenced by alternative data sources. Examples of particular note are those developed by the French research organization PRIFAS. These have been developed for the Senegalese grasshopper and the migratory locust. According to a recent PRIFAS report, the Senegalese grasshopper model was 80% accurate in its forecasts of the magnitude and location of the 1986 pest infestation. A.I.D. will invest resources to expand research relating to such computer-based programming, as well as to develop closer working relationships with PRIFAS and other research centers working on such locust/grasshopper modeling.

C. Surveys and Assessments

It was generally agreed that the weakest link in the 1986 pest campaign was the lack of reliable data concerning the location and magnitude of the pests. While technological advances may help to pinpoint the general location of the pest menace, field surveys will still be the backbone source of the data required for operational decisions. The existence of quantifiable guidelines, as cited in Section V. A above, will assist the decision-maker, and better trained scouts and survey teams will be required to gather the data. Thus, A.I.D. resources will be directed toward improving the availability and skills of survey personnel.

Similarly, given the close relationship that exists between assessment of on-going program operational efficacy and early warning preparedness, A.I.D. will contribute resources to the improvement of such efforts. However, based upon prior experience, program assessment activities will be carried out jointly with other donors and host countries.

VII. CHEMICAL CONTROL GUIDELINES

When the use of chemicals becomes the main weapon in a pest control program, it is generally because the pest has gotten out of control, i.e., cultural, mechanical and biological techniques were not adequate in preventing a major infestation. Generally, this means that emergency actions, at least initially, are required to reassert control over the pest. However, over the longer-term, reliance on chemicals/pesticides should be reduced. It is also important to remember that pesticides are an important component of other control techniques (e.g., baiting), and that environmental concerns about handling and usage for these purposes are similar to those that apply to direct spray operations.

Although, essentially, a technical issue to be considered in the design of operational activities, the handling of agricultural chemicals, e.g., pesticides, presents special problems that warrant special A.I.D. concern. Thus, it is A.I.D. policy that special focus be given to the safe handling of agricultural chemicals when used, including the disposition of used pesticide containers and the provision of appropriate clothing and other essential equipment and supplies needed to effect high safety levels during the planning and execution of activities involving their use.

A. Environmental Concerns

Despite the security and dependability provided by the proven effectiveness of using chemicals (pesticides) to fight locusts and grasshoppers, their use introduces a set of environmental problems that have the potential of being as serious as the pests themselves. Thus, A.I.D. recognizes a responsibility to

ascertain that the pesticides it finances, and those financed and used by others in programs with which A.I.D. is associated, are as environmentally safe as testing can determine; properly handled, formulated, applied and stored; and used only when judged to be significantly more appropriate for use than alternative control methods. A.I.D. and Africa Bureau policy concerning the selection and financing of pesticides for the control of locusts and grasshoppers follows.

In accordance with the National Environmental Policy Act of 1969, in 1976 (updated in 1980) A.I.D. published environmental procedures (Regulation 16) which, inter alia, proscribe how chemicals/pesticides must be treated under A.I.D. activities. Other appropriate guidelines on the subject include the World Bank Policy Guidelines on Pesticide Control, attached as Appendix B, which were jointly developed by A.I.D. and the World Bank, and the FAO Code of Conduct covering the use of pesticides (Appendix C).

When choosing to use pesticides, it is A.I.D. policy:

-- to ensure prior knowledge of their environmental consequences by the U.S. and the host country, and to assure that appropriate safeguards for handling and use are adopted;

-- to strengthen host country capacity to appreciate and evaluate the potential environmental effects of the pesticides and to select, implement, and manage effective environmental measures;

-- to identify environmental impacts resulting from such activities; and

-- to promote integrated pest management to the maximum extent possible.

For the purposes of locust/grasshopper pest threats in Africa, compliance with the pesticide procedures contained in Regulation 16 is required.

Subject to the availability and cost competitiveness of U.S. chemicals/pesticides, U.S. source-origin criteria will be applied to all A.I.D.-financed chemical/pesticide procurements.

B. Testing

Procedures for pesticide efficacy testing will be based upon recommendations developed by the U.S. Department of Agriculture-Animal, Plant, Health Inspection Service (USDA/APHIS), Regional Locust Control Organizations, the FAO, and other bilateral donors. The USDA will be requested to coordinate the development of standardized testing procedures. A.I.D. resources will be used, in conjunction with other donors, to test various

pesticides in the African environment. It is Africa Bureau policy that any A.I.D.-financed pesticide for locust/grasshopper control be registered with the EPA and have a tolerance established for at least one food use, or meet the established acceptable daily intake and maximum residue level recommended by the Joint Meeting on Pesticide Residues to the FAO/WHO Codex Committee on Pesticide Residues. In addition, the supplier must provide all necessary supporting technical data relating to human and environmental safety of the specific formulation under the proposed conditions of use.

C. Formulation

With the exception of ultra-low-volume formulations, pesticides are always mixed with other ingredients and sold as "formulated" products. For maximum efficacy and safety to the applicator and the non-target environment, the various specific formulation types must be carefully matched with application equipment.

In addition, the selected formulations must possess certain physical and chemical properties to assure that they can be dispensed safely. All products used for locust control should conform to a predetermined set of specifications, which will be developed.

D. Application

Procedures and equipment for aerial application have been developed; but each pesticide formulation has its own unique requirements with regard to types of spray nozzles, booms, and atomization equipment. It is imperative that all pesticide formulations be "pre-matched" to specific application equipment, and that appropriate individual case-by-case specifications be worked out by experienced aerial applications experts.

In the context of aerial spraying, it must also be recognized that a vast number of unique logistic and communications requirements are generated. Thus, A.I.D. financing of aerial operations will include planning for, and the funding of, appropriate levels of management support.

Much is known about the good and bad features of various ground application equipment and procedures; but little has been committed to paper. There is ample technology and knowledge to establish certain minimum standards for the various types of ground spray, dusting, baiting, etc. equipment; however, equipment and formulations must be carefully matched. For example, there is no such thing as a "universally acceptable" sprayer. Since existing standards are inadequate, additional research is required. It may be prudent to impanel an "experts committee" to evaluate any major equipment selection process.

E. Storage

More explicitly defined storage guidelines are needed--particularly ones appropriate to African conditions. A.I.D. has some experience in constructing storage facilities, and plans for a modest sized facility are available from the USDA. One of the better reviews of this important subject is contained in the A.I.D. funded second edition of the UNIDO publication entitled "Formulation of Pesticides in Developing Countries".

In any event, decisions to provide pesticides, particularly for the pre-positioning of pesticides, must consider the availability of adequate storage facilities. Adequate storage facilities for pesticides are necessary to prevent:

-- unintentional diversion by theft;
-- inadvertent contamination of food and feed;
-- excessive exposure of chemicals to heat, moisture, and sunlight;
-- physical contamination at sensitive environmental sites;
-- accidental release due to earthquake, fire, or flood; and
-- release within populated areas.

VIII. RESEARCH AND DEVELOPMENT

The African locust/grasshopper problem has existed for ages because efficient and cost effective control technologies have not yet been developed that can continually keep pest infestation down to acceptable levels. While the ultimate solution to the locust/grasshopper problem may remain elusive for the forseeable future, there are signs that improved entomological, early warning, and chemical technologies are enabling managers to consider new ways to treat this pest.

It is the policy of the Bureau for Africa to give high priority and substantial resources to the immediate implementation of additional research on African locust and grasshopper control technologies. Numerous references have been made previously in this document to the types of adaptive research that might be undertaken. Examples of appropriate areas include:

-- pest parasite and predator studies;
-- remote sensing for early warning;
-- chemical efficacy, formulation, and application testing;
-- entomological studies;
-- use of incentives for inducing private sector involvement;
-- pest survey and assessment improvement; and
-- computer modeling for early warning/prediction.

IX. STRATEGY PAPER IMPLEMENTATION

The operational guidelines contained in this Strategy Paper will be implemented through:

- -- the normal process of the OFDA, for disaster-related short-term responses to the pest problem;
- -- the design and approval of a Bureau for Africa regional DA-financed project, for medium-term (2-3 years) activities; and
- -- through various centrally funded and bilateral projects, for long-term activities.

To meet the immediate crisis, a regional project to help afflicted African countries reassert control over locust/grasshopper pests will be designed for AA/AFR approval early in calendar 1987. It will be consistent with this strategy, and it will consider the views of concerned African USAID Missions. Among the major activities it will address are: research priorities; the prepositioning of pesticides; the improvement of survey and assessment inputs; institutional development relationships, particularly support for private sector institutions; donor coordination; support for regional organizations concerned with the locust/grasshopper problem, relationship with the FAO, its responsibilities; the environmental aspects of pest control; and human resource development. The Bureau for Africa's new Office of Emergency Operations (AFR/OEO) will be responsible for implementation of this medium-term project. AFR/OEO will also work closely with OFDA in its implementation of short-term interventions.

The development of long-term projects to provide for the control of the pest following the resolution of the current crisis will be a responsibility of the various USAID Missions and geographic offices of the Bureau for Africa, and A.I.D.'s central Bureau for Science and Technology. However, any such activities should be consistent with this Strategy Paper.

DESERT LOCUST (Schistocerca gregaria)

Distribution and Seasonal Movements: See maps. These show the areas where breeding has occurred and hopper bands have been produced over a 35-year period.

In summer, the potential breeding area extends across Africa between 14° and 20° N. latitude, and also extends south into Ethiopia, across the southeastern edge of the Arabian peninsula and into Pakistan and northwestern India. The resulting swarms of adults move as indicated by the arrows into northwestern and northern Africa, into the central and northern parts of the Arabian peninsula, the Middle East and Iran, and also occasionally south into east Africa.

In winter, breeding is concentrated in the Somali peninsula and along the Red Sea. Breeding may also occur in Pakistan and northwest India, further south in east Africa, and in scattered areas across the summer breeding zone in west Africa. Some of the resulting swarms may move north and east into Arabia and the Middle East, but usually most of the swarms move south and southwest into the Somali Peninsula and east Africa.

In spring, breeding takes place in northern and northwest Africa, Arabia and the Middle East, Iran, and Pakistan. The swarm movement is mostly south toward the summer breeding areas.

Breeding Habitat: Females prefer to lay eggs in sandy or silty soils. The egg case is embedded in soil to a depth of 5-15 cm., and the soil must be sufficiently moist at that depth for the female to oviposit. Approximately 15-20 mm. of rain within 24 to 48 hours of laying is generally enough.

Life Cycle: Generally, if the soil has enough moisture, eggs develop without any dormant period. However, dormant periods of 2-3 months have been recorded when soil moisture is limiting. Once the eggs begin to develop, the rate of development is related to temperature. At 32-34° C. (air temperature), development proceeds at the maximum rate and hatching takes place in 11 days. At 20° C., hatching takes about 24 days.

The 20-25 mm. of rainfall required for egg-laying are also generally enough to ensure growth of short-lived desert plants, on which the hoppers depend for food. The rate of hopper development is also dependent on temperature: About 20 days from hatching to adult at 38° C., to 66 days at 24°. Non-gregarious populations may take 5-10 more days to develop at the same temperature.

Once the insects are adults, they can migrate in search of favorable habitats for maturation and egg-laying. Locusts may remain in the immature adult stage, without laying eggs, for as little as three weeks, under exceptionally good conditions, to as long as nine months. The usual duration of this stage is probably 2-4 months. Once the locusts reach an area with widespread and heavy rainfall, they can mature in about one week, as long as the temperature is above 17° c.

Females can lay eggs up to 3 times in their lives. The number of eggs in an egg pod average about 95 for solitary females or 81 for gregarious females laying eggs for the first time. The number of eggs in the 2nd and 3rd pods are somewhat lower.

Swarm Formation and Movement: Factors leading to swarm formation: 1) Rainfall over a long enough period to allow prolonged breeding and growth of green vegetation for food, which may attract additional flying locusts. 2) Features tending to concentrate populations, such as convergent wind systems, barriers, and patchy vegetation drying unevenly.

Locust swarms move in the same direction as the wind. The speed of movement is variable, and the rate at which the swarm moves relative to the ground is generally less than the wind speed, and usually less than one-half the wind speed, because the locusts within the swarm periodically stop on the ground for short periods. The speed of the swarm is generally higher over arid land with no green vegetation, and when the temperature is high. Distances travelled per day vary from 5-200 km.

Preferred Food and Feeding Damage: The Desert Locust feeds on a broader range of plants than most other grasshoppers and locusts. Like other species, it feeds readily on crops related to the grasses: millet, sorghum (primarily the ripening heads), maize, wheat and barley, although rice is usually grown in environments too wet for the Desert Locust to thrive. It also feeds on a range of broad-leaved plants, and can do serious damage to cotton, grapevines, and fruit-trees.

Natural Enemies: Natural enemies of the Desert Locust have been surveyed, and the prevailing opinion is that while natural enemies may delay or prevent outbreaks, particularly in areas with continuous populations present, they do not have much effect on the large rapidly moving gregarious populations.

Methods of Survey, Forecasting, and Control: There are two different overall strategies for Desert Locust survey and forecasting, based on different ideas on the importance of present gregarious swarms in the production of future gregarious swarms. One group, led by R. Rainey, believes that each gregarious swarm is made up of a substantial proportion of individuals whose parents or grandparents were gregarious. Thus, the tracking and destruction of each gregarious swarm is of critical importance, even when a particular swarm is not threatening to crops or pasture, because it has the potential to give rise to further swarms.

The other group, led by C. Hemming, believes that gregarious swarms can disperse and become solitary and that solitary locusts can form large gregarious swarms when conditions are favorable for breeding and concentration of populations. For this group, survey and assessments of areas with favorable breeding conditions (i.e. prolonged rains and growth of vegetation) is more important than tracking every gregarious swarm.

