

# FAO'S EMPRES (*Desert Locust*) Programme – Towards Sustainable Preventive Control

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## Abstract

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The Desert Locust plague of 1986-1989 and the upsurges that followed in 1992-1994 led to widespread concern at the cost of control and the potential for adverse environmental side-effects. In response to these concerns, the FAO Director-General launched a Special Programme EMPRES (Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases) with one component addressed only to the Desert Locust *Schistocerca gregaria*. EMPRES was launched with a Central Region field programme in 9 countries around the Red Sea in 1997, and is in the process of being extended to 9 countries in the Western Region (West and North-West Africa). EMPRES includes a further 4 countries in the Eastern Region (South-West Asia), but no programme has been developed there so far. The programme focuses on strengthening national capacities to carry out Early Warning locust surveys and to implement Early Reaction control practices with the objective of reducing the risk of plague development. The presentation will review the progress achieved to date in establishing preventive control in the Central Region and the pilot activities accomplished in the Western Region. New technologies offer the prospect for better detection of the initial outbreaks, reduced survey costs and environmentally friendlier/cheaper control, but the ability of national units to carry out regular and efficient surveys remains fundamental to avoiding surprises. EMPRES Central Region is also placing emphasis on contingency planning, such that countries can react in an orderly way to the different scenarios that may develop as Desert Locust populations increase.

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## Introduction

The Desert Locust Component of the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) was born as a result of the locust situation that applied in the early 1990s. The incoming FAO Director-General reviewed, through various bodies, the many and various factors having a major impact on agriculture, and those for which FAO, as an international agency of the United Nations, had a comparative advantage. A proposal was made to Council at its Session in mid-1994, that a new effort should be made to deal with transboundary pests and diseases, under the umbrella of the EMPRES Programme. One component was devoted to transboundary animal diseases and the other to the Desert Locust. The Desert Locust *Schistocerca gregaria* (Forsk.) was chosen because, during a full-blown plague, it could affect more than 60 countries and therefore had the largest impact geographically of any pest of this type. Furthermore it was highly mobile and could not be controlled by countries working in isolation, requiring coordination and collaboration between countries that FAO was best placed to provide. There was also widespread dismay at the heavy costs that had fallen on both the international donor community and on the locust-affected countries during the 1986 to 1989 plague, which continued, albeit at a lower level, with another upsurge from 1992 into 1994 that showed no signs of stopping. Finally, great concern was felt about the affects of such large scale use of chemical pesticides on the health of locust workers and on the sensitive environments in which locusts occurred.

Following Council's approval of EMPRES, it was given the status of a Special Programme of the Director-General, thereby receiving priority support from within FAO. A Steering Committee chaired by the Director-General was formed and it was decided that the first field programme should focus on nine countries around the Red Sea (Djibouti, Egypt, Eritrea, Ethiopia, Oman, Saudi Arabia, Somalia, Sudan and Yemen). This area, known as the Central Region, was chosen because several plagues in the recent past were thought to have originated there. The Desert Locust is distributed permanently in its so-called recession area,

covering 22 countries. In addition to the 9 in the Central Region, there are a further 9 in the Western Region (Algeria, Chad, Libya, Mali, Mauritania, Morocco, Niger, Senegal and Tunisia) and 4 in South-West Asia (Afghanistan, India, I.R. Iran and Pakistan).

EMPRES (Desert Locust) was initiated in 1995 through pilot activities mainly in the Central Region but also in Mauritania in the Western Region. Participating countries in the Central Region nominated EMPRES Liaison Officers (ELOs) to act as the point of contact for these activities. The process of formulating a field programme for the Central Region was launched in the same year. It involved the locust-affected countries, donors and FAO staff. After long discussions on the programme, EMPRES Central Region (EMPRES/CR) became operational in early 1997, with the appointment of an EMPRES/CR Coordinator based in Asmara, Eritrea.

This paper reviews the status of the EMPRES (Desert Locust) Programme, in particular in relation to its significance to Arab countries in Africa and the Middle East.

