STAKEHOLDER WORKSHOP ON THE PROCUREMENT AND SUPPLY OF PESTICIDES FOR LOCUST CONTROL

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of the United Nations

TABLE OF CONTENTS

INTRODUCTION

Large areas in Africa, the Near East, the Caucasus and Central Asia, and southwest Asia are treated with insecticides against migratory species of locusts, such as the Desert Locust, Migratory Locust, Moroccan Locust and Italian Locust (Fig. 1). FAO plays an important role in early warning and forecasting, coordinating surveys and control operations, providing technical support, and procuring insecticides and application equipment.

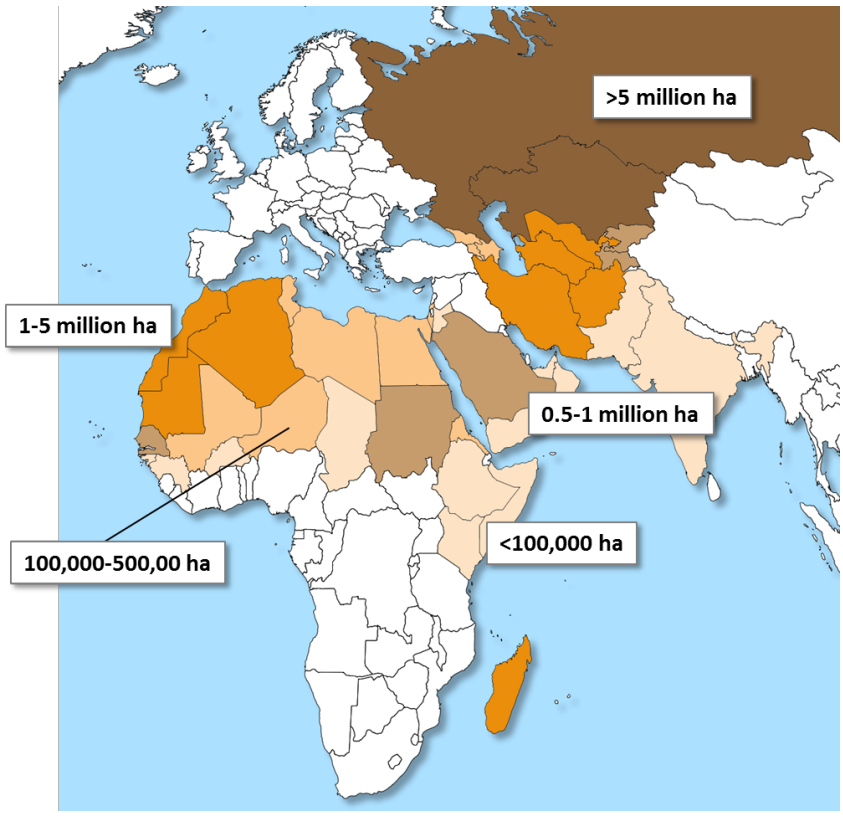


Figure 1. Areas treated against various species of migratory locusts in Africa and Asia, 2000–2014.

For example, 12.9 million ha were sprayed using over 13 million litres of insecticides for a total cost of more than USD 280 million during the Desert Locust upsurge in West Africa in 2003–2005. The overall cost of the locust upsurge, including food assistance and rehabilitation, was estimated at approximately USD 400 million[1].

However, at the end of the control campaign more than 6.3 million litres of insecticides remained unused for various reasons, including the late mobilization of funds, slow supply chain procedures, poor donor coordination, and national over-purchasing as an insurance or due to political pressure.

Since then, part of these remaining stocks have been locally used for locust and grasshopper control, moved to other locust-affect countries in need of insecticides ("triangulation"), or kept in stock either as still usable or obsolete product.

[1] Multilateral Evaluation of the 2003-05 Desert Locust Campaign. Available at: http://www.fao.org/ag/locusts/en/publicat/meeting/topic/misc/documents_1913.html

As of August 2015, approximately 546 000 litres of left-over insecticides from the 2003–2005 campaign have been triangulated, 2 370 000 litres are confirmed obsolete and 2 850 000 litres are still usable (though some of the latter is likely to become obsolete soon).