Both groups use meteorological information, but the first is mainly interested in wind speed and direction in the area of existing gregarious swarms, and the second group would use weather maps to locate favorable breeding areas and convergent winds that concentrate groups of locusts from a wide area

Control: Control by small farmers has generally used dusts (BHC was widely used). On a larger scale, dieldrin, applied aerially or using truck-mounted sprayers forcing pesticide through an exhaust nozzle, is applied to vegetation to kill hoppers. To kill adult swarms, fenitrothion has been applied directly to the swarm by airplane.

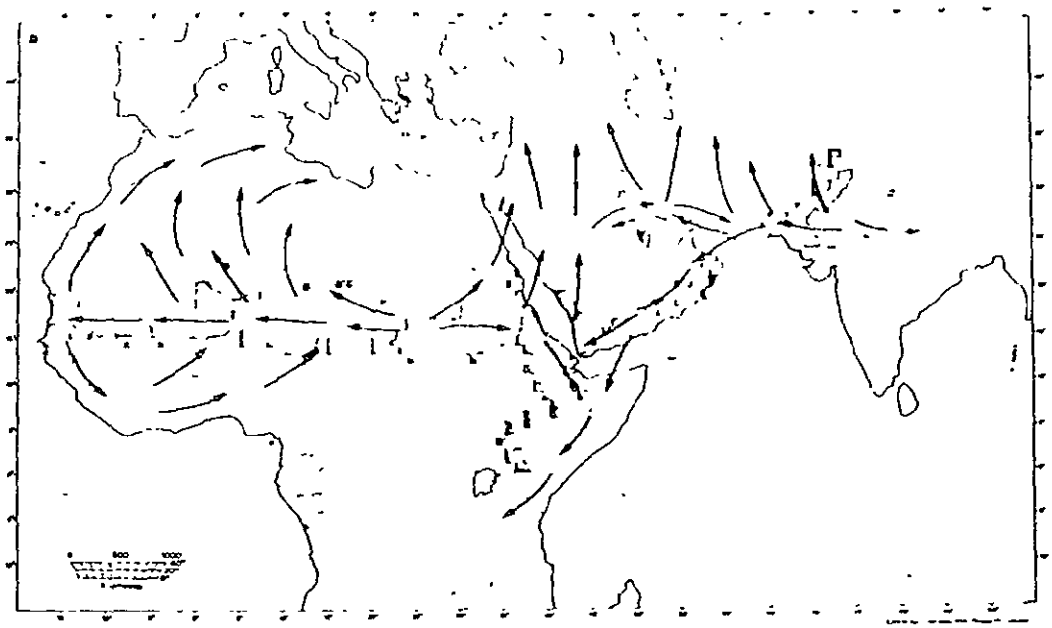
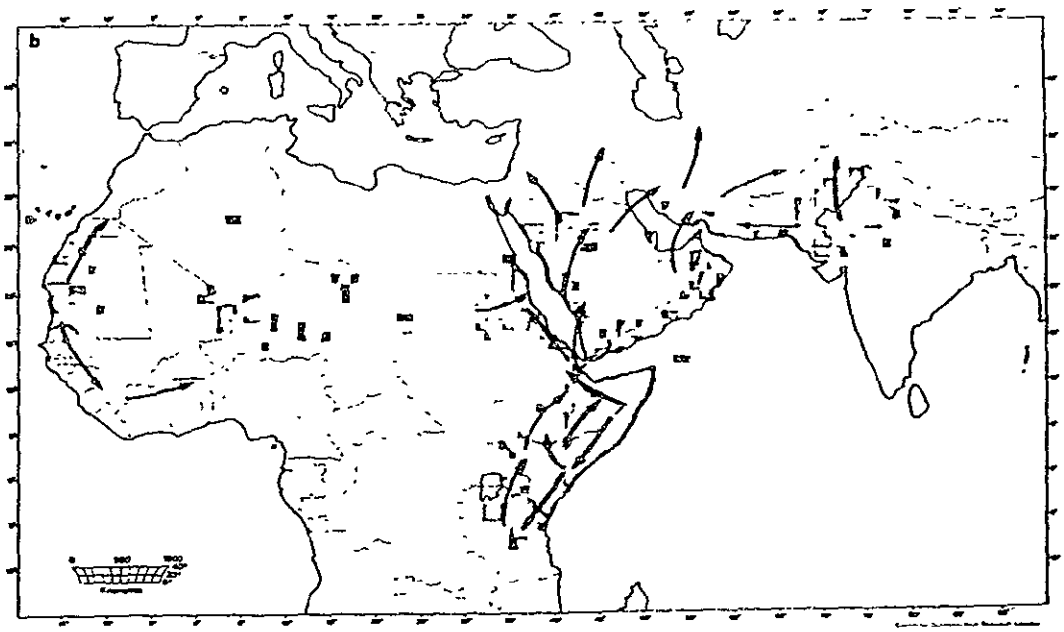
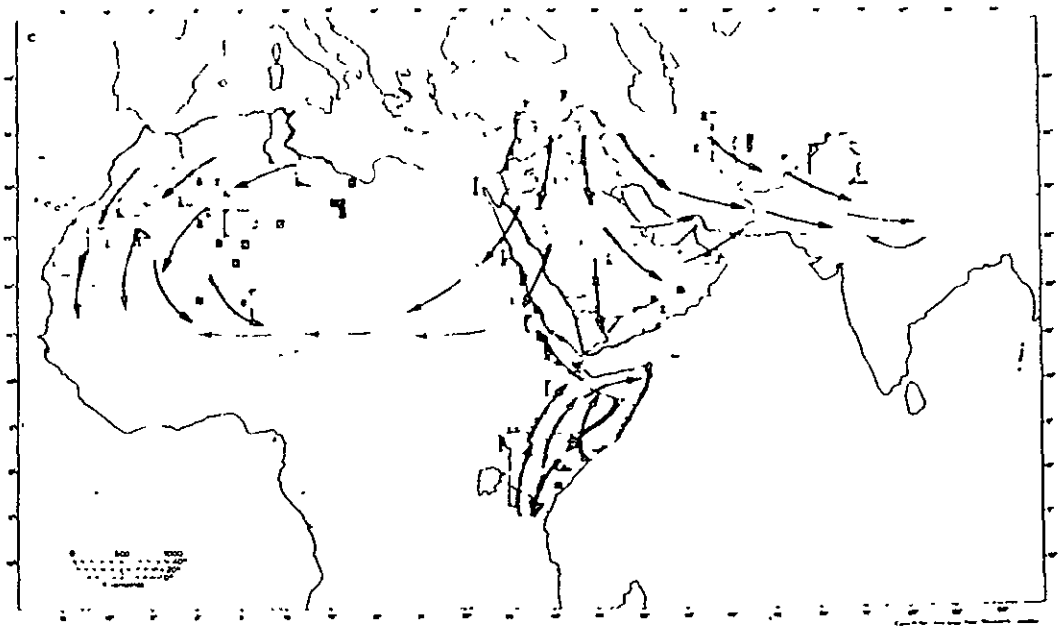


Fig. 2.6 Breeding areas and major movements of resulting swarms *(opposite).*

a Summer. Degree squares with hopper band infestations in at least *two* years during the period 1939 to 1975 from August to October, but only August and September on the Somali Peninsula. Degree squares with infestations in at least *one* year are shown in Arabia east of 50°E. Arrows show major movements of summer swarms in the following winter and spring.



b Winter. Degree squares with hopper band infestations in at least *one* year during the period 1939 to 1975 from November to January, but October to January on the Somali Peninsula. Arrows show major movements of winter swarms in winter and spring.



c Spring. Degree squares with hopper band infestations in at least *two* years during the period 1939 to 1975 from March to June Degree squares with infestations in at least *one* year are shown in West Africa west of 15°E and in Arabia east of 50°E. Arrows show major movements of spring swarms in spring and summer. Heavy arrows in East Africa show the movements in the following winter.

AFRICAN MIGRATORY LOCUST (Locusta migratoria migratorioides

Distribution and Migration: The African Migratory Locust normally lives as a solitary grasshopper at low densities throughout Africa south of the Sahara, except in the equatorial zone. It is only known to multiply to high densities in the three suspected outbraek areas: the Niger River Delta in Mali, the south and southeast parts of the Lake Chad basin, and the Blue Nile region in the Sudan. Only the first of these three areas is known to have produced a locust outbreak -- the last migratory locust plague in 1928 to 1944. There is also another subspecies of Locusta migratoria which lives in Madagascar and has an outbreak area there.

In the Niger River area, the African Migratory Locust has a complex yearly pattern of migration which allows the species to breed continuously and lay eggs into suitable moist soil. The first generation of the year takes place in the southern flooding zone in December, January and February, just after the flood waters have receded. The adults produced move north (against the prevailing wind direction) to lay eggs in the northern flooding zone in February and March, just after these flood waters recede. The next generation moves south again to lay eggs in the central plains in April and May, just prior to the beginning of the rains. Then one or two (depending on the duration of the rains) more generations move north and spread out on the Sahelian plains in late summer and autumn.

Dispersal of the newly fledged adults, before they begin to reproduce, appears to be an obligatory part of the life cycle, even if conditions are still favorable where they grew up. Dispersal is not necessarily in the direction of the prevailing winds, so the locusts must be able to direct their flight based on some external cue, possibly humidity gradients.

Life Cycle: Egg survival and development is often limited by the availability of moisture in the soil for those generations that depend on rain (rather than receding flood waters). If no rain comes within a month or so, the eggs gradually dry out and die. If there are only light showers, the eggs take up water, but do not develop. At least 25 mm. of rain are required for development. In the presence of adequate moisture, the rate of development depends on temperature. Hatching takes place in 10 days in the hot season, but takes 46 days in the cool months of December and January.

Hopper development is also dependent on temperature, and can take as little as 20 days from hatching to adult with mean air temperatures at 32° c. when sufficient green vegetation is preent. During the cool season (November-March) development takes up to 50 days.

The fledgling stage lasts 5-10 days, and then the adults are ready to lay eggs. Each female can lay three egg pods with 115 eggs per pod under favorable conditions in solitary populations (presumably fewer in gregarious population.

Unlike other species of locusts, the African migratory locust does not have any stage which can tolerate a long period of unfavorable conditions. Populations must breed continuously or die out. On the other hand, rapid development and frequent dispersal give this species the capacity to multiply and spread rapidly when there are widespread rains of long duration.

Natural Enemies and Nautral Mortality: As mentioned, soil moisture is important in determining the survival of the eggs. Predators and parasites kill an average of 40% of the eggs, but when the egg densities are higher, this proportion drops. Thus, natural enemies do not regulate high populations.

The main period of mortality is in the fist instar of the hopper stage. From 70% to 99% of these hoppers die and the cause of mortality is unknown, although it is known that this mortality is low in the presence of abundant moisture.

Food Preferences and Crop Damage: African migratory locusts have a strong preference for grasses and related cereal crops. Millet, sorghum and rice are particularly suceptible. There have been occasional reports of damage to bananas, coconut trees and other crops, but only when other food is unavailable. According to the Locust Handbook, the African Migratory Locust has the reputation of causing the greatetst crop damage of all locust species.

Survey Forecasting and Control: The main outbreak area in the Niger River basin and surrounding areas was surveyed regulrly by OICMA for numbers, stage age and phase of locusts. Information on optimum ecological conditions (annual rainfall greater than 50-100 mm. and less than 300 mm., monthly temperature greater than 25°) was used to determine the need and regions for survey.

The need for control was determined by adult density, the formation of gregarious bands, or crop damage. Ground spraying and spraying with fixed-wing aircraft were used for control. As with other locust species, spraying vegetation with persistent chlorinated hydrocarbon insecticides (e.g. dieldrin) was used to control hoppers, and adults were sprayed directly with malathion or fenitrothion.

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non-flooded surrounding areas between May and September. Conditions are favourable for breeding in the flood plains during every month whilst in the surrounding non flooded regions breeding is restricted to the short rainy season only (Fig 45).

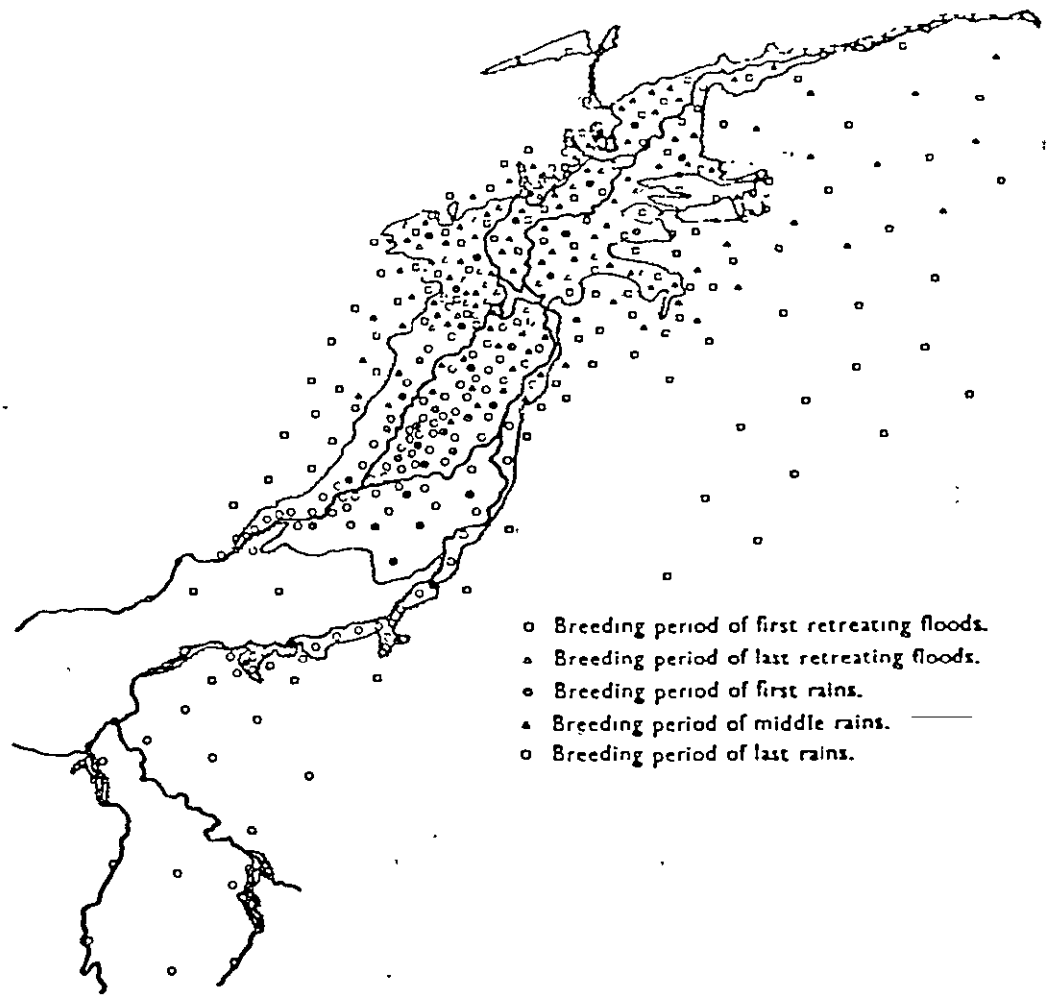

Fig. 45. Diagrammatic map of the distribution of the breeding areas. (Niger Delta area, Mali.)