## EMPRES Progress in the Central Region

The overall EMPRES/CR Programme Document gave the primary goal as:-

***“To minimize the risk of Desert Locust plagues emanating from the Central Region of the Desert Locust distribution area through well-directed surveys and timely, environmentally sound, interventions in order to mitigate food security concerns in the Central Region and beyond.”***

And the objective of the Programme as:-

***“To promote and catalyze the realization of regional self-sufficiency for averting locust plagues, through strengthening existing national, regional, and international components of Desert Locust management system”.***

The Programme Document stressed that EMPRES/CR was a combined effort between the locust-affected countries, regional organizations, the international donor community and FAO. Its emphasis was on strengthening national capacities for **Early Warning** locust surveys and for **Early**

**Reaction** control operations against outbreaks and upsurges in locust populations. It was also intended to encourage applied **Research** that would lead to improved locust survey or control practices. It was not intended to replace existing institutions either at the national or regional level. Although it was planned as a long-term initiative, probably requiring three phases of four years duration each, i.e. a total of 12 years, it was eventually expected to hand over its functions to national and regional bodies, according to how it evolved.

Phase I of EMPRES/CR ran from 1997 to 2000 and Phase II from 2001 to 2003. Phase III is expected to operate from 2004 to 2006 and is likely to be the last Phase, provided that sufficient progress is made. The three Phases were financed by a multi-donor consortium; by FAO's Regular Programme, by Trust Funds supported by Germany, the Netherlands, Switzerland, and the United States, by funds and contributions in kind by the locust-affected countries, and bilaterally by Sweden and the United Kingdom. By the end of 2003, only the Netherlands, Switzerland and the United States continued to contribute because of changes in political priorities in the other countries, despite the knowledge that EMPRES was always expected to be a long term effort.

As is standard practice for FAO Programmes, EMPRES/CR has been independently evaluated three times, in 1999, 2001 and 2003. Many of the achievements relate to organizational or infrastructural improvements, but here the emphasis will be given to the technical aspects that have received attention.

The essential starting point in implementing a preventive control strategy is to carry out locust surveys and detect the earliest stages of the change in the Desert Locust from its harmless widely scattered solitary form to its concentrated swarming gregarious form that can devastate crops and pastureland. EMPRES has placed most of its efforts into strengthening national capacities to carry out such surveys through extensive training and to reporting the findings quickly back to the national Locust Control Unit HQ. EMPRES produced Desert Locust Guidelines covering each element of locust management including surveying for locusts, and Standard Operating Procedures in pocket-sized cards that every locust survey officer could carry with him. During Phases I and II, the training evolved into developing national capacities to carry out training sustainably, creating national Master Trainers and a comprehensive Training Manual, including, for example, overheads for use by the trainers.

Given that well-trained locust survey officers now exist in almost all the EMPRES/CR countries, a major problem remains in selecting where the teams should be sent. The potential habitats for Desert Locust are vast within most of the countries affected and the number of teams and resources available is limited. While EMPRES has assisted countries in providing some equipment, a few vehicles, and some operational funds, there has been an urgent need to narrow down the areas that should be surveyed. In 2002 and 2003, FAO has recruited a consultant to help make operational use of the GIS database "Reconnaissance and Monitoring System for the Environment of *Schistocerca*" (RAMSES) which allows incoming survey data or other sources of information to be compared with past records of Desert Locust outbreaks. RAMSES also provides a platform through which satellite images of the vegetation in locust habitats can be viewed. The consultant has accessed improved images from the European satellite SPOT-VGT that have a resolution of 1 sq.km and more recently certain areas can be examined on

the MODIS satellite that has a resolution of 250m. These images have been used in several surveys both in the Central and Western Regions as a practical tool to decide survey routes and also to identify areas that should be checked. As more ground-truthing is carried out, the use of images is expected to become more and more refined, as false positives are eliminated and new areas favoured by locusts are identified. The objective is to make locust surveys more targeted and thereby more efficient, with the important consequence that the costs of Early Warning surveys are kept as low as possible.