The cost of managing left-over pesticide stocks is high. This includes storage and quality control as well as collection, repackaging and disposal if the products become obsolete. The overall cost of disposing locust control insecticides is approximately USD 5 000 per ton, which means that the cost of disposal of the obsolete stocks from the 2003–2005 campaign could reach 7–10 percent of the total control costs.

It was therefore considered essential to review pesticide procurement procedures for locust control. While the right insecticides should be available in locust-affected countries in the right quantities at the right time, it is necessary to avoid the accumulation of unused stocks that may become obsolete and require disposal.

Although the workshop focused on improvements to the supply chain for locust control insecticides, the broad range of participants present at the meeting also discussed related issues such as pesticide procurement requirements, application equipment and product development.

OPENING

The meeting was opened by Annie Monard, Team Leader of the Locusts and Transboundary Plant Pest and Diseases group and Mark Davis, Team Leader of the Environmental and Social Safeguards and Sustainability group in FAO.

They welcomed all present and noted with satisfaction that participants from so many different sectors involved in locust control were present, including representatives from locust-affected countries, pesticide manufacturers and suppliers, sprayer manufacturers, regional Desert Locust Commissions, donors and FAO staff.

It was pointed out that this meeting was called as a follow-up to the last session of the Pesticide Referee Group held in December 2014, which stressed the importance of re-engaging with stakeholders to discuss pesticide procurement.

Participants were reminded of the fact that a large international programme for disposal of obsolete pesticides had been initiated in the 1990s, which included important stocks of obsolete locust control insecticides. They had been stored for long periods in remote parts of Africa and had degraded and leaked into the environment. At the time, USD 50–60 million had been required to clean up these obsolete stocks of which only a portion have been effectively disposed. Unfortunately, after the 2003–2005 Desert Locust upsurge, additional stocks of obsolete insecticides were generated.

It was argued that holding large strategic insecticide stocks for locust control is not the appropriate approach as the risk of generating obsolete pesticides is too high. Instead, mechanisms should be put into place that ensure locust affected countries will receive the right insecticides in the right amount at the right time with absolute certainty.

Participants were also informed of the fact that great advancements in locust monitoring, forecasting and control had been made by both locust-affected countries and FAO. This includes the eLocust field data collection and transmission system, high-resolution satellite imagery to detect green vegetation, geographic information systems (GIS) for data management and analysis, six-month

seasonal rainfall and temperature predictions incorporated into locust forecasts, improved insecticide stock management, streamlined procurement procedures, collection and recycling of empty pesticide containers, and triangulation of insecticides from countries with large stocks to countries in need of insecticides. These advances have led to significant improvements over the last decade. But the problems related to insecticide procurement in locust control have not been completely solved, and this meeting was therefore considered very important and long overdue.

PROCUREMENT REQUIREMENTS

Introduction

FAO purchases insecticides for locust control on a regular basis. These insecticides are often used under difficult circumstances that include rough terrain over which the products need to be transported and temporary storage in sometimes sub-optimal conditions. Both the insecticide and its packaging should therefore be of high quality. In addition, strict standards with respect to efficacy, toxicological and physio-chemical properties need to be adhered to.

The technical specifications for pesticides to be purchased by FAO are provided in Appendix 1 of the *FAO Invitation to Bid* cover letter, and together are part of the FAO tendering documentation. The technical specifications for locust control insecticides are presently under review and the draft updated specifications were presented to the meeting.

The most important proposed amendments were:

– **Pesticide specifications and certification.** The commercial pesticide product should have a specification approved and published by the FAO/WHO Joint Meeting of Pesticide Specifications (JMPS). Alternatively, a specification by a reputable national or regional authority, which follows the methodology described in the *Manual on development and use of FAO and WHO specifications for pesticides*[2], may be acceptable. Compliance with the specification must be shown through analysis by a GLP certified laboratory.