The two major breeding seasons are separated by distinct lulls in reproductive activity due to temporary unfavourable arid conditions in the Sahel and flood plains respectively. Resumption of breeding at the flood retreat is marked by colonisation and laying by immigrants as the first habitats are uncovered. At the onset of the rains the recommencement of breeding is characterised not by immigration or the start of laying, as might be expected, but by the resumption of development of eggs which had been previously laid in dry flood plain soils (Fig. 29). Breeding is, therefore, synchronised twice a year with the start of the monsoon and flood retreat and follows a strictly annual rhythm. The timing of

RED LOCUST (Patanga (or Nomadacris) septemfasciata)

Distribution, Habitat Preferences and Migration: There are nine areas where Red Locust swarms have been known to form (See Map 1). They have been listed in order of importance as: Rukwa, Mweru wa Ntipa, Wembare, Malagarasi, Busi-Gorongosa, Iku, Kafue, and Chilwa. Their importance has changed over the years, however. Rukwa and Mweru wa Ntipa were continuously flooded from 1962 until at least the late 70's, while other areas suddenly became important, perhaps because they were then starting to be periodically flooded. Intermittent flooding is the only characteristic the outbreak areas appear to have in common. There is a relationship between high rainfall (and presumably flooding) in one wet season and red locust breeding success in the following wet season. The most prolific outbreak areas have either closed or highly impeded drainage and highly saline clay alluvial soils. Fire also occurs during the dry season in all the outbreak areas, and the locusts lay most of their eggs in bare ground in recently burned areas.

In the last Red Locust plague (1930-1944), two major breeding areas were established (See Map 2), one in Mozambique, Zimbabwe, Malawi and part of Zambia, and the other on the western side of Lake Victoria in Uganda, Rwanda, Burundi, and northern Tanzania. From the more southern breeding area, the locusts moved northwest into Zaire and Angola in April-July, and then south across Zambia and Botswana to South Africa in August-October. Also a large population remained in the breeding area all year.

Life Cycle: The Red Locust has one generation per year. It spends the dry season as an immature adult, maturing at the start of the rains, typically in November. Each female lays 1-2 egg pods, each containing about 100 eggs. The eggs begin to hatch around the end of the year, and hoppers take about 60 days to develop to adulthood. Fledging starts late in February and continues into March and April.

Natural Enemies: Eggs are eaten by rats and mites, and parasitized by wasps, but the influence of these predators and parasites is not significant. Young (first and second instar) hoppers are heavily preyed on by several species of robber flies and damsel flies, and as many as 90% of the first instar hoppers may die. Mortality among other hoppers and adults is normally low. They are attacked by insect predators and parasites, a species of nematode, and several species of birds.

Food Preferences and Crop Damage: Although the Red Locust is primarily a grass feeder and thus prefers cereal crops, sugar cane and bananas, it has also been recorded damaging many other crops. The adult swarming period, May-October, is not the main summer growing period and this tends to limit the damage done by escaping swarms.

Survey and Control: As the resources of the International Red Locust Control Organization decreased, they abandoned ground surveys and ground spraying. Recent methods of control have relied on lattice spraying of vegetation to kill bands of hoppers as they marched through and fed in the area. Dieldrin, an insecticide which is not acceptable to A.I.D., but which is useful for this type of control because of its long persistence on vegetation, was used. Control action would be taken when 15 hopper bands/sq. mile could be spotted by air. Aerial spraying with fenitrothion was used on swarms of adults.

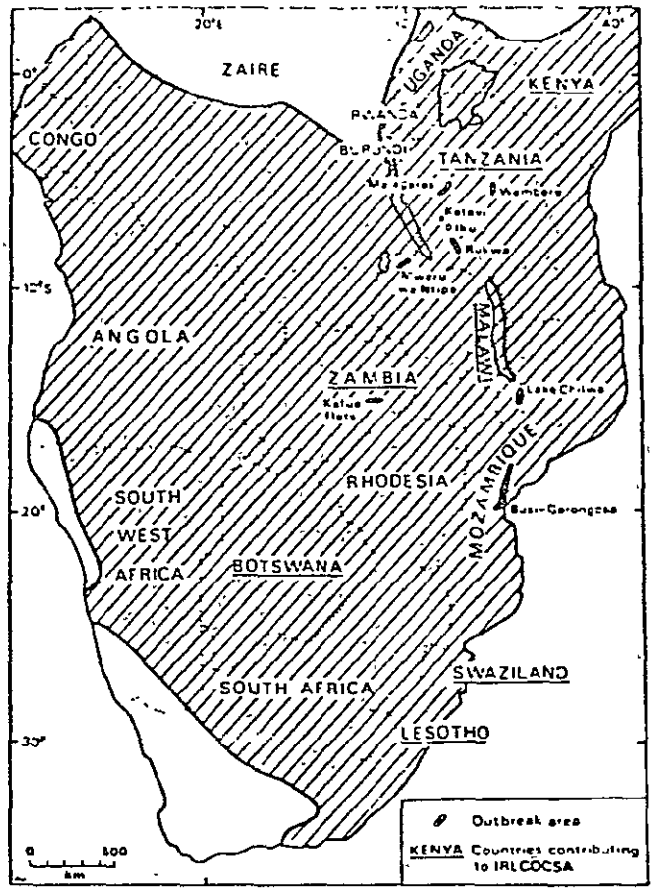

FIG. 1. — The area infested by Red Locusts during the plague 1930–44, shown shaded, the recognised outbreak areas and the countries liable to attack.

porary evidence to show this; even if swarms did form in Rukwa they are unlikely to have been essential in starting the plague (Symmons 1964). In 1949 the International Red Locust Control Service (IRLCS) was formally established with the task of preventing swarm escapes from the designated outbreak areas and so preventing plagues. In 1971 IRLCS was dissolved and in part replaced by the International Red Locust Control Organisation for Central and Southern Africa (IRLCOCSA) (Fig. 1).

No plague has occurred since IRLCS was established so it would seem reasonable to assume that the outbreak area theory is sound and that control within the outbreak areas has been satisfactory. In fact doubt exists on both counts. The number of areas which have either produced swarms, or would have probably produced swarms without control, has increased from the two specifically mentioned in the agreement setting up IRLCS, to the six for which IRLCOCSA acknowledges responsibility, with a seventh in a non-member country. It is possible to save the theory by designating every fresh area which produces a swarm as an outbreak area but the theory then becomes a progressively less satisfactory basis for a control strategy. The task of policing many widely separated areas, most of which seldom produce swarms, is costly and difficult.

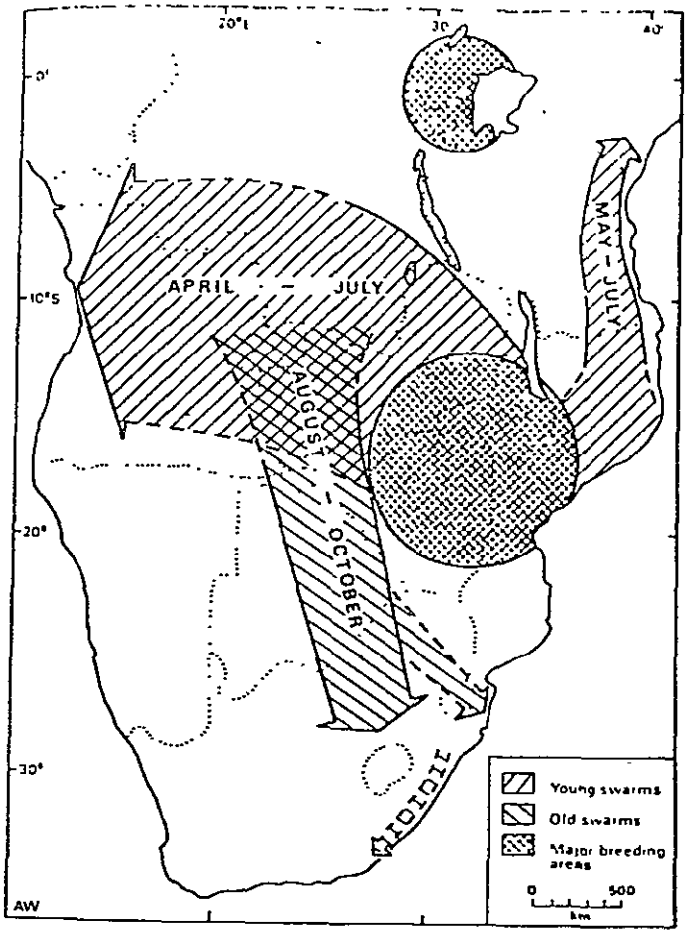

Fig. 9 — Major plague breeding areas and generalised directions of plague migration.

In each case there was a major breeding area which was persistently infested (Fig. 9). In the south an annual open migration circuit was established (Fig. 9) with swarms moving north-westwards into Zaïre and Angola soon after fledging, and southwards through western Zambia, western Rhodesia (then Southern Rhodesia) into Botswana (then Bechuanaland) and South Africa in August, September and October. In eastern Africa there was no such regular movement but some swarms left the major breeding area on many occasions, as a rule moving north-eastwards.

The major breeding areas were not the only regions where breeding occurred nor is it likely that all migrating swarms reached the furthest extremities of the migration routes. Over most of the invasion area it is likely that even the fastest moving swarms were displaced an average distance of only a few kilometres a day, while many moved even more slowly and some moved hardly at all. Thus, some swarms were always retained in the major breeding area. In central and southern Africa there was a regular net displacement of swarms into areas which were either very dry and where the swarms almost certainly failed to survive, or to areas where breeding was, as a rule, unsuccessful. In eastern Africa the

BROWN LOCUST (*Locustana pardalina*)

Distribution and Migration: The outbreak region of the Brown Locust is in South Africa and southern Namibia, mostly in the Karoo area, in a belt with annual summer rainfall between 130 and 380 mm (see Map 1). The invasion area (Map 2) has extended as far north as the Zambezi River - covering Botswana, Zimbabwe, Namibia, and parts of Mozambique.

Migration of brown locusts has not been well-described in the literature. They are believed to fly mostly downwind, and in general, the overall direction of movement is north (or northeast or northwest) early in summer and east (or northeast or southeast) late in summer. Occasionally, swarms from all directions have been tracked flying into one giant central swarm.

Life Cycle: Brown Locust eggs are extremely resistant to desiccation. They can survive almost 15 months without any rain, and when light rain falls (as low as 2.5 mm), they can absorb moisture to allow continued survival. Also, the eggs of solitary populations go through a dormant period of 20-95 days when they cannot hatch, even under favorable conditions. For any eggs that are not dormant, 10 mm of rain and a temperature of at least 14° c. stimulate development. In practice, this means that eggs hatch from late October or November to early March or April. The hoppers hatch out 8-18 days after the rain (mean of 11 days at a mean temperature of 19.5° c.). Duration of the hopper stage depends on the temperature and on whether the hoppers are solitary or gregarious. For solitary hoppers, development to adulthood averages 25 days under field conditions. For gregarious hoppers, about 40 days.

Egg laying takes place 15-20 days after the locusts become adults. Each egg pod has an average of 37 eggs for solitary populations or 47 eggs for gregarious populations, with the number somewhat higher for young females than for those who have laid eggs before. A new egg pod can be produced every 7-8 days and a female can produce 4-5 egg pods over her lifetime.

Natural Mortality and Natural Enemies: A study of a solitary population of locusts estimated the average mortality from hatching to adulthood at 94% and mortality during the first four weeks of adulthood at 44%. The causes of this high mortality were not known.

Among the known enemies of the Brown Locust are several species of insects that feed on egg pods; robber flies, scorpions, and other predators of hoppers and adults; birds such as the white stork, the white-bellied stork, and the wattled starling, which particularly feed on bands and swarms of gregarious locusts; and the micro-organism *Malamoeba locustae*, which may kill, or weaken females so they cannot lay viable eggs.

Swarm Formation and Cyclical Outbreaks: When brown locusts are in their solitary phase in the outbreak area, they avoid each other. As populations increase, the density of locusts becomes more uniform over the outbreak area, as the larger number of locusts still maintain the same distance from their neighbors. Finally, the numbers become so high that the locusts can no longer avoid each other and their behavior switches - they begin to congregate into swarms. Thus, when swarming takes place, it occurs over a wide area after a long period of high locust densities.