EMPRES has also introduced two other key technologies. One is the standard use of hand-held Global Positioning System (GPS) devices that provide the survey team with the exact location of each locust concentration found. The other is the linking in of GPS to the electronic entry of locust data into palm-top computers using the *elocust* programme, and the transmission of the data with the location through an HF radio, straight onto computer screen at the National HQ. From each National HQ, it then becomes an extremely rapid process to transmit the information to the Desert Locust Information Service (DLIS) at FAO HQ. The DLIS has the responsibility to analyse national reports against other satellite information on rainfall, winds and cold cloud cover, make forecasts for the following six weeks and issue a monthly Bulletin in English, Arabic and French. The FAO Bulletin is the pre-eminent source of information on the Desert Locust situation and likely developments across the species global distribution from Mauritania to the Indo-Pakistan border.

The second core EMPRES theme is Early Reaction, which means having the capacity to control populations of gregarized Desert Locusts quickly enough to prevent them from developing into a plague. In the Central Region, the emphasis has again been on training. A series of training events have been held in which locust officers have been instructed in the use of hand-held sprayers and vehicle-mounted sprayers. The major constraint has been that, since early 1998, there have been no outbreaks of Desert Locusts on which control teams could practice their training. As a component of Early Reaction, EMPRES/CR also initiated discussions on contingency planning, with the objective that each country would have the necessary preparations in place for different types of locust scenario. A workshop was held and countries were encouraged to prepare their contingency plans. Progress was limited with only the Sudan managing to produce a first draft plan, with the result that contingency planning has been placed at the top of the agenda for Phase III. In terms of new technology, the regional organization that operates in the Central Region, the Desert Locust Control Organization for Eastern Africa (DLCO-EA), has had one of its Beaver aircraft equipped with Differential GPS (DGPS) equipment, through EMPRES/USAID funding. This guides the spray pilot in placing his swaths accurately and also provides a print-out after each spray operation of exactly where the spraying has been done and how much chemical has been used. Studies carried out in Sudan suggest that for full-cover treatments, the system, through its accuracy, reduces the amount of pesticide required by about 30% (Ottesen *et al.* 1999), and is also a useful management tool by producing a spray report. USAID has agreed to fund the equipping of four more DLCO-EA aircraft. In the event of a large outbreak of Desert Locust, it is likely that one of the most important tactics that will be used to overcome the outbreak will be the spraying of barriers of pesticides, often separated by at least 1 km. This tactic will allow large areas

to be treated quickly with relatively small amounts of pesticide. EMPRES/CR also planned to test biopesticides under operational conditions, but the lack of field populations of Desert Locusts has limited the tests to semi-field trials using reared insects. The two products under investigation have been the entomopathogen *Metarhizium anisopliae* var. *acridum* and the degregarization pheromone phenyl-acetonitrile (PAN) identified by the International Centre for Insect Physiology and Ecology (ICIPE). EMPRES/Swiss funds have been provided to ICIPE to promote collaborative action on PAN.

Under the third EMPRES theme, Research, the main effort has been put into encouraging institutions within the region to carry out small research projects on the Desert Locust, that might contribute to improved survey or control. Success has been limited again because of the lack of field populations of locusts, making it difficult to find suitable topics. Nevertheless several projects have been completed including one in which the effect of *Metarhizium* on honey bees was tested in Yemen (no effect was found). Research has also been conducted on the economics of locust control both by international institutions and by consultants from within the region. A major report was produced by Joffe (1998) and other unpublished reports have been prepared by EMPRES consultants Bezabih and Nasr, and by Thomson and Miers (2002), of Oxford Policy Management.

## EMPRES Progress in the Western Region

In parallel to the Phase I activities in the Central Region, FAO provided support to the national Anti-Locust Control Centre (CLAA) in Mauritania with a view to strengthening its capacity for Early Warning and Early Reaction as a pilot activity for EMPRES Western Region (EMPRES/WR). In 1997, Norway funded a project hosted by Mauritania, which focussed on reducing the amount of pesticide required to control Desert Locust through improved application techniques. The project worked closely with the CLAA in developing innovative approaches to improving application practices and also investigated GPS technologies that would allow more accurate spray swaths both for aerial spraying and for ground spraying. By 2001, Mauritania's capacity for locust survey and control was assessed by the second evaluation mission to have been developed into an effective and efficient organization that could serve as a "best practice" model for other countries in the region. However Mauritania still requires extensive financial support in order to be able use these capacities operationally.