  With the respect to showing compliance with FAO/WHO Specifications, the following procedures were proposed:

  i. A JMPS Specification exists and the bidding company is the holder of the Specification:
     - The bidder shows compliance through analysis by a GLP-certified laboratory.

  ii. A JMPS Specification exists and the bidding company is not the holder of the Specification, but the insecticide technical material (TC) is sourced from the specification holder:
     - The bidder submits the physio-chemical specifications of the formulation only;
     - The bidder shows compliance of the TC through analysis by a GLP-certified laboratory;
     - FAO requests the JMPS to review equivalence of the formulation.

[2] Availabe at http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/jmps/manual/en/

iii. The bidder claims equivalence with the published Specification of another specification holder:

- The bidder submits a technical dossier for equivalence determination for the TC and the formulation;
- FAO requests the JMPS to establish equivalence.

iv. The bidder wishes to establish a JMPS Specification:

- The bidder submits a technical dossier for establishment of a full JMPS Specification;
- FAO requests the JMPS to establish a Specification.

v. A relevant national Specification is available:

- The bidder submits the relevant national Specification;
- FAO requests the JMPS to review the national Specification;
- The bidder shows compliance through analysis by a GLP-certified laboratory.

– **Pesticide registration.** The product must be registered for locust control in the country of delivery, or an emergency/temporary authorization of the product for use in locust control should have been issued by the national responsible authority.

– **Packaging.** Packaging should be in UN-certified metal drums or plastic containers, of which the technical specifications are detailed in the bidding requirements.

– **Labelling.** The label of the individual container must be in the language of country of delivery, and meet the requirements of the updated *FAO/WHO Guidelines on good labelling practice for pesticides* (2015)[3]. The labelling and marking of the consignment should be according to requirements for international transportation such as the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), the International Maritime Organization (IMO), or the International Air Transport Association (IATA).

– **Safety Data Sheet (SDS).** A copy of the most recent SDS must be provided as part of the bidding documents. The tender will include a specified number of the most recent SDS to be provided to the consignee.

– **Empty container management.** A requirement for the take-back and recycling/disposal of empty containers may be included in the bidding requirements for a specific tender.

Discussion

In the discussion that ensued, the draft updated technical requirements as presented to the meeting were generally considered appropriate and feasible. The need for high quality insecticides for locust control was supported

It was stressed, though, that a clear distinction should be made between the establishment of a specification for a pesticide on the one hand, and the certification of compliance with that specification on the other hand.

[3] Available at http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/code/list-guide-new/en/

Establishment of a specification for the TC and/or formulation of an insecticide is defined in internationally accepted procedures of the JMPS. It was not considered overly demanding for manufacturers or formulators to apply for such a specification. Suppliers that do not manufacture or formulate insecticides could provide the relevant specification through a letter of access by the manufacturer or formulator. Establishment of a specification would only be required once for a given insecticide product, unless significant formulation changes are made.

Presently, only a limited number of insecticides used in locust control have a FAO/WHO Specification, It was therefore emphasized that manufacturers and formulators should submit applications for a specification as soon as possible, to ensure that they are established in advance of a future locust outbreak.

Confirmation of compliance of an insecticide consignment with its specification is done through analysis by a GLP-certified laboratory. This must in principle be done for each consignment procured by FAO. To facilitate compliance monitoring by locust-affected countries, it was suggested that a list of GLP-certified laboratories for pesticide quality control be made available.

It was noted that solvents are presently not part of FAO/WHO Specifications. Given the importance of solvents and other co-formulants for the quality of an insecticide, it was suggested that these should be included in the specifications, at least for locust control insecticides.

Finally, it was suggested that the FAO technical tendering requirements could be an example for other countries or organizations procuring insecticides for locust control.

Recommendations

The following recommendations were made by the meeting with respect to the technical requirements for procurement by FAO of insecticides for locust control:

- The draft updated technical requirements as presented to the meeting were generally considered appropriate and feasible.

- It was recommended, however, to clearly distinguish between the need for the one-time establishment of a pesticide specification of the product concerned and the requirement for quality control of individual shipments.