Over a long period (going back to the 1780's), it has been observed that outbreaks and recessions of the Brown Locust occur in regular cycles: each outbreak lasts 7-11 years, and is followed by a recession of approximately equal length. (The last outbreak I have seen mentioned ran from 1962-1971. By this theory, the current outbreak is about four years overdue). There are some hypotheses about why this regular cycle takes place, but evidence is lacking.

Survey and Control: Because the population build-up occurs over a wide area, and because the South Africans are convinced that an outbreak period will continue for seven years, regardless of the control applied, there are no attempts to knock down high populations in the outbreak area. Populations are carefully monitored, however, by "locust officers" who make a regional survey in asigned areas each fall to evaluate the year's population. The survey is made by walking a fixed distance (440 yeards) and counting the numbers of locusts flushed. These counts are used to produce a map (on 1/4° x 1/4° scale) of locust densities in the outbreak area.

Swarms are located and controlled by mobile teams, with the help of farmers and ranchers, who are encouraged to report swarms and bands to the authorities. The emphasis is on destroying swarms escaping from the outbreak area before they do serious damage to cropland and before they reproduce.

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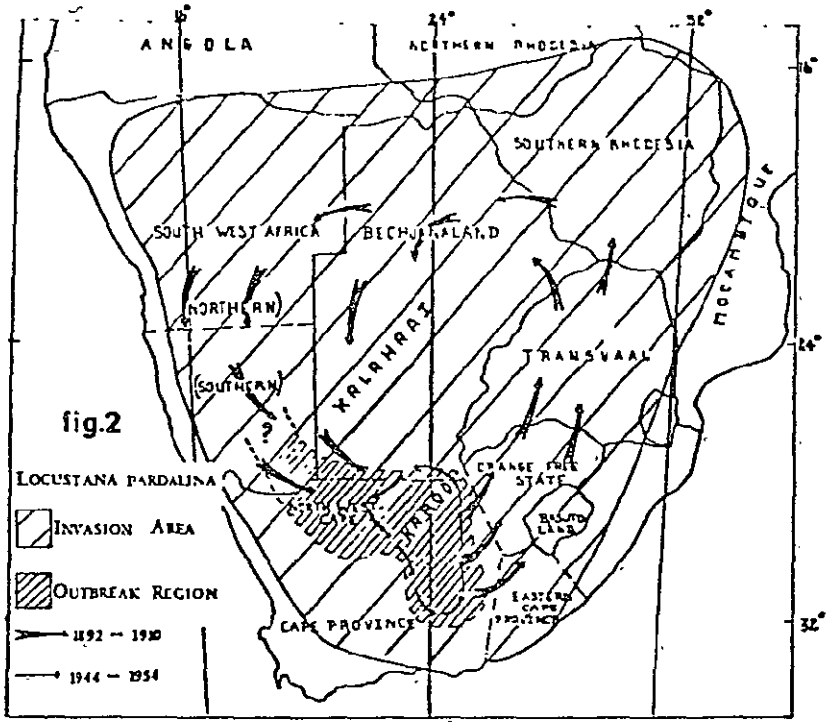


Fig. 2. Semi-schematic representation of an old and a recent plague cycle of the brown locust. The arrows indicate the supposed or known main directions of migration, forked arrows for the old cycle and simple ones for the recent one. See fig. 1.

The broadly hatched area represents the invasion area of the species: the narrowly hatched zone in the Karoo and North West Cape is the known extent of the outbreak region within which swarms can arise from an increase of the solitary population.

centre of the outbreak region. By 1950 practically the whole of the outbreak region was involved and some swarms even escaped into the Transvaal. The last swarm locusts were more or less successfully controlled in the western and north-western Cape in 1953. By 1954 it was clear that the plague had shot its bolt. Since then there have been sporadic outbreaks over many parts of the outbreak region, but the control organization has not been extended. At the time of writing (June 1960) the locusts are extremely quiet and the only solitary phase populations of any significance are located in or near the central part of the outbreak region in De Aar and Prieska.

Two main facts emerge from a consideration of Figure 1. Firstly, it is clear that even rather efficient suppressive control seems incapable of preventing the initiation of fresh swarming and the frequency of outbreaks has not been noticeably reduced by man's efforts.

In the past escaping swarms regularly invaded the Kalahari from where they or their progeny frequently returned. It is for this reason that the Kalahari was erroneously designated as the true home of brown locusts for a long time.

The neighbouring territories Mozambique, Rhodesia, Botswana and Lesotho are also included in the invasion area. The last time the two first-mentioned were invaded was in 1924/25 while the two last-mentioned were still invaded as recently as 1963/64, but only on a small scale.

LIFE CYCLE

As can be seen in Sketch 2, there are three life forms, namely eggs, hoppers and flyers.

The young hoppers hatch from the eggs. When the hopper life in its various stages has been completed the hoppers change into flyers which lay the eggs for the following generation. In their youth locusts are therefore called hoppers. These have to be content to walk or jump; they cannot fly as their parents, the adults did.

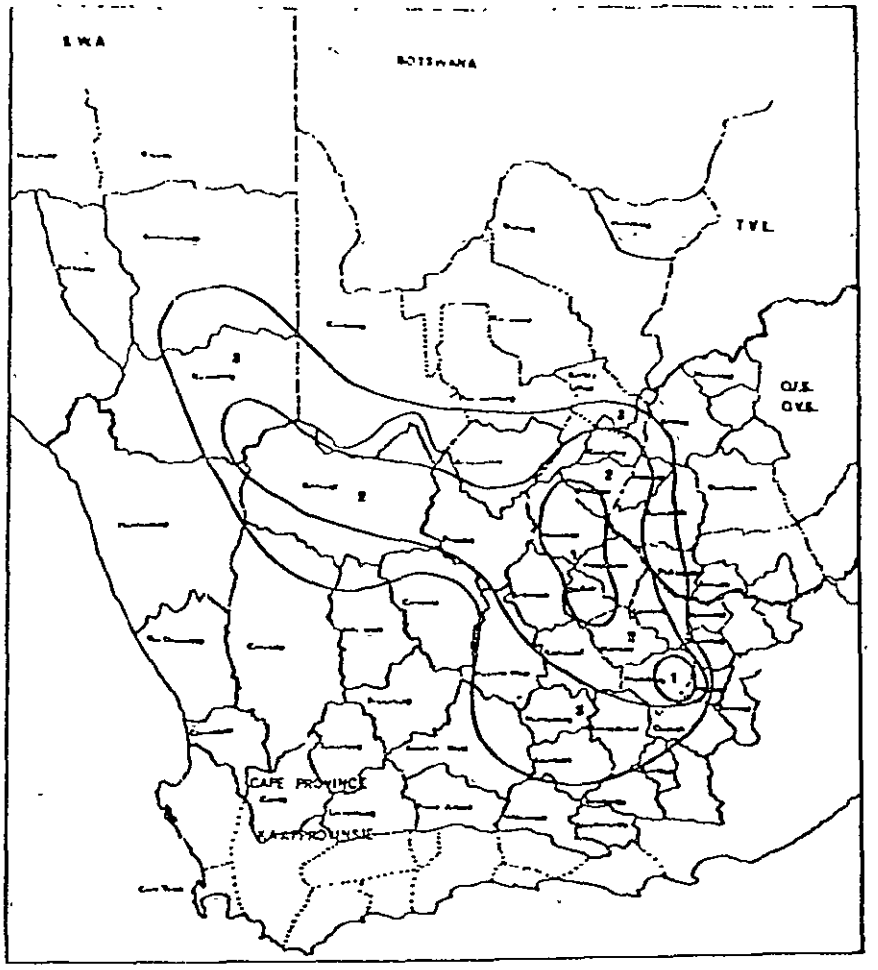
PHASES

It is well known that sooner or later hopper bands and flyer swarms of locusts such as the brown locust will make their appearance.

What is not generally known is that locusts are also found as single individuals. These solitary-living locusts appear and behave very much like any of the thousands of species of grasshoppers that are commonly found scattered in the veld. Locusts and grasshoppers have been compared in the first article of the series. When swarms cannot be found this does not mean that the locusts have died out because the solitaries are still there.

Under favourable conditions these solitary-living individuals multiply so rapidly that it is no longer possible to call their children or progeny solitary. The locusts are then found in loose aggregations. These indicate that the locust is in the very early stages of swarming. As the process of swarming continues or with further multiplication, denser aggregations are found until eventually dense swarms make their appearance.

Scientists refer to the solitary living locusts as being in phase *solitaria* (= solitary phase; the locusts in swarms as phase *gregaria* (= swarm phase); and those at the intermediate densities as phase *transiens* (= transient phase).



Sketch 1: The outbreak region of the brown locust indicating frequency of incipient swarm outbreaks in three areas, marked "1", "2" and "3", over a period of 25 years. There are almost certainly areas beyond the outer boundary of this diagram where incipient outbreaks may occur even more rarely. These areas are most likely to be in South West Africa (as far north as Maltahöhe).

Explanation:
Area "1": Areas with high frequency of outbreaks — 17-18 years out of a total of 25.
Area "2": Area with medium frequency of outbreaks — 13-16 years out of a total of 25.
Area "3": Area with low frequency of outbreaks — 9-12 years out of a total of 25.

There is good reason for making these distinctions since the locusts are basically very different in these various phases, both in behaviour and appearance. It is for this reason that the life history and habits of brown locusts are given separately for the three phases.

SWARM PHASE

Mating and egg-laying

When a swarm begins to form an egg "nest", millions of flyers are found settled densely on the ground. There is much chirping as the males compete for the favours of the females. Mating takes place with the males on the backs of the females. Afterwards the females, still with the males like jockeys on their backs, begin drilling into the ground with their abdomens. This is done with the aid of four powerful plates, called "ovipositor", at the tip of the abdomen. The males do not have these ovipositors and the tips of their abdomens are more or less

SENEGALESE GRASSHOPPER (*Oedaleus senegalensis*)

Distribution and Migration: In a band across Africa north of the equator (but also reaching south into Tanzania), the Middle East and southwest Asia. The band falls entirely within the area receiving 250 mm - 1000 mm annual rainfall. Launois, in West Africa, breaks this band into three areas defined by rainfall: 1) the area of initial multiplication, in the south, where development begins at the start of the wet season. Grasshoppers are here in April and May, then again inNovember. Rainfall: 750 - 1000 mm. 2) Transitonal area of multiplication. Generally has grasshoppers in June, July and October. 500 -750 mm. 3) Northern area of multiplication. Grasshoppers present in August and September. 250 - 500 mm. Movement of this grasshopper, like many of the locusts, follows the movement of the Inter-Tropical Convergence Zone. They have been shown to be able to move up to 100 km. in a single night when travelling with the wind.

Habitat and Preferred Foods:

O. senegalensis is generally found in open, grassy habitat, perhaps with occasional bushes and trees. It prefers to lay eggs in light sandy soils. It feeds predominantly on grasses and crops in the grass family and is particularly damaging to millet (both young plants and plants with maturing seed heads) and to mature sorghum. It has occasionally been recorded to feed on legumes, cotton, and other broad-leaved plants, usually in the absence of other suitable food.

Life Cycle: Each female can lay 1-2 egg pods, each containing 20-30 eggs. If the eggs are laid after the autumnal equinox in September, they remain dormant until the following spring. Otherwise, the eggs can be stimulated to develop by moisture. A rain of 30 mm or more will cause the majority of eggs to develop and hatch. Less rain will result in partial development which will be completed when more moisture is available. The eggs are very resistant to drying and will remain viable without moisture for more than one year. There is some dispute about whether some eggs may remain dormant for more than one year in the presence of adequate moisture.

Rates of development are determined by the humidity, temperature and the presence of suitable green vegetation. Under optimum conditions (temperature greater than 27.5^{o} C., ratio between actual and potential evaporation = 0.10 - 0.20, vegetation completely green), the eggs hatch in 15 days, the hoppers develop into adults in 23 days, and the adults begin to produce eggs after 13 days, so a generation could take only 51 days.

Natural Enemies: The number of egg pods destroyed by predators has been estimated at 50-60%. Surveys of insect diseases have found viruses, protozoans, and fungi present at low levels.

Forescasting, Survey, and Control: There is a model, the work of M. Launois, which should provide rough forecasting of development rates, movements, and survival rates, based on meteorological data and forecasts. Shortly after the beginning of the dry season, a measure of the numbers of grasshoppers present during the wet season and whether they were adults or nymphs can be obtained by looking at the abundance and size of the fecal pellets. Egg pods can also be surveyed (quite laboriously) by scraping the top 1-3 cm. of soil off the surface to expose the tops of the pods.

The little literature I have found on control recommends small scale control by farmers using BHC (not acceptable to A.I.D.) or propoxur dust just after hatching. Damage to millet can also be reduced by delaying planting until after other green vegetation is present, rather than planting at the first big rain so that seedlings and grasshoppers emerge from the soil at the same time.