The FAO Conference passed a resolution in 1995 that EMPRES should be extended to the nine countries in the Western Region, but it was not until 1997 that a draft Programme Document was formulated. Donor support was slow to materialize and meanwhile pilot activities continued. These included significant organizational changes including the creation of a new FAO Commission for Controlling the Desert Locust in the Western Region in 2002 and the nomination of EMPRES Liaison Officers by each country. The installation of RAMSES, the use of *elocust*, and access to satellite images was initiated during the last two years. Donor support began to fall into place during the second part of 2003 when a major grant was approved by the African Development Bank. These funds are likely to become available from the beginning of 2004. Resources will then be available for further development of the technologies that have so far been introduced, and for the support of research

by institutions within the region on improved methods of locust survey and control.

## The Significance of EMPRES for Arab Countries in Africa and the Middle East

Most people in their fifties from the Arab countries in North Africa or the Middle East have childhood memories of the effects of Desert Locust in the major plague that began in 1949 and continued until 1964. Swarms caused havoc to the Souss Valley in Morocco, where damage to crops was estimated at US\$ 13 million (Joffe 1998) and locusts spread right through the Middle East as far as Lebanon, Syria, Jordan and Iraq. Not only was agriculture affected over all these Arab countries, but often rural populations were forced to abandon their homes because there was nothing left to cultivate and move to the cities to search for work. After the end of the plague, the Desert Locust went into recession and by mid-1985 was thought to have reached its lowest population level for 50 years. With the return of wetter conditions, it took only two years from that point to mid-1987 for a new plague to be in the making. Swarms escaped from Mali, Niger, Chad and western Sudan and invaded Morocco and Algeria. Later on Libya, Egypt, Yemen, Oman and Saudi Arabia were affected. Although the number of Arab countries infested was less during the 1986-1989 plague, the resources devoted to controlling them amounted to millions of dollars from national sources, apart from the large contributions from foreign donors. For example, Morocco was reported to have mobilized 39 aircraft and hundreds of vehicles to combat the arriving swarms. Algeria estimated costs of US\$ 104 million spent during the period 1987- 1996, which includes the peak plague years of 1987 and 1988, and Saudi Arabia an amount of at least US\$ 26 million, which was said to be incomplete (Joffe, *loc.cit.*).

These examples suggest that a locust plague can have disastrous consequences on Arab countries not only on agriculture itself but on national economies as a whole. In almost all cases in which plagues have developed, the initial outbreaks that subsequently gave rise to a plague have either occurred in non-Arab countries or have developed in countries in which capacities/resources for dealing with plagues have been small. The most serious economic impact of a plague has been felt by the more developed Arab economies. At the same time, recent studies of the socio-economics of the impact of the Desert Locust have suggested that it is the poorest farmers who suffer the most, as they have no other resources on which to fall back. Smallholder farmers interviewed in Mauritania and Eritrea said that their most serious problem was drought, but after drought, their greatest fear was a locust attack (Thomson and Miers 2002).

The EMPRES (Desert Locust) Programme seeks to develop a sustainable strategy for preventive Desert Locust management and to reduce the risk that plagues will develop in the future. EMPRES will concentrate on developing national capacities focussing on the countries in which the initial outbreaks are most likely to occur. However EMPRES, although planned as a long-term initiative of up to 12 years in each region, is not intended to create any new institutions. The question then arises as to how preventive control can become sustainable. FAO's approach has been to plan eventually to transfer EMPRES activities to the regional Locust Commissions. Steps have been taken in the Central region towards achieving this, with the EMPRES/CR Coordination Office placed next to the Secretariat of