- The meeting noted that co-formulants are presently not included in FAO/WHO Specifications for pesticides, and recommended that JMPS discusses their future inclusion.

SUPPLY CHAINS

Introduction

Countries that are affected by locusts require the right insecticides, in the right amount to be available at the right time during a control campaign. Over-purchasing should be avoided to minimize the risk of stocks being unused and becoming obsolete.

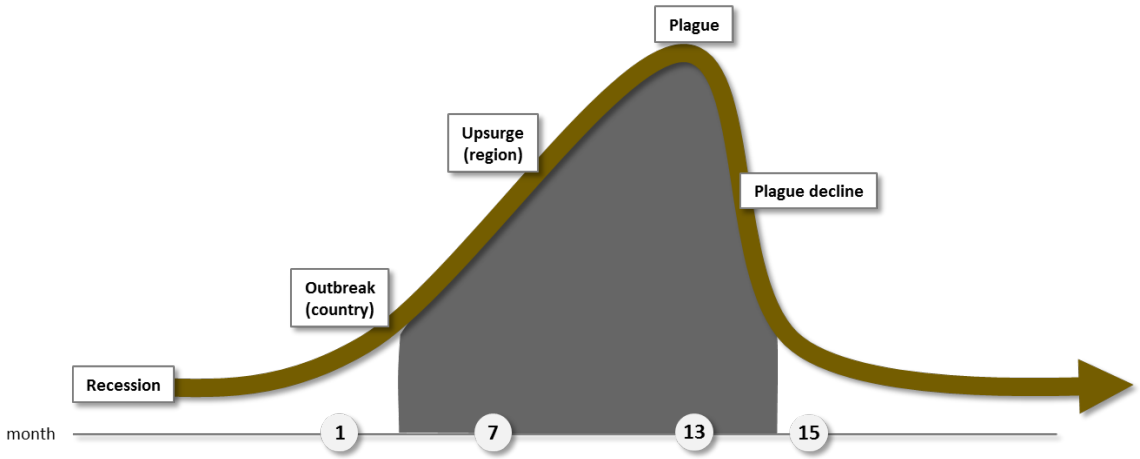
Striking a proper balance between these two potentially contradictory requirements has been shown to be difficult. This is due to the relatively unpredictable nature of locust outbreaks and upsurges, difficulties in planning the logistics of a control campaign, unavailability of appropriate insecticides

from suppliers, insufficiently coordinated procurement by different donors/actors, and political pressure to build up large stocks of insecticide.

The processes that determine emergency insecticide needs were presented. They include field monitoring of weather and locust populations followed by data collection and analysis at the country level. FAO, with its global overview, analyzes all the data to assess the current situation and provide forecasts on the timing, scale and location of locust breeding and migration. It also monitors resources levels in each country. Procurement needs for insecticides are then based on these assessments.

Locust plagues do not develop overnight and instead usually take up to one year or more to occur (Fig. 2). A small and localized outbreak within a single country is the first stage of locust population increase after a recession period. Desert Locust outbreaks are very unpredictable and the short lead time for intervention may be only about one month. If an outbreak is not controlled and breeding conditions remain favourable, an upsurge may develop within a matter of months that involves more countries and is on a larger scale. At this stage, external insecticide inputs are often needed. The reliability of exactly predicting upsurges is low and the lead time for interventions about three months. If an upsurge is not successfully controlled and favourable ecological conditions persist, a plague may develop. Predicting plague development can be done with medium to high reliability. Interventions will be required over large areas, up to millions of hectares. However, they are likely to have a lead time of about six months. While it may take a year or more for a locust plague to develop from an initial outbreak, a plague will decline very rapidly, usually within 2–3 month and Desert Locust populations become low and non-threatening.