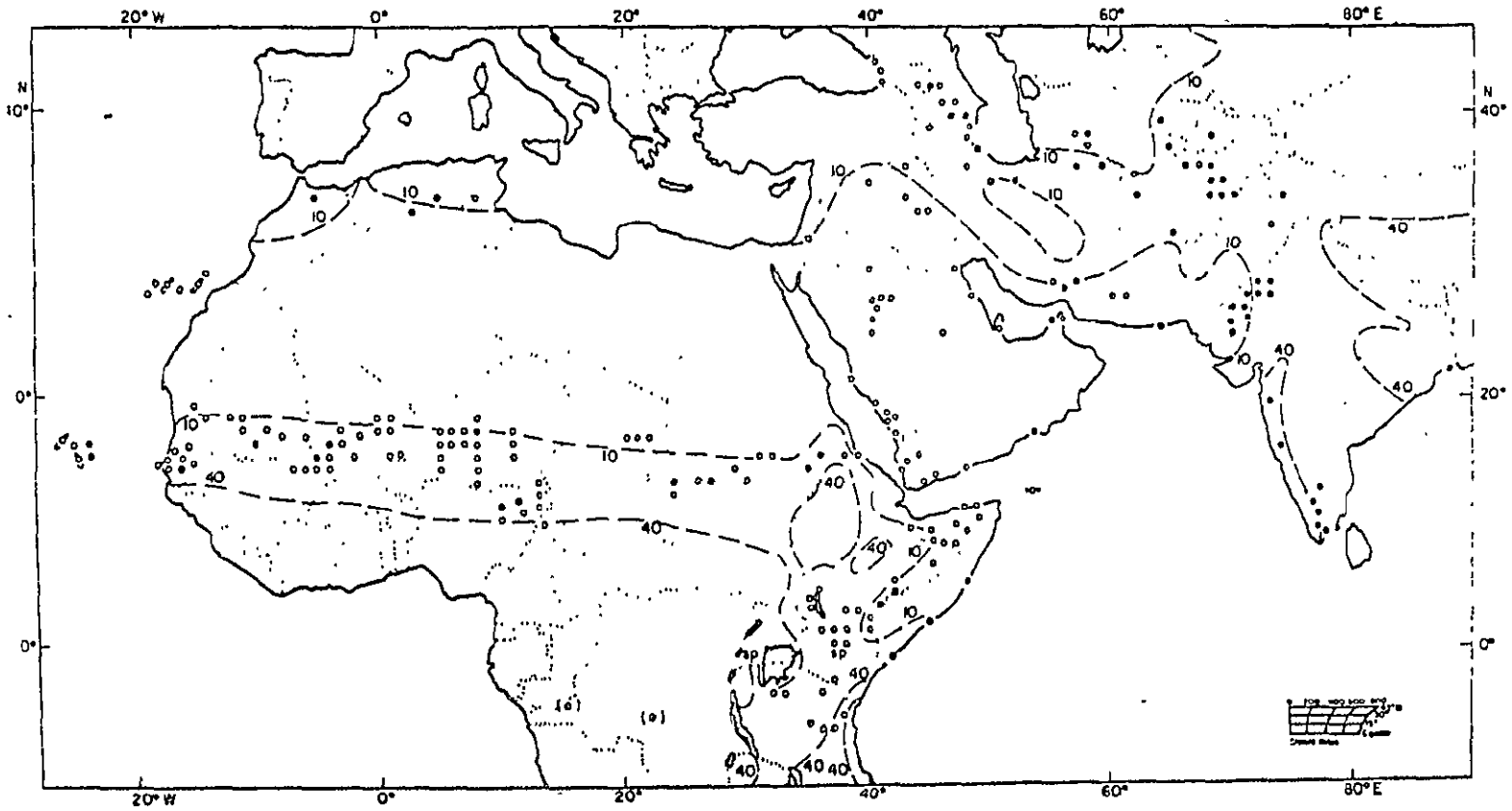


FIG. 1. Distribution area of *Oedaleus senegalensis*. ○, Locality of occurrence; ⊕, recorded gregarization; sp, species undetermined; (○), dubious record; - - -, mean annual isohyet (in.).

GUIDELINES FOR THE SELECTION AND USE OF PESTICIDES IN BANK FINANCED PROJECTS AND THEIR PROCUREMENT WHEN FINANCED BY THE BANK

Introduction

1. Pest control is widely recognized as an essential element in improving human welfare in all areas of the world. A wide range of insects, weeds, disease microorganisms, nematodes and rodents reduce food and fiber yields by attacking livestock, forests, crop plants and stored agricultural products in addition to directly damaging human health. Throughout the history of agriculture a variety of techniques have been used to combat this threat; control of pests has traditionally been accomplished through a combination of cultural practices, selection and breeding of resistant plant varieties, encouragement of natural enemies and the introduction of biological control agents, as well as the application of chemical control materials (including insecticides, acaricides, molluscicides, nematicides, fungicides, bactericides and herbicides as well as poison baits for rodent control). Properly used, chemical pesticides are essential elements in a pest management program. However, there is now great concern over the ever greater reliance on chemical pesticides throughout the world. The problem is particularly significant in the developing world where exclusive reliance on chemical control is a common response to the increased levels of infestation by pests, diseases and weeds which have accompanied recent increases in the intensity of crop and livestock production and human settlement. This approach is frequently taken without adequate safeguards for those who handle or may be exposed to the pesticides or for the environment, and with little regard to pest-induced crop losses or the cost-effectiveness of chemical control.

2. It is becoming increasingly evident that the unilateral chemical approach, in addition to posing potential threats to human health and to the environment, does not lead to sustainable and profitable agricultural production. The rapidly increasing cost of pesticides as well as the development of secondary pest species and the growing incidence of insecticide-resistance in pest populations limit the effectiveness of chemical pest control. For this reason and in line with Bank policy to promote sound technologies which do not carry with them excessive environmental costs, it is important that use of pesticides in Bank projects should be consistent with sound pest management practices and accompanied by safeguards to protect the users, the general public and the environment. Sound pest management should aim to reduce dependence on chemical pesticides through the establishment of economic control thresholds and through the use, wherever possible, of agronomic or related practices which reduce the severity of pest attack. The Integrated Pest Management (IPM) approach, which includes the prudent use of pesticides when damage reaches unacceptable levels, should be the objective of Bank strategy in agricultural development. In addition, it is important that appropriate attention be paid to technical suitability, safety and efficient procurement during

the preparation, appraisal and supervision of all Bank projects which promote or increase the use of pesticides and particularly those which would finance the procurement of pesticides (either explicitly or through short term credit for production inputs).

3. The following sections provide guidance on the use of pesticides and their selection and purchases. Section A outlines the present state of the art in Pest Management Practices within the context of which a pest control program should be assessed. Section B concerns handling, storage and application safety. Section C discusses particular considerations in the selection of pesticides for a particular situation. Section D treats pesticide procurement. These sections may from time to time require more detailed treatment than is appropriate in this OPN. In such cases Supplementary Technical Notes will be issued jointly by the Agriculture Department (AGR) and the Environment Unit (PPDES) and will have the authority of this OPN with which they should be filed.

4. During appraisal and supervision of Bank lending operations in which financing is being provided for pesticides, it is the responsibility of Bank missions to ascertain whether pest management is or will be appropriate and safe, and if necessary, to make appropriate recommendations to correct the situation.

A. Pest and Pesticide Management Practices

5. Effective pest management involves maintaining quantity and quality of production or improving health by the least costly means and the maximization of net benefits should be the guiding principle of all pest management. While pesticides will continue to play an important part in pest management, an integrated approach combining the use of resistant varieties, biological control techniques and modified cultural practices where appropriate, together with judicious use of chemical pesticides, can offer better prospects for long term control and reduced environmental damage while increasing the margin between benefits and the costs of control measures.

6. The costs of pest control can be direct such as those for the purchase, distribution and application of pesticides and the increased costs of changing cropping practices, or indirect such as the harmful effects on human health and the environment which can arise from inappropriate and unsafe pesticide use. They can be short or long term, the latter including the cost of changing chemical control materials to combat increased pest resistance. Some costs are straightforward while others are difficult to quantify. Use of pesticides as well as other control measures should always be the result of a considered evaluation that the benefits to be gained outweigh the direct and indirect costs, in-so-far as these can be assessed.

7. Every effort should be made to promote the Integrated Pest Management concept within Bank agricultural projects by selecting pesticides and pesticide use patterns which are compatible with an IPM approach. Three major points should be considered:

(a) pesticides should be viewed as a short-term response to the build-up of a particular pest species to threshold levels which have been found as a result of field trials and past experience to be economically damaging. The overall control of pest populations should be attempted by other methods such as the use of crop varieties which are resistant or tolerant to the pest, biological control, and cultural practices including crop rotation, timing of planting to avoid the coincidence of particularly susceptible growth stages of the crop with peaks in pest populations or disease incidence, and timing of irrigation to discourage susceptibility of the plants to fungal infection.

(b) wherever possible, narrow-spectrum pesticide materials should be selected which are effective against the pest species but cause minimum harm to other useful insects (especially the important predators and parasites of the pest species). This approach requires that one or more key target pest species and, if possible, their principal natural enemies first be properly identified.

(c) application methods and timing also should be aimed at minimizing the risk of harming these natural enemies.

8. The build-up of pesticide resistance, particularly in insect populations, is a serious constraint on chemical pest control. Measures to reduce the rate of this build-up and thereby prolong the usefulness of effective materials include:

(a) using as few chemical pesticide applications as possible and delaying application until pest populations reach preset economic thresholds and susceptible life stages,

(b) refraining from using for agricultural pest control chemicals which are also in use in the same vicinity for human disease vector control,

(c) using application methods which minimize the area of pesticide exposure.

It has also been suggested that using combinations of chemicals which differ in mode of action may prevent or delay the development of resistance to any one material. This may involve changing chemicals from one season to another or using mixtures of chemicals, each at a relatively low concentration. However, the effectiveness of this approach remains uncertain.

B. Handling, Storage and Application Safety

9. Correct and careful handling and application of chemical pesticides is essential for safe and effective pesticide use. To reduce the risk of accidents and damage to health or environment resulting from

misuse of pesticides and to maximize the effectiveness of their application, it is essential that proper precautions be taken in the packaging, transport, storage and disposal of pesticides and surplus pesticide containers and that necessary equipment and proper training in application techniques be provided to the users.

10. Standards of packaging of pesticides should be specified in tenders and should be adequate to withstand the considerable abuse which can occur during transport and storage. Clear and durable labelling of all packages to depict the hazardous nature of the contents should always be required. The labels should be in an appropriate language and should be consistent with internationally accepted standards such as those specified in the FAO Guidelines on good Labelling Practices for Pesticides.[1/] The distribution of pesticides in single dose packages or small containers should be encouraged to reduce the need for measuring out concentrates and alleviate some of the problems of on-farm storage of open pesticide containers. Repackaging should only be permitted in properly licensed and inspected facilities meeting acceptable safety standards and preferably under the control of the bulk supplier who should be fully responsible for the suitability of the new package including labelling and use instructions, the quality of the repackaged product and the safety of the repackaging process.

11. While all empty containers should be destroyed, it would be unrealistic to expect adherence to this rule in countries where empty containers suitable for storing liquids are in short supply. To avoid this hazard, manufacturers should be encouraged to design containers which discourage such re-use and to adopt this type of container where a suitable design already exists. When such containers are available, the borrower should be required to specify them in tendor documents. The Bank does not approve of re-use of pesticide containers and strongly recommends that all possible deterrent measures be taken but, in instances where the only available and suitable package offered by suppliers is a non-returnable drum and where destruction of all sound empty containers cannot be ensured, their thorough washing with an appropriate solvent and numerous water rinses should be required to minimize the risk in the event of re-use. Flammable containers should be incinerated in a site where fumes will not be carried into occupied areas by prevailing winds.

12. Stores should protect containers and their contents from the elements, be fenced to discourage unlawful entry, have a nearby water supply and be adequately ventilated. Containers should be stacked on a hard standing with a sill to contain spills and containers should not be stacked beyond the recommended stacking height. Drainage from the storage area should outfall into an evaporation pond to eliminate contamination of streams, canals or groundwater. Where substantial quantities of highly toxic pesticide materials are stored, their presence may require a

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1/ See FAO Plant Protection Bulletin No. 2 1983 Vol. 13.

Serious Hazard Assessment to be undertaken. This involves the consideration of the kinds of accidents which may occur, endangering the staff, people nearly and the surrounding environment. For such a situation the assessment would determine the adequacy of:

(a) the warning systems installed which would alert staff and the public to an emergency;

(b) the established procedures to deal with such an emergency including evacuation of people if it should be necessary;

(c) the availability and working order of emergency equipment; and

(d) the training of staff and their regular practice of emergency drills.

Guidance on this should be sought from PPDES.

13. To prevent contamination in the process of pesticide distribution, food materials should never be transported simultaneously with pesticides. Vehicles used regularly to transport pesticides should be clearly marked and should not be used to transport food products. When other, general purpose vehicles are used to transport pesticides they should be thoroughly decontaminated by washing immediately afterwards. When offloading containers into store, a ramp should be provided in the absence of fork lift equipment to avoid rupture and damage to containers resulting from dropping to the ground. Any damaged containers should be set aside and the contents transferred to sound containers under supervision.

14. Persons handling concentrated materials should have protective face shields or goggles, gloves, aprons and footwear and should be adequately supervised. It is unrealistic to expect workers to wear more complete protection and respirators in hot conditions but selection of pesticides should take into account the minimal protection which handlers will practice. Materials which are likely to become widely distributed should be made available only in relatively low-toxicity formulations. Arrangements should be made for the washing and decontamination of clothing and particular care should be taken to avoid workers contaminating their home environment. All spills should be promptly washed down.

15. Where pesticides are applied by contractors they should be required to take all necessary precautions to protect the public and the environment from damage due to spray drift or other accidental contamination. Licensing of operators on completion of an appropriate course of training is recommended when particularly hazardous materials are to be used. Operators and supervisory staff engaged in regular spraying operations should be trained in the specific first aid procedures for poisoning relating to the material being used. Medical services should be familiar with symptoms and treatment for such poisoning cases and specific antidotes should be readily available. With particularly toxic materials

it may be expedient to require the supplier to supervise the correct handling and application of the materials in accordance with accepted safety standards.