Commission for Controlling the Desert Locust in the Central Region (CRC) and the two bodies working closer and closer together. Joint-workplans are now prepared and it is intended that the transfer of duties from EMPRES/CR to the CRC will be one of the main tasks of Phase III. In the Western Region, the work of the Secretariat and of EMPRES/WR are at the start of full field operations already unified in one post. The major constraint on sustainability is that the budgets of the Commissions are probably too small to be able to provide the level of support that the poorer countries require in order to carry out the Early Warning surveys and Early Reaction control that successful preventive control requires. As EMPRES evolves, it is likely that the richer Arab nations will need to invest more in their poorer neighbours in order to ensure that preventive control functions and they are protected from the enormous costs that occur if a plague develops. While international donor support may be forthcoming in the event of large outbreaks, the Arab countries need to ensure that the basic structures required for Early Warning and Early Reaction are in place in the countries in which initial increases in Desert Locust populations can occur.

## Conclusion

The Desert Locust has been a problem for agriculture since the earliest recorded history. FAO's new initiative under the EMPRES (Desert Locust) Programme provides the opportunity finally to overcome the problem. The combination of new technology together with strengthened national capacities should allow preventive control to become a realistic solution, provided that all locust breeding areas can be accessed freely without security limitations. Nevertheless the task remains a difficult one, especially if it is to become sustainable, and it is only beginning in the Western Region. It is most important that even during recession periods, front-line countries maintain a core unit for Early Warning surveys and have properly prepared contingency plans that can be called into action whenever required. EMPRES also needs to work hard to use the available technologies to minimize the costs of preventive control, so that it is within the resources of the poorer countries with some help from their richer neighbours and with support from FAO's regional Locust Commissions.

## المخلص

إيليوت، كلايف. 2003. برنامج EMPRES (الجراد الصحراوي) التابع لمنظمة الأغذية والزراعة. مجلة وقاية النبات العربية. 21: 184-187.

قاد تفشي الجراد في الفترة ما بين 1986 و 1989 وزيادة العدديّة التي تلت ذلك في الفترة ما بين 1992-1994 إلى قلق على مستوى واسع حول كلفة المكافحة واحتمال ظهور آثار سلبية لها على البيئة. ورداً على هذه المخاوف، أطلق المدير العام لمنظمة الزراعة والأغذية برنامجاً خاصاً (نظام المنع الطارئ للحيوانات وآفات النبات وأمراضه عبر الحدود - EMPRES) والذي تضمن مكوناً واحداً موجهاً فقط للجراد الصحراوي *Schistocerca gregaria* وقد أطلق البرنامج عام 1997 مع برنامج حقلي للمنطقة الوسطى في 9 دول حول البحر الأحمر وهو الآن في مرحلة امتداد ليشمل 9 دول في المنطقة الغربية (غربي وشمال غربي إفريقيا). كما يضم البرنامج أربع دول أخرى في المنطقة الشرقية (جنوب غربي آسيا)، ولو أنه لم يتم تطوير البرنامج هناك بعد. ويركز البرنامج على تعزيز القدرات الوطنية للقيام بمسوحات جراد مبكرة تحذيرية ولتطبيق ممارسات مبكرة بغية تقليل مخاطر تطور الوباء. وستركز المداخل على مراجعة التقدم الذي تم التوصل إليه حتى الآن في إرساء المكافحة الوقائية في المنطقة الوسطى والأنشطة الرائدة التي تم تنفيذها في المنطقة الغربية. وتقدم التقاني الحديثة إمكانية كشف أفضل عن الأوبئة البدائية، الإقلال من تكاليف المسح، وإنفاذ المكافحة بتكاليف أرخص وأكثر أماناً للبيئة، على أن مقدرة الوحدات الوطنية للقيام بمسوحات نظامية وفاعلة تبقى الأساس لاجتباب المفاجئات. كما يركز البرنامج في المنطقة الوسطى على التخطيط فيما بين الدول المتجاورة بحيث تتفاعل الدول مع السيناريوهات المختلفة التي قد تتطور مع زيادة عشائر الجراد.

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