The planning of insecticide procurement for locust control is complex and often based on relatively high levels of uncertainty, short lead times, and limited periods for interventions. Furthermore, increased insecurity in many areas limits the possibility to monitor and control locusts. Finally, the timely availability of funding determines to a large extent the possibility to procure insecticides at the right moment (Fig. 3). As result of these factors, the risk of under- or over-supply of insecticides is



Lead time:	<1 month	3 months	6 months
Reliability:	low-medium	low	medium-high
Scale:	<50 000 ha	1 million ha	>10 million ha

Figure 2. Schematic development of the development of a Desert Locust plague from recession to outbreak and upsurge, followed by its subsequent decline. The reliability of forecasts, lead time for control actions and scale of the interventions are indicated for each developmental stage of a Desert Locust plague.

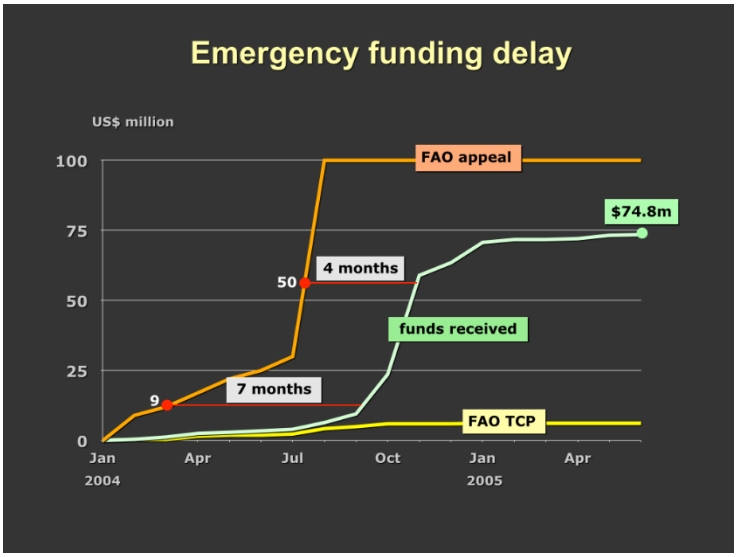


Figure 3. Mobilization over time of emergency funding for the 2003–2005 Desert Locust upsurge based on FAO appeals.

high. National and international forecasting and control campaign management should therefore closely coordinate with insecticide suppliers to ensure that the right product will be delivered in the right quantities at the right time.

FAO procurement of insecticides is based on the fundamental principles of best value for money, fairness, transparency, economy and effectiveness. FAO applies a formal contract award procedure following a competitive tender process. Participation is based on invitation of registered, pre-identified vendors. FAO intends to build sustainable relationships with vendors and relies on input from vendors to improve its procurement activities.

Inspection of goods is contracted by FAO with third party independent superintendence companies. Inspections are in principle carried out at loading to verify the quality, quantity, packaging, marking, etc. and at unloading to identify damage/loss during transport. However, to meet tight deadlines for locust control, FAO may instruct vendors to dispatch goods without waiting for inspection results.

Major constraints encountered with the procurement of ultra low volume (ULV) pesticides[4] over the past three years included low participation rate to tenders, low response rate due to certifications/registration requirements and/or delivery requirements, delayed delivery, non-compliance with packaging requirements (quality of drums), and provision of inappropriate insecticide formulations (corrosiveness).

Over the last three years, FAO procured approximately 650 000 litres of insecticides for locust control, split over four different active ingredients. The total time needed for procurement and delivery to the final destination ranged from three to seven months.

[4] While the industry standard is to indicate formulations as a two-character abbreviation (e.g. UL for ultra low volume), ULV is used for the purposes of this report.

Discussion

The discussion on improving the supply chain mechanism for locust control insecticides focused on the question "How can we deliver the right product in the right quantities at the right time?" The main principles of an appropriate supply chain mechanism were considered to be:

- Security of a locust-affected country to avoid impact of locusts;
- Minimal environmental damage from control operations;
- Minimal costs of storage and quality control;
- Minimal costs of disposal of obsolete pesticides;
- Minimal environmental damage from obsolete stocks;
- All at a fair cost.