16. Where pesticides are being supplied to farmers it is essential that materials are selected which can be applied safely and effectively without close supervision and that the extension services are adequately supported and trained in the use of the materials so that they may demonstrate the correct techniques and give appropriate advice, including advice for on-farm storage of concentrates and eventual disposal of surplus pesticides and empty containers and calling on specialists in pest control when problems arise. Training should include the storage and handling of concentrates, dilution and mixing, application techniques and suitable application equipment, cleansing and maintaining spray equipment and precautions to avoid environmental damage through spray drift or leaching into streams or groundwater. Equipment and clothing needed for the safe and effective use of pesticides should be easily available and all reasonable measures should be taken to promote its proper use and maintenance. Farmers should be instructed on safety precautions, wearing of suitable protective clothing, the importance of decontamination and of avoiding introduction of pesticides into the household environment. They should also be able to recognize possible early symptoms of poisoning and be aware of the need to seek medical assistance quickly.

C. Selection of pesticide materials and pesticide formulations

17. The selection of chemical pesticides for use in agriculture should take account of the safety and effectiveness of alternatives under local climatic and environmental conditions, their compatibility with Integrated Pest Management, the existence of national or international regulations or recommendations regarding use of particular materials for particular crops and the reliability of potential suppliers to deliver products of a high quality, appropriately packaged and backed by well qualified technical advice and support. In addition the indigenous capability for handling toxic materials and regulating their distribution should be taken into account.

18. The World Health Organization periodically revises and reissues its Classification of Pesticides by Hazard. This lists technical products by their generic names, tabulating them in categories ranging from Extremely Hazardous to unlikely to present acute hazard in normal use. Guidance is given on use of the tables to assess the hazard of particular formulations. Materials listed in Categories 1a Extremely Hazardous or 1b Highly Hazardous are unsuitable for use by small farmers and should only be considered for use in large scale operations if all necessary training, protection and supervision can be assured. 1/

1/ A current copy of the Classification is available for reference in the Sectoral Library.

19. Certain products, notably many of the chlorinated hydrocarbon insecticides have characteristics of excessive persistence in the environment, bioaccumulation in tissues, biomagnification in food chains and in some cases carcinogenicity or cause genetic abnormalities. They should not be used for agricultural purposes but some which have environmental hazards but low health risk may be considered for other purposes such as disease vector control where the risks are minimized and satisfactory alternatives do not exist. Compounds containing Mercury, Thallium, Lead, Cadmium or Selenium are all unsuitable for agricultural use. Fumigant products having high vapor pressures and relatively high toxicities are too hazardous for use by small farmers who do not have sealed storage compartments for grain. 1/

20. Not only active ingredients but contaminants in the formulation may also be harmful. Suppliers should be required, in appropriate instances, to provide analyses by an independent and reputable laboratory showing the formulation to be free of such a contaminant or that the content of such a contaminant meets internationally accepted limits for use of the formulation for specific purposes under close supervision.

21. Preference should be given to products which are registered in the country of proposed use, if such regulatory authority exists, or which are already registered for an identical use in a country where capability exists to evaluate their efficiency, toxicity and long term effects. Products which do not meet this requirement should be considered only if their use for the same purpose has been reviewed by the FAO/WHO Joint Meeting on Pesticide Residues 2/ and acceptable daily intake and maximum residue levels subsequently recommended to the Codex Committee on Pesticide Residues 3/ or if the material has been registered or reviewed for a similar rather than identical application. In both these latter cases special provisions must be made to monitor crop residue levels and the manufacturer may be required to submit information regarding residue decline rates and tolerances and an analytical method suitable for monitoring residues of the pesticide and significant metabolites and degredation products.

22. When pesticides are to be used on food crops it should be ensured as far as possible that FAO/WHO maximum residue limit recommendations will not be exceeded. In the case of crops which make a significant

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1/ AGR and PPDES intend issuing and periodically updating a Supplementary Technical Note listing specific materials and formulations, the use of which should be avoided or strictly limited.

2/ FAO publishes periodically reports and supplements recommending maximum residue limits in food and livestock feeds.

3/ The Codex Committee is responsible for development of international limits for residues in food within the Codex Alimentarius Commission which is a Joint FAO/WHO food standards program.

contribution to the diet, maximum residue levels must be viewed in the light of the need to ensure that acceptable daily intake levels are not exceeded. Where such materials are to be used on food crops for export, compliance with such accepted residue limits or tolerances established by the importing country must be assured. If a pesticide is being considered for which registration in developed countries precludes its use for treating forages and crop residues subsequently to be fed to animals, provision should be made to prevent such feeding of treated materials to animals.

23. If a proposed pesticide is not registered in the country of proposed use but a pesticide regulation authority exists, the necessary steps to assure registration should be taken before it is introduced into the country. Such registration should establish labelling requirements for the product and require the provision by the manufacturer of particular information on the material's toxicity and persistence and the movement of the material and possibly harmful breakdown products in the environment if it is not readily available in published literature.

24. Selection of pesticides should be based on a careful evaluation of possible hazard to the environment and to important natural resources. For example, materials having high acute toxicity to fish or aquatic invertebrates should not be used where there are aquatic resources which could be adversely affected by runoff, drift or soil erosion and those highly toxic to honeybees should not be used when they will present a threat to important pollinators. Information on toxicity to non-target organisms should be available from the manufacturer if it is not in the published literature. Any use of pesticides should be designed to minimize the area of exposure, but when materials known to present a significant environmental risk are used an environmental monitoring program should also be implemented.

D. Procurement of Pesticides

25. Wherever possible competitive tenders should be sought for the supply of pesticides. In order to evaluate tenders from different sources offering different materials for control of the same pest, prior comparison of the different materials in field tests is necessary to evaluate their relative efficiencies. Where adequate information is available, efficiency weightings may be given to different materials and used in the evaluation of bids but to do so, the weights must be made public in the documents supplied to potential bidders so that in making offers they are aware of the conditions under which their product will be evaluated. Such weights may be used to reflect the advantage a particular material might offer by controlling other pests besides the one for which the spray is intended, by being less harmful to predators, or by being less dangerous to handle and apply. Where data is insufficient to apply such efficiency factors, materials are compared on the basis of their cost per unit area when applied, in accordance with the local recommended practices in the country and taking account of the manufacturers recommendations, at the rate and frequency to control the pest concerned. Where one material has been shown in trials and in practice to offer a longer period of control than another,

so requiring fewer applications, the saving in application costs needs to be taken into account in evaluating bids.

26. To enable different suppliers, each formulating a particular active ingredient under one or more different trade names to compete, the invitation to bid and tender documents should use the accepted generic name or names of the material or materials which would be considered. The specification should define all the critical characteristics in the formulation covering such aspects as solvents, emulsifers, and surfactants in the case of emulsifiable concentrates, or particle size in the case of dusts or suspensions, which may affect the performance of the pesticide. The manufacturer should certify that the product is exactly the same (in terms of physical and chemical properties, formulating ingredients and manufacturing process) as that marketed and registered in the country of origin, or be willing to state any deviations and provide an acceptable rationale for them. Materials to be used for seed treatments should be formulated with warning colorants or dyes which will persist under anticipated storage and handling conditions.

27. The specification should indicate any special features of packaging and labelling which are necessary for product protection during handling and storage and to ensure effective use. It should require packaging and labelling to be consistent with accepted standards. Reference may be made to internationally accepted packaging and labelling standards such as those described in FAO Plant Protection Bulletin No. 2 1983 Vol. 13. In the case of products which are not water soluble, the manufacturer should be required to recommend and provide a suitable solvent for washing application equipment and containers. Where available, containers which discourage re-use for storing liquids should be specified.

28. Where only a single product from a single manufacturer is effective in controlling a particular pest or where a single product has such outstanding advantages over other products on the market that it would not be technically justified to use anything else, direct purchase may be resorted to following negotiations with the supplier. In such cases prudent enquiries should be made to determine the prices paid by other recent purchasers of the product in order to ascertain whether the price being quoted is a fair one, taking account of the quantity being ordered and delivery requirements.

29. Where quantities being purchased are small so that competitive bidding would not be an efficient means of procurement local shopping may be resorted to, obtaining quotations from at least three different suppliers.

S. Shahid Husain
Vice President, Operations Policy

March 1985

JCCollins/DKing:js

International Code of Conduct on the Distribution and Use of Pesticides

APPENDIX C

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS
Rome, 1986

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Introduction

The action by FAO to develop, in consultation with appropriate United Nations agencies and other organizations, an International Code of Conduct on the Distribution and Use of Pesticides follows and accompanies many other events, some going back 25 years. All these events were designed to benefit the international community and to serve to increase international confidence in the availability, regulation, marketing and use of pesticides for the improvement of agriculture, public health and personal comfort.

One of the basic functions of the Code, which is voluntary in nature, is to serve as a point of reference, particularly until such time as countries have established adequate regulatory infrastructures for pesticides.

The Director-General of FAO in 1981 suggested that such a Code could help to overcome a number of difficulties associated with pesticides. The FAO Panel of Experts on Pesticide Specifications, Registration Requirements and Application Standards, at its meeting in 1982, agreed that activities involving the export and import of pesticides, and thereby their safe use, might be best dealt with through the adoption of a Code of Conduct. To that end a working paper was prepared for the FAO Second Government Consultation on International Harmonization of Pesticide Registration Requirements, Rome, 11-15 October 1982. The formal decision to develop the Code was taken at that Consultation, which recommended that FAO, in consultation with the appropriate United Nations organizations and bodies and international organizations outside the United Nations system, should draft a Code (1). The Code itself was adopted by the FAO Conference at its Twenty-third Session in 1985 by way of Resolution 10/85, which appears as an Annex to the present publication.

A number of governments and organizations have expressed

concern about the propriety of supplying pesticides to countries which do not have infrastructures to register pesticides and thereby to ensure their safe and effective use. It should be noted that the development of national regulatory programmes is the first priority of FAO activities in this field. There has also been concern over the possibility that residues of certain pesticides, not needed or not permitted in particular countries, are present in imported agricultural commodities produced in other countries where the use of such pesticides is not restricted. While recognizing that it is impossible to eliminate all such occurrences, because of diverging pest control needs, it is none the less essential that every effort be made to apply pesticides only in accordance with good and recognized practices. It is at the same time important for industrially developed countries to recognize, in their regulatory activities concerning residues, the pest control needs of developing countries, particularly the needs of countries in tropical regions

In the absence of an effective pesticide registration process and of a governmental infrastructure for controlling the availability of pesticides, some countries importing pesticides must heavily rely on the pesticide industry to promote the safe and proper distribution and use of pesticides. In these circumstances foreign manufacturers, exporters and importers, as well as local formulators, distributors, repackers, advisers and users, must accept a share of the responsibility for safety and efficiency in distribution and use

The role of the exporting country needs to be considered Much emphasis has been given recently to the desirability of regulating the export of pesticides from producing countries. It is generally accepted that no company should trade in pesticides without a proper and thorough evaluation of the pesticide, including any risks. However, the fact that a product is not used or registered in a particular exporting country is not necessarily a valid reason for prohibiting the export of that pesticide. Developing countries are mostly situated in tropical and semi-tropical regions. Their climatic, ecological, agronomic, social, economic and environmental conditions and therefore their pest problems are usually quite different from those prevailing in countries in which pesticides are manufactured and exported. The government of the exporting country, therefore, is in no position to judge the suitability, efficacy, safety or fate of the pesticide under the conditions in the country

where it may ultimately be used. Such a judgement must, therefore, be made by the responsible authority in the importing country in consultation with industry and other government authorities in the light of the scientific evaluation that has been made and a detailed knowledge of the conditions prevailing in the country of proposed use.

The export to developing countries of pesticides which have been banned in one or more other countries or whose use has been severely restricted in some industrialized countries has been a subject of public concern which has led to intensive discussions on whether the exporting country should assume responsibility for the marketing and use of such products in the importing country. In this respect it is essential to note that when pesticides are banned, the reasons are toxicological, environmental or social. Valid and adequate toxicological reasons justifying banning a product are of concern, though not necessarily of equal importance, to most countries. Consequently, such products should not be exported or imported without careful consideration of the toxicological implications for those likely to be exposed.

While a Code of Conduct may not solve all problems, nevertheless it should go a long way toward defining and clarifying the responsibilities of the various parties involved in the development, distribution and use of pesticides, and it should be of particular value in countries which do not yet have control procedures. Where there is a pesticide regulatory process in a country, the need for a Code of Conduct will obviously be less than where there is no such scheme in operation.

The Code of Conduct is not a short or simple document, mainly because the nature, properties, uses and effects of pesticides are diverse and therefore require comprehensive consideration. Furthermore, the strong public pressure for banning or restricting the use of some effective and much-needed pesticides often stems from a lack of understanding of the many important issues involved. This document is designed, therefore, also to provide the general public with some basic guidance on these issues.

Text of the Code

Article 1. Objectives of the Code

1.1 The objectives of this Code are to set forth responsibilities and establish voluntary standards of conduct for all public and private entities engaged in or affecting the distribution and use of pesticides, particularly where there is no or an inadequate national law to regulate pesticides.

1.2 The Code describes the shared responsibility of many segments of society, including governments, individually or in regional groupings, industry, trade and international institutions, to work together so that the benefits to be derived from the necessary and acceptable use of pesticides are achieved without significant adverse effects on people or the environment. To this end, all references in this Code to a government or governments shall be deemed to apply equally to regional groupings of governments for matters falling within their areas of competence.

1.3 The Code addresses the need for a cooperative effort between governments of exporting and importing countries to promote practices which ensure efficient and safe use while minimizing health and environmental concerns due to improper handling or use.

1.4 The entities which are addressed by this Code include international organizations; governments of exporting and importing countries; industry, including manufacturers, trade associations, formulators and distributors; users; and public-sector organizations such as environmental groups, consumer groups and trade unions.