The meeting was asked to explore other supply chain mechanisms, such as:

- Pesticide bank (framework contract): Active ingredients or formulated products are stored by the supplier and delivered within a guaranteed short time;
- Product purchase and return: The supplier takes back any unused insecticide stocks at the end of a control campaign;
- Trust fund: Availability of sufficient funds for removal and disposal of obsolete insecticide stocks;
- Any combinations of these, or other options.

Various criteria were taken into account when reviewing these options, including the shortness of guaranteed delivery time, flexibility in quantity delivered, confidence that the pesticides will be delivered on time, minimization of left-over stocks, management of empty containers and left-over stocks, encouragement of suppliers to register pesticide products, compliance with required specifications and overall cost.

Recommendations

The following recommendations were made by the meeting with respect to insecticide supply chain mechanisms for locust control:

- It was emphasized that the supply mechanism should allow the right insecticide of the right quality to be delivered to a locust-affected country in the right quantity at the right time, while avoiding the build-up of obsolete stocks.

- It was further stressed that the supply mechanism should ensure that empty containers resulting from locust control are collected and recycled/disposed of in compliance with FAO guidelines either by the supplier or through established local container management schemes, in collaboration with national governments.

- The establishment of framework contracts (sometimes referred to as a pesticide bank system) was considered a viable option in contributing to achieving the above objectives. It was recommended that FAO considers the services required and pursues dialogue with suppliers to define the contractual terms of such framework contracts.

- The meeting acknowledged that governments should take responsibility to avoid over-stocking of insecticides intended for locust control, e.g. through appropriate contingency planning, FAO technical advice and Desert Locust forecasts.

- A purchase with return option, where unused insecticides would be taken back by the supplier, was not considered a feasible supply mechanism, for legal, operational and fiscal reasons.

- The establishment of a trust fund for the disposal of any obsolete stocks that are left-over from locust control operations was not considered appropriate as it would not be an incentive to reduce over-supply of insecticides.

- Alternatively, the establishment of a trust fund could be useful to permit the rapid activation of any framework contract, as well as covering externality costs such as insecticide quality control, the management of empty containers or the disposal of small unavoidable quantities of obsolete stocks.

- It was further suggested that a buffer stock of the biopesticide *Metarhizium* could be established in one or more strategic locations with appropriate storage facilities to be used for control operations during recession and early outbreak periods. Should such a stock become obsolete, the disposal would not incur large costs.

- It was recommended that insecticide procurement through tenders should be streamlined in order to reduce the time for the technical evaluation of bids received under ad-hoc tenders through a pre-selection of suppliers that meet technical requirements such as the availability of insecticide specifications and appropriate registration in recipient countries. This activity would be applicable in addition to the establishment of framework contracts.

APPLICATION EQUIPMENT

Introduction

In recent locust control campaigns, problems with the compatibility between ULV formulations and pesticide application equipment have in some cases damaged the sprayers. These problems were traced back to the solvents used in the ULV formulations.

The Pesticide Referee Group, after reviewing this case, recommended in its 2014 meeting: “To avoid damage to spray equipment by ULV insecticide formulations, the PRG recommended that in the procurement of insecticides the supplier should indicate all solvents in the formulation and should certify that they do not affect the spray equipment used in locust control. Furthermore, the PRG recommended that a meeting be organized between spray equipment manufacturers and pesticide manufacturers to identify solvents that must be avoided in ULV formulations for locust control.”

Discussion

The discussion that ensued therefore focussed on options to avoid procurement of insecticide formulations that may damage spray equipment. The possibilities discussed included:

- For FAO to establish a list of solvents/co-formulants that are incompatible with specific equipment parts and materials commonly used for locust control;

– For insecticide suppliers to list all solvents/co-formulants (above a critical concentration) as part of the FAO bidding document;

– For insecticide suppliers to ensure and certify that the formulations they provide are compatible with application equipment and materials commonly used for locust control.

The meeting mostly considered that it was the responsibility of the insecticide suppliers to ensure that the product which they provide are compatible with relevant application equipment. Extensive information on the compatibility of active ingredients and co-formulants is available for pesticide manufacturers and formulators. FAO, not being specialized in these aspects, should not need to establish lists of incompatible combinations of application equipment and chemicals. It was noted, that FAO has published *Minimum requirements for ground-based locust and grasshopper sprayers*[5].

Recommendations

With respect to pesticide application equipment, and in particular its compatibility with insecticide formulations procured for locust control, the meeting made the following recommendations:

– It was recommended that pesticide suppliers should ensure formulation compatibility with ultra low volume (ULV) spray equipment.

– In this respect, any pesticide tender should specify that the product be compatible with commonly used ULV aerial and ground application materials, such as (but not limited to) glass reinforced plastic (GRP) polyester or epoxy aircraft tanks; high-density polyethylene (HDPE) tanks; Viton™ or other fluoroelastomer seals and washers, nylon or PTFE hose tubing.

– The meeting noted the need for chemical/biological insecticide and sprayer manufacturers to work together to find solutions regarding the compatibility of formulations with commonly used application equipment.

INSECTICIDES

Introduction

Almost three-quarters of the insecticides used for locust control in Africa and the Near East during the past few years (primarily against Desert Locust and Malagasy Migratory Locust) have been organophosphates – mainly chlorpyrifos and malathion (Fig. 4). Pyrethroids, primarily deltamethrin and lambda-cyhalothrin, and benzoyl-urea insect growth regulators (IGRs), mainly teflubenzuron, account for an additional 25 percent of the volume. The use of *Metarhizium* has been relatively limited, covering approximately 36 000 ha. Almost all insecticides used for locust control in Africa and the Near East are ULV formulation.

In the Caucasus and Central Asia, large areas are treated against Moroccan Locust, Italian Locust and Migratory Locust. Some 3 to 7 million hectares are treated annually. Pyrethroids are the insecticides of choice in this region, while lesser quantities of organophosphates, neonicotinoids and benzoyl-ureas are being applied. Historically, water-based formulations (e.g. emulsifiable concentrates (EC), suspension concentrates (SC)) were sprayed, but lately ULV formulations are increasingly being used.

[5] Available at http://www.fao.org/docrep/007/y5774e/y5774e00.htm

The bulk of insecticides presently used for locust control are thus organophosphates and pyrethroids. These have relatively quick action and can be used against all locust targets during recessions, outbreaks, upsurges and plagues. However, the organophosphate insecticides have globally come under heightened regulatory scrutiny because of health and environmental risks. Their use in locust control may be restricted in the near future.

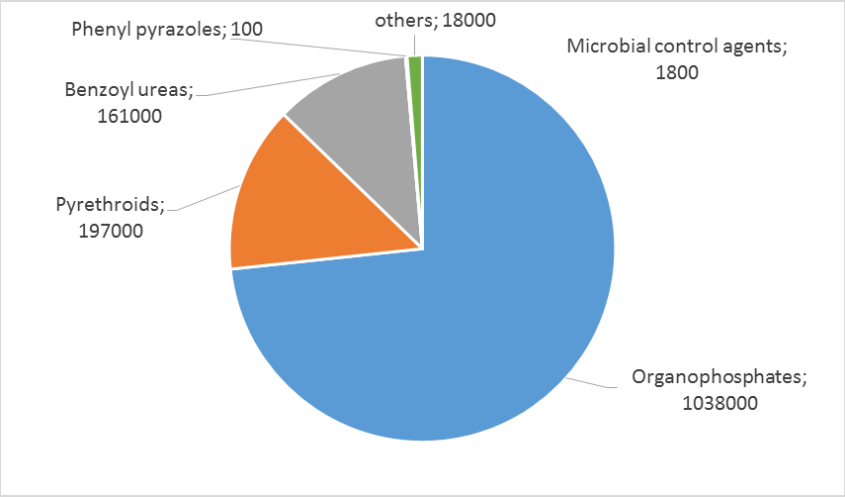


Figure 4. Approximate volumes (litres or kg) of insecticides used for locust control in Africa and the Near East, 2010–2014.