1.5 The standards of conduct set forth by this Code:

1.5.1 encourage responsible and generally accepted trade practices;

1.5.2 assist countries which have not yet established controls designed to regulate the quality and suitability of pesticide products needed in that country and to address the safe handling and use of such products;

1.5.3 promote practices which encourage the safe and efficient use of pesticides, including minimizing adverse effects on humans and the environment and preventing accidental poisoning from improper handling;

1.5.4 ensure that pesticides are used effectively for the improvement of agricultural production and of human, animal and plant health.

1.6 The Code is designed to be used, within the context of national law, as a basis whereby government authorities, pesticide manufacturers, those engaged in trade and any citizens concerned may judge whether their proposed actions and the actions of others constitute acceptable practices.

Article 2. Definitions

For the purpose of this Code:

Active ingredient means the biologically active part of the pesticide present in a formulation.

Advertising means the promotion of the sale and use of pesticides by print and electronic media, signs, displays, gift, demonstration or word of mouth.

Banned means a pesticide for which all registered uses have been prohibited by final government regulatory action, or for which all requests for registration or equivalent action for all uses have, for health or environmental reasons, not been granted.

Common name means the name assigned to a pesticide active ingredient by the International Standards Organization or adopted by national standards authorities to be used as a generic or non-proprietary name for that particular active ingredient only.

Distinguishing name means the name under which the pesticide is

labelled, registered and promoted by the manufacturer and which, if protected under national legislation, can be used exclusively by the manufacturer to distinguish the product from other pesticides containing the same active ingredient.

Distribution means the process by which pesticides are supplied through trade channels on local or international markets.

Environment means surroundings, including water, air, soil and their interrelationship as well as all relationships between them and any living organisms.

Extension service means those entities in the country concerned responsible for the transfer of information and advice to farmers regarding the improvement of agricultural practices, including production, handling, storage and marketing.

Formulation means the combination of various ingredients designed to render the product useful and effective for the purpose claimed; the form of the pesticide as purchased by users.

Hazard means the likelihood that a pesticide will cause an adverse effect (injury) under the conditions in which it is used.

Integrated pest management means a pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest populations at levels below those causing economically unacceptable damage or loss.

Label means the written, printed or graphic matter on, or attached to, the pesticide; or the immediate container thereof and the outside container or wrapper of the retail package of the pesticide.

Manufacturer means a corporation or other entity in the public or private sector or any individual engaged in the business or function (whether directly or through an agent or through an entity controlled by or under contract with it) of manufacturing a pesticide active ingredient or preparing its formulation or product.

Marketing means the overall process of product promotion, including advertising, product public relations and information services as well as distribution and selling on local or international markets.

Maximum residue limit (MRL) means the maximum concentration of a residue that is legally permitted or recognized as acceptable in or on a food, agricultural commodity or animal feedstuff.

Packaging means the container together with the protective wrapping used to carry pesticide products via wholesale or retail distribution to users.

Pesticide means any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies. The term includes substances intended for use as a plant-growth regulator, defoliant, desiccant, or agent for thinning fruit or preventing the premature fall of fruit, and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

Pesticide industry means all those organizations and individuals engaged in manufacturing, formulating or marketing pesticides and pesticide products.

Pesticide legislation means any laws or regulations introduced to regulate the manufacture, marketing, storage, labelling, packaging and use of pesticides in their qualitative, quantitative and environmental aspects.

Poison means a substance that can cause disturbance of structure or function, leading to injury or death when absorbed in relatively small amounts by human beings, plants or animals.

Poisoning means occurrence of damage or disturbance caused by a poison, and includes intoxication.

Product means the pesticide in the form in which it is packaged and sold; it usually contains an active ingredient plus adjuvants and may require dilution prior to use.

Protective clothing means any clothes, materials or devices that are designed to provide protection from pesticides when they are handled or applied.

Public-sector groups means (but is not limited to) scientific associations; farmer groups; citizens' organizations, environmental, consumer and health organizations; and labour unions.

Registration means the process whereby the responsible national government authority approves the sale and use of a pesticide following the evaluation of comprehensive scientific data demonstrating that the product is effective for the purposes intended and not unduly hazardous to human or animal health or the environment.

Repackaging means the transfer of pesticide from any commercial package into any other, usually smaller, container for subsequent sale.

Residue means any specified substances in food, agricultural commodities, or animal feed resulting from the use of a pesticide. The term includes any derivatives of a pesticide, such as conversion products, metabolites, reaction products, and impurities considered to be of toxicological significance. The term "pesticide residue" includes residues from unknown or unavoidable sources (e.g. environmental) as well as known uses of the chemical.

Responsible authority means the government agency or agencies responsible for regulating the manufacture, distribution or use of pesticides and more generally for implementing pesticide legislation.

Risk means the expected frequency of undesirable effects of exposure to the pesticide.

Severely restricted — a limited ban — means a pesticide for which virtually all registered uses have been prohibited by final government regulatory action but certain specific registered use or uses remain authorized.

Toxicity means a physiological or biological property which determines the capacity of a chemical to do harm or produce injury to a living organism by other than mechanical means

Trader means anyone engaged in trade, including export, import, formulation and domestic distribution

Use pattern embodies the combination of all factors involved in the use of a pesticide, including the concentration of active ingredient in the preparation being applied, rate of application, time of treatment, number of treatments, use of adjuvants and methods and sites of application which determine the quantity applied, timing of treatment and interval before harvest, etc.

Article 3. Pesticide management

3.1 Governments have the overall responsibility and should take the specific powers to regulate the distribution and use of pesticides in their countries.

3.2 The pesticide industry should adhere to the provisions of this Code as a standard for the manufacture, distribution and advertising of pesticides, particularly in countries lacking appropriate legislation and advisory services

3.3 Governments of exporting countries should help to the extent possible, directly or through their pesticide industries, to:

3.3.1 provide technical assistance to other countries, especially those with shortages of technical expertise, in the assessment of the relevant data on pesticides, including those provided by industry (see also Article 4);

3.3.2 ensure that good trading practices are followed in the export of pesticides, especially to those countries with no or limited regulatory schemes (see also Articles 8 and 9)

3.4 Manufacturers and traders should observe the following practices in pesticide management, especially in countries without legislation or means of implementing regulations:

3.4.1 supply only pesticides of adequate quality, packaged and labelled as appropriate for each specific market;

3.4.2 pay special attention to formulations, presentation, packaging and labelling in order to reduce hazard to users, to the maximum extent possible consistent with the effective functioning of the pesticide in the particular circumstances in which it is to be used;

3.4.3 provide, with each package of pesticide, information and instructions in a form and language adequate to ensure safe and effective use;

3.4.4 retain an active interest in following their products to the ultimate consumer, keeping track of major uses and the occurrence of any problems arising in the actual use of their products as a basis for determining the need for changes in labelling, directions for use, packaging, formulation or product availability.

3.5 Pesticides whose handling and application require the use of uncomfortable and expensive protective clothing and equipment should be avoided, especially in the case of small-scale users in tropical climates.

3.6 National and international organizations, governments, and pesticide industries should take action in coordinated efforts to disseminate educational materials of all types to pesticide users, farmers, farmers' organizations, agricultural workers, unions and other interested parties. Similarly, affected parties should seek and understand educational materials before using pesticides and should follow proper procedures.

3.7 Governments should allocate high priority and adequate resources to the task of effectively managing the availability, distribution and use of pesticides in their countries.

3.8 Concerted efforts should be made by governments and pesticide industries to develop and promote integrated pest management systems and the use of safe, efficient, cost-effective application methods. Public-sector groups and international organizations should actively support such activities.

3.9 International organizations should provide information on specific pesticides and give guidance on methods of analysis through the provision of criteria documents, fact sheets, training sessions, etc.

3.10 It is recognized that the development of resistance of pests to pesticides can be a major problem. Therefore, governments, industry, national institutions, international organizations and public-sector groups should collaborate in developing strategies which will prolong the useful life of valuable pesticides and reduce the adverse effects of the development of resistant species.

Article 4. Testing of pesticides

4.1 Pesticide manufacturers are expected to:

4.1.1 ensure that each pesticide and pesticide product is adequately and effectively tested by well-recognized procedures and test methods so as to fully evaluate its safety, efficacy (2) and fate (3) with regard to the various anticipated conditions in regions or countries of use;

4.1.2. ensure that such tests are conducted in accordance with sound scientific procedures and good laboratory practice (4) – the data produced by such tests, when evaluated by competent experts, must be capable of showing whether the product can be handled and used safely without unacceptable hazard to human health, plants, animals, wildlife and the environment (3);

4.1.3 make available copies or summaries of the original reports of such tests for assessment by responsible government authorities in all countries where the pesticide is to be offered for sale. Evaluation of the data should be referred to qualified experts;

4.1.4 take care to see that the proposed use pattern, label claims and directions, packages, technical literature and advertising truly reflect the outcome of these scientific tests and assessments;

4.1.5 provide, at the request of a country, advice on methods for the analysis of any active ingredient of formulation that they manufacture, and provide the necessary analytical standards;

4.1.6 provide advice and assistance for training technical staff in relevant analytical work. Formulators should actively support this effort;

4.1.7 conduct residue trials prior to marketing in accordance with FAO guidelines on good analytical practice (5) and on crop residue data (6, 7) in order to provide a basis for establishing appropriate maximum residue limits (MRLs).

4.2 Each country should possess or have access to facilities to verify and exercise control over the quality of pesticides offered for sale, to establish the quantity of the active ingredient or ingredients and the suitability of their formulation (8).

4.3 International organizations and other interested bodies should, within available resources, consider assisting in the establishment of analytical laboratories in pesticide-importing countries, either on a country or on a multilateral regional basis; these laboratories should be capable of carrying out product and residue analysis and should have adequate supplies of analytical standards, solvents and reagents.

4.4 Exporting governments and international organizations must play an active role in assisting developing countries in training personnel in the interpretation and evaluation of test data.

4.5 Industry and governments should collaborate in conducting post-registration surveillance or monitoring studies to determine the fate and environmental effect of pesticides under field conditions (3).

Article 5. Reducing health hazards

5.1 Governments which have not already done so should:

5.1.1 implement a pesticide registration and control scheme along the lines set out in Article 6;

5.1.2 decide, and from time to time review, the pesticides to be marketed in their country, their acceptable uses and their availability to each segment of the public;

5.1.3 provide guidance and instructions for the treatment of suspected pesticide poisoning for their basic health workers, physicians and hospital staff;

5.1.4 establish national or regional poisoning information and control centres at strategic locations to provide immediate guidance on first aid and medical treatment, accessible at all times by telephone or radio. Governments should collect reliable information about the health aspects of pesticides. Suitably trained people with adequate resources must be made available to ensure that accurate information is collected:

5.1.5 keep extension and advisory services, as well as farmers' organizations, adequately informed about the range of pesticide products available for use in each area:

5.1.6 ensure, with the cooperation of industry, that where pesticides are available through outlets which also deal in food, medicines, other products for internal consumption or topical application, or clothing, they are physically segregated from other merchandise, so as to avoid any possibility of contamination or of mistaken identity. Where appropriate, they should be clearly marked as hazardous materials. Every effort should be made to publicize the dangers of storing foodstuffs and pesticides together.

5.2 Even where a control scheme is in operation, industry should:

5.2.1 cooperate in the periodic reassessment of the pesticides which are marketed and in providing the poison control centres and other medical practitioners with information about hazards:

5.2.2 make every reasonable effort to reduce hazard by:

5.2.2.1 making less toxic formulations available;

5.2.2.2 introducing products in ready-to-use packages and otherwise developing safer and more efficient methods of application;

5.2.2.3 using containers that are not attractive for subsequent reuse and promoting programmes to discourage their reuse;

5.2.2.4 using containers that are safe (e.g. not attractive to or easily opened by children), particularly for the more toxic home-use products;

5.2.2.5 using clear and concise labelling;

5.2.3 halt sale, and recall products, when safe use does not seem possible under any use directions or restrictions.

5.3 Government and industry should further reduce hazards by making provision for safe storage and disposal of pesticides and containers at both warehouse and farm level, and through proper siting and control of wastes from formulating plants.

5.4 To avoid unjustified confusion and alarm among the public, public-sector groups should consider all available facts and try to distinguish between major differences in levels of risk among pesticides and uses.

5.5 In establishing production facilities in devoloping countries, manufacturers and governments shoud cooperate to:

5.5.1 adopt engineering standards and safe operating practices appropriate to the nature of the manufacturing operations and the hazards involved:

5.5.2 take all necessary precautions to protect the health and safety of operatives, bystanders and the environment;

5.5.3 maintain quality-assurance procedures to ensure that the products manufactured comply to the relevant standards of purity, performance, stability and safety.

Article 6. Regulatory and technical requirements

6.1 Governments should:

6.1.1 take action to introduce the necessary legislation for the regulation, including registration, of pesticides and make provisions for its effective enforcement, including the establishment of appro-

priate educational, advisory, extension and health-care services; the FAO guidelines for the registration and control of pesticides (9) should be followed, as far as possible, taking full account of local needs, social and economic conditions, levels of literacy, climatic conditions and availability of pesticide application equipment;

6.1.2 strive to establish pesticide registration schemes and infrastructures under which products can be registered prior to domestic use and, accordingly, ensure that each pesticide product is registered under the laws or regulations of the country of use before it can be made available there;

6.1.3 protect the proprietary rights to use of data;

6.1.4 collect and record data on the actual import, formulation and use of pesticides in each country in order to assess the extent of any possible effects on human health or the environment, and to follow trends in use levels for economic and other purposes.

6.2 The pesticides industry should:

6.2.1 provide an objective appraisal together with the necessary supporting data on each product;

6.2.2 ensure that the active ingredient and other ingredients of pesticide preparations marketed correspond in identity, quality, purity and composition to the substances tested, evaluated and cleared for toxicological and environmental acceptability;

6.2.3 ensure that active ingredients and formulated products for pesticides for which international specifications have been developed conform with the specifications of FAO (8), where intended for use in agriculture; and with WHO pesticide specifications (10), where intended for use in public health;

6.2.4 verify the quality and purity of the pesticides offered for sale;

6.2.5 when problems occur, voluntarily take corrective action, and when requested by governments, help find solutions to difficulties.