Pyrethroids tend to cause quick knockdown of the insects, which makes them appropriate for use in cultivated areas. However, apparent recovery of locusts after initial knockdown is often observed, complicating efficacy assessment in the field, and sometimes leading to overdosing of the insecticide. Furthermore, they pose certain environmental risks, limiting their use near water bodies.

For barrier treatments, the benzoyl-urea IGRs are efficacious up to mid-instar hopper bands and have been used on a relatively large scale over the last few years. However, they are less effective against late instar hopper bands. The phenyl-pyrazole fipronil has been recommended previously for use in barrier treatments, but is effectively unavailable for locust control in Africa and the Near East due to environmental concerns. It is being used in Australia.

The entomopathogen *Metarhizium acridum* is increasingly being used in locust control although on a small scale, in particular in sensitive ecosystems and where crops are not directly threatened. Its use is limited, however, by the relatively elaborate storage, transport and application requirements when compared to conventional chemical insecticides.

Given these considerations, there is a need for new low-risk insecticides having a rapid mode of action to complement and/or replace organophosphates and pyrethroids.

Discussion

Pesticide manufacturers present at the meeting indicated that no new molecules have been tested for locust control recently. It was considered that the market for locust control insecticides is probably too limited and variable to justify the required investments needed for developing and field testing specific ULV formulations, even if the active ingredients are already on the market. If other

markets would use similar formulations, such development would become more feasible. It was suggested, however, that there may be scope for screening and field testing existing or new insecticides for use in locust control under an external funding mechanism which could cover at least part of the costs. Reference was made to the international system in place for the development of new malaria vector control insecticides.

It was also proposed to further test mixtures of existing insecticides (e.g. pyrethroids and organophosphates) as they may prove to be effective against locusts.

It was noted that detailed guidelines are available from FAO for the execution of field efficacy trials of insecticides on locusts and grasshoppers[6].

Recommendations

With respect to insecticides used for locust control, the meeting made the following recommendations:

- The meeting noted with concern that no new insecticides had been sufficiently tested in the last 20 years to confirm effective dose rates against locusts.

- The meeting also took note of the constraints with respect to lack of data protection expressed by pesticide manufacturers to test new chemical and biological insecticides.

- It was recognized that it is difficult to make a purely financial business case for the development of new products solely for locust control. However social aspects, such as alleviation of poverty and preserving food security in developing countries, could also be considered.

- It was recognized that current efforts by FAO to promote regional pesticide registration schemes could also facilitate the registration of insecticides for locust control.

- There may be scope to screen and field test existing or new insecticides for use in locust control, possibly under an external funding mechanism. As an interim option, mixtures of insecticides may prove to be effective against locusts, subject to additional field testing.

- The meeting noted that progress has been made in increasing the production capacity of *Metarhizium acridum,* which should facilitate its wider use in locust control. While the initial cost of *Metarhizium* is still relatively high, it was noted that its use does not contribute to the generation of hazardous waste and is environmentally acceptable.

CLOSURE

The meeting was closed by Richard Thompson, Agriculture Officer in the Pest and Pesticide Management group at FAO, who concluded that significant actions had been identified that can be taken to improve locust control. He thanked everyone for their active participation in the workshop and constructive contributions to the discussions.

[6] Available at http://www.fao.org/ag/locusts/en/publicat/gl/index.html

Annex 1. Meeting programme

Wednesday, 2 September 2015	
Opening of the workshop	Annie Monard, Mark Davis Workshop chairs : Annie Monard, Richard Thompson
Insecticide procurement requirements	Introduction: Harold van der Valk Plenary discussion
Supply chain issues	Introductions: Keith Cressman, Davide Blancato, Richard Thompson Breakout groups and plenary discussion
Thursday, 3 September 2015	
Application equipment issues	Introduction: Harold van der Valk Plenary discussion
Pesticide product issues	Introduction: Harold van der Valk Plenary discussion
Conclusions and recommendations	Plenary discussion
Closure of workshop	Richard Thompson

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