Article 7. Availability and use

7.1 Responsible authorities should give special attention to drafting rules and regulations on the availability of pesticides. These should be compatible with existing levels of training and expertise in handling pesticides on the part of the intended users. The parameters on which such decisions are based vary widely and must be left to the discretion of each government, bearing in mind the situation prevailing in the country.

7.2 In addition, governments should take note of and, where appropriate, follow the WHO classifications of pesticides by hazard (11) and associate the hazard class with well-recognized hazard symbols as the basis for their own regulatory measures. In any event, the type of formulation and method of application should be taken into account in determining the risk and degree of restriction appropriate to the product.

7.3 Two methods of restricting availability can be exercised by the responsible authority: not registering a product; or, as a condition of registration, restricting the availability to certain groups of users in accordance with national assessments of hazards involved in the use of the product in the particular country.

7.4 All pesticides made available to the general public should be packaged and labelled in a manner which is consistent with the FAO guidelines on packaging (12) and labelling (13) and with appropriate national regulations.

7.5 Prohibition of the importation, sale and purchase of an extremely toxic product may be desirable if control measures or good marketing practices are insufficient to ensure that the product can be used safely. However, this is a matter for decision in the light of national circumstances.

Article 8. Distribution and trade

8.1 Industry should:

8.1.1 test all pesticide products to evaluate safety with regard to

human health and the environment prior to marketing, as provided for in Article 4, and ensure that all pesticide products are likewise adequately tested for efficacy and stability and crop tolerance, under procedures that will predict performance under the conditions prevailing in the region where the product is to be used, before they are offered there for sale;

8.1.2 submit the results of all such tests to the local responsible authority for independent evaluation and approval before the products enter trade channels in that country;

8.1.3 take all necessary steps to ensure that pesticides entering international trade conform to relevant FAO, (8), WHO (10) or equivalent specifications for composition and quality (where such specifications have been developed) and to the principles embodied in pertinent FAO guidelines, and in rules and regulations on classification and packaging, marketing, labelling and documentation laid down by international organizations concerned with modes of transport (ICAO, IMO, RID and IATA in particular);[1]

8.1.4 undertake to see that pesticides which are manufactured for export are subject to the same quality requirements and standards as those applied by the manufacturer to comparable domestic products;

8.1.5 ensure that pesticides manufactured or formulated by a subsidiary company meet appropriate quality requirements and standards which should be consistent with the requirements of the host country and of the parent company;

8.1.6 encourage importing agencies, national or regional formulators, and their respective trade organizations to cooperate in order to achieve fair practices and safe marketing and distribution

[1] ICAO: International Civil Aviation Organization
IMO: International Maritime Organization
RID: International regulations concerning the carriage of dangerous goods by rail
IATA: International Air Transport Association.

practices and to collaborate with authorities in stamping out any malpractices within the industry;

8.1.7 recognize that the recall of a pesticide by a manufacturer and distributor may be desirable when faced with a pesticide which represents an unacceptable hazard to human and animal health and the environment when used as recommended, and cooperate accordingly;

8.1.8 endeavour to ensure that pesticides are traded by and purchased from reputable traders, who should preferably be members of a recognized trade organization;

8.1.9 see that persons involved in the sale of any pesticide are trained adequately to ensure that they are capable of providing the buyer with advice on safe and efficient use;

8.1.10 provide a range of pack sizes and types which are appropriate for the needs of small-scale farmers and other local users to avoid handling hazards and the risk that resellers will repackage products into unlabelled or inappropriate containers.

8.2 Governments and responsible authorities should take the necessary regulatory measures to prohibit the repackaging, decanting or dispensing of any pesticide in food or beverage containers and should rigidly enforce punitive measures that effectively deter such practices.

8.3 Governments of countries importing food and agricultural commodities should recognize good agricultural practices in countries with which they trade and, in accordance with recommendations of the Codex Alimentarius Commission, should establish a legal basis for the acceptance of pesticide residues resulting from such good agricultural practices (7, 14).

Article 9. Information exchange

9.1 The government of a pesticide-exporting country which takes action to ban or severely restrict the use or handling of a pesticide in order to protect health or the environment domestically should

notify, directly or indirectly, the designated national authorities in other countries of the action it has taken (15).

9.2 The purpose of the notification regarding control action is to give competent authorities in other countries the opportunity to assess the risks associated with the pesticide, and to make timely and informed decisions as to the importation and use of the pesticides concerned, after taking into account local, public-health, economic, environmental and administrative conditions. The minimum information to be provided for this purpose should be:

9.2.1 the identity (common name, distinguishing name and chemical name);

9.2.2 a summary of the control action taken and of the reasons for it — if the control action bans or restricts certain uses but allows other uses, such information should be included;

9.2.3 the fact that additional information is available, and the name and address of the contact point in the country of export to which a request for further information should be addressed.

9.3 If export of a banned or severely restricted pesticide occurs, the country of export should ensure that necessary steps are taken to provide the designated national authority of the country of import with relevant information.

9.4 The purpose of information regarding exports is to remind the country of import of the original notification regarding control action and to alert it to the fact that an export is expeected or is about to occur. The minimum information to be provided for this purpose should be:

9.4.1 a copy of, or reference to, the information provided at the time of the notification of control action;

9.4.2 indication that an export of the chemical concerned is expected or is about to occur.

9.5 Notification of control action should be provided as soon as practicable after the control action is taken. For pesticides banned

or severely restricted before the implementation of the Code, an inventory of prior control action should be provided to the International Register of Potentially Toxic Chemicals (IRPTC), unless such information has already been provided.

9.6 Provision of information regarding exports should take place at the time of the first export following the control action, and should recur in the case of any significant development of new information or condition surrounding the control action. It is the intention that the infomation should be provided prior to export.

9.7 The provision of such information by the exporting country must take into account protection of the confidentiality of data in the importing country.

9.8 Governments of importing countries should:

9.8.1 establish internal procedures for the receipt and handling of such information from the exporting country;

9.8.2 ensure that such information received is not used in any manner which would be inconsistent with the provisions of the General Agreement on Tariffs and Trade (GATT).

Article 10. Labelling, packaging, storage and disposal

10.1 All pesticide containers should be clearly labelled in accordance with applicable international guidelines, such as the FAO guidelines on good labelling practice (13).

10.2 Industry should use labels that:

10.2.1 include recommendations consistent with those of the recognized research and advisory agencies in the country of sale;

10.2.2 include appropriate symbols and pictograms whenever possible, in addition to written instructions, warnings and precautions;

10.2.3 in international trade, clearly show appropriate WHO hazard classification of the contents (11) or, if this is inappropriate

or inconsistent with national regulations, use the relevant classification;

10.2.4 include, in the appropriate language or languages, a warning against the reuse of containers, and instructions for the safe disposal or decontamination of empty containers;

10.2.5 identify each lot or batch of the product in numbers or letters that can be read, transcribed and communicated by anyone without the need for codes or other means of deciphering;

10.2.6 are marked with the date (month and year) of formulation of the lot or batch and with relevant information on the storage stability of the product.

10.3 Industry should ensure that:

10.3.1 packaging, storage and disposal of pesticides conform in principle to the FAO guidelines for packaging and storage (12), the FAO guidelines for the disposal of waste pesticides and containers (16), and WHO specifications for pesticides used in public health (10);

10.3.2 in cooperation with governments, packaging or repackaging is carried out only on licensed premises where the responsible authority is convinced that staff are adequately protected against toxic hazards, that the resulting product will be properly packaged and labelled, and that the content will conform to the relevant quality standards.

10.4 Governments should take the necessary regulatory measures to prohibit the repacking, decanting or dispensing of any pesticide into food or beverage containers in trade channels and rigidly enforce punitive measures that effectively deter such practices.

Article 11. Advertising

11.1 Industry should ensure that:

11.1.1 all statements used in advertising are capable of technical substantiation;

11.1.2 advertisements do not contain any statement or visual presentation which, directly or by implication, omission, ambiguity or exaggerated claim, is likely to mislead the buyer, in particular with regard to the safety of the product, its nature, composition, or suitability for use, or official recognition or approval;

11.1.3 pesticides which are legally restricted to use by trained or registered operators are not publicly advertised through journals other than those catering for such operations, unless the restricted availability is clearly and prominently shown;

11.1.4 no firm or individual in any one country simultaneously markets different pesticide active ingredients or combinations of ingredients under a single distinguishing name;

11.1.5 advertising does not encourage uses other than those specified on the approvel label;

11.1.6 promotional material does not include use recommendations at variance with those of the recognized research and advisory agencies;

11.1.7 advertisements do not misuse research results or quotations from technical and scientific literature; and scientific jargon and irrelevances are not used to make claims appear to have a scientific basis they do not possess;

11.1.8 claims as to safety, including statements such as "safe", "non-poisonous", "harmless", "non-toxic", are not made, with or without a qualifying phrase such as "when used as directed";

11.1.9 statements comparing the safety of different products are not made;

11.1.10 misleading statements are not made concerning the effectiveness of the product;

11.1.11 no guarantees or implied guarantees — e.g. "more profits

with...", "guarantees high yields" — are given unless definite evidence to substantiate such claims is available;

11.1.12 advertisements do not contain any visual representation of potentially dangerous practices, such as mixing or application without sufficient protective clothing, use near food, or use by or near children;

11.1.13 advertising or promotional material draws attention to the appropriate warning phrases and symbols as laid down in the labelling guidelines (13);

11.1.14 technical literature provides adequate information on correct practices, including the observance of recommended rates, frequency of applications, and safe pre-harvest intervals;

11.1.15 false or misleading comparisons with other pesticides are not made;

11.1.16 all staff involved in sales promotion are adequately trained and possess sufficient technical knowledge to present complete, accurate and valid information on the products sold;

11.1.17 advertisements encourage purchasers and users to read the label carefully, or have the label read to them if they cannot read.

11.2 International organizations and public-sector groups should call attention to departures from this Article.

11.3 Governments are encouraged to work with manufacturers to take advantage of their marketing skills and infrastructure, in order to provide public-service advertising regarding the safe and effective use of pesticides. This advertising could focus on such factors as proper maintenance and use of equipment, special precautions for children and pregnant women, the danger of reusing containers, and the importance of following label directions.

Article 12. Monitoring the observance of the Code

12.1 The Code should be published and should be observed

through collaborative action on the part of governments, individually or in regional groupings, appropriate organizations and bodies of the United Nations system, international governmental organizations and the pesticide industry.

12.2 The Code should be brought to the attention of all concerned in the manufacture, marketing and use of pesticides and in the control of such activities, so that governments, individually or in regional groupings, industry and international institutions understand their shared responsibilities in working together to ensure that the objectives of the Code are achieved.

12.3 All parties addressed by this Code should observe this Code and should promote the principles and ethics expressed by the Code, irrespective of other parties' ability to observe the Code. The pesticide industry should cooperate fully in the observance of the Code and promote the principles and ethics expressed by the Code, irrespective of a government's ability to observe the Code.

12.4 Independently of any measures taken with respect to the observance of this Code, all relevant legal rules, whether legislative, administrative, judicial or customary, dealing with liability, consumer protection, conservation, pollution control and other related subjects should be strictly applied.

12.5 FAO and other competent international organizations should give full support to the observance of the Code, as adopted.

12.6 Governments should monitor the observance of the Code and report on progress made to the Director-General of FAO.

12.7 Governing Bodies should periodically review the relevance and effectiveness of the Code. The Code should be considered a dynamic text which must be brought up to date as required, taking into account technical, economic and social progress.

Annex

FAO Conference Resolution 10/85:
International Code of Conduct
on the Distribution and Use of Pesticides

THE CONFERENCE,

Recognizing that increased food production is a high priority need in many parts of the world and that this need cannot be met without the use of indispensable agricultural inputs such as pesticides,

Noting that FAO's study entitled *Agriculture: toward 2000* foresees a steady increase in the worldwide use of pesticides,

Convinced that such growth in pesticide use is likely to take place in spite of necessary intensive parallel efforts to introduce biological and integrated pest control systems,

Acknowledging that pesticides can be hazardous to humans and the environment and that immediate action must be taken by all concerned, including governments, manufacturers, traders and users, to eliminate, as far as possible and within the scope of their responsibility, unreasonable risks, not only in the country of origin but also in the countries to which pesticides may be exported,

Being aware that the requirements for the safe and proper use of pesticides in some developed countries have led to the adoption of complex systems of regulations and of enforcement mechanisms, but that many other countries have neither such mechanisms nor the necessary legislation, regulations or infrastructures to control the import, availability, sale or use of pesticides,

Convinced that additional efforts are needed to enable such countries to control pesticides more effectively and to assess the hazards which could result from their use or misuse,

Recognizing that a voluntary International Code of Conduct, based on internationally agreed technical guidelines, would provide a practical framework for the control of pesticides, especially in countries that do not have adequate pesticide registration and control schemes,

Noting that such a draft Code was reviewed by the Committee on Agriculture at its Eighth Session, and endorsed by the Council at its Eighty-eighth Session,

Having further noted the conclusions and recommendations of these bodies,

1. *Hereby adopts* a voluntary International Code of Conduct on the Distribution and Use of Pesticides as given in the annex to this Resolution;

2. *Recommends* that all FAO Member Nations promote the use of this Code in the interests of safer and more efficient use of pesticides and of increased food production;

3. *Requests* governments to monitor the observance of the Code, in collaboration with the Director-General who will report periodically to the Committee on Agriculture;

4. *Invites* other United Nations agencies and other international organizations to collaborate in this endeavour within their respective spheres of competence.

(Adopted 28 November 1985)

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