

The SSE-Programme

**Review of the
Grasshopper Control Project
in Yelimané Cercle, Mali
Implemented by
the Strømme Foundation**

Report by :

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List of Acronyms

| | | |
|---------------|---|--|
| CILSS | - | Comite Inter-Etats de Lutte Contre la Secheresse Dans le Sahel |
| FAO | - | United Nations Food and Agriculture Organisation |
| GTZ | - | Gesellschaft for Technische Zusammenarbeit (German Bilateral Donor) |
| IPM | - | Integrated Pest Management |
| MFA | - | Norwegian Ministry of Foreign Affairs |
| NGO | - | Non-Governmental Organisation |
| NOK | - | Norwegian Kroner |
| NORAD | - | Norwegian Directorate for Development Assistance |
| NRI | - | Natural Resources Institute |
| OCLALAV | - | Organisation Commune pour la Lutte Antiacridienne et la Lutte Antiviaria |
| SF | - | Strømme Foundation |
| SNPV | - | Services National de Protection Végétaux |
| SSE-Programme | - | Sahel-Sudan-Ethiopia-Programme |
| ULV | - | Ultra Low Volume |
| USAID | - | USA Aid in Development (American Bilateral Donor) |

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0.Executive Summary and Recommendations

The Yelimané Grasshopper Control Project was initiated in 1986 after a call from Mali for international assistance to help fight the massive grasshopper attacks that occurred after the drought years in the beginning of the eighties. The Strømme Foundation (SF) became one of the main contributors, through its support from the SSE-Programme, and was allocated the responsibility for the Yelimané area in North-western Mali. The project was implemented through the Service Nationale de Protection Végétaux (SNPV) (the National Plant Protection Agency). Massive airplane spraying with pesticides was conducted the first four years of the project. Due to the concern for detrimental environmental impacts, SF, after studies by and recommendations from the University of Oslo, started using reduced doses of pesticides as early as from 1987. They also initiated a more targeted approach, through training of village brigades that would treat smaller areas with knapsack-sprayers. The last years of the project the rationale has changed towards local participation and empowerment in dealing with the pest problems. Thus a major emphasis has been training farmers in more integrated and preventive measures of crop protection. By 1997 the project claims to have reached every village in the project area and most farmers have received training in crop protection and brigades have been established.

The Review team is of the opinion that the Yelimané Grasshopper Control Project has developed in a more environmentally sound and sustainable approach to pest management. The focus on more integrated methods and a high degree of local participation and knowledge of pest problems has reduced the need for pesticides to a minimum.

Through interviews with the local population the team got the impression that other types of pests than grasshoppers in some years could be an equally or even more serious threat to crops. This underlines the need for promoting integrated pest management approaches and methods.

The Project Manager is currently looking at ways to further improve methods of integrated pest management. The team would strongly recommend that the SF support and assist this activity in the future. It is recommendable, that some assistance is given to structure the layout and registration of results from his in-field trials and research, preferably through contact with Malian researchers and research stations. Noragric would be willing to promote Master Candidates to undertake field work in the area if this is of interest from SF.

Pesticide distribution has been organised through large central stores managed by SNPV and through established village stores managed by a village committees. Only representatives of groups of farmers or village committees can purchase pesticides directly from SNPV central stores, not individual farmers. Individual farmers would buy pesticides

from the village store at a slightly higher price than SNPV prices and the margin would be set aside for a fund to cover running costs and new purchases. The organisation and management of the village stores seemed to vary widely. An initial revolving fund that had been put in place by SF in the form of a grant of pesticides is not available today and has been proven difficult to maintain. However, in some villages the money for purchase of pesticides was undertaken through collection among interested farmers. This is probably a more sustainable model and could be used for future farmer-to-farmer training.

Several farmers pointed out the problem of access to the SNPV pesticide stores. This problem should be discussed with SNPV in the last year of the project. The physical conditions of the SNPV pesticide stores seem poor, a subject which will be thoroughly covered in the coming report from Bellona and thus will not be further mentioned here.

The supply of pesticides has up to 1996 been a divided responsibility between SF and the SNPV. At the initial stages of the project, SF handed out pesticides for free. During the last years they have been sold at a subsidy rate of more than 50% by SF, while SNPV are selling at a subsidy rate of 30%. The team was informed that as of from 1996 all selling of pesticides had been taken over by SNPV. Pesticide prices will thus be markedly higher than before. However, the team would like to commend and support that SF has chosen to withdraw from pesticide supply and distribution, while instead emphasising the dissemination of Integrated Pest Management methods. This approach is more suitable to deal with the multiplicity of pest problems in the area and the farmers economy.

The establishment of brigades to take care of spraying smaller areas with knapsack-sprayers, seems to have taken place in most villages. According to the project the brigades are trained in simple maintenance of sprayers, while a village mechanic would receive training in the total overhaul of sprayers. Through interviews with village brigades this did not seem to function very well.

If a pest problem rises above a certain level (massive upsurge of grasshoppers or locusts) SNPV has an overall national responsibility to provide means to deal with the problem. It remains unclear to the team what strategy will be used in case of a serious outbreak, specifically what role the village pesticides stores and the village brigades is to play in this case. The last year of the project should clarify these issues.

The training of farmers in integrated pest management is stated to have reached every village in the area. With SFs support the level and frequency of training has been higher than what the SNPV with it's current level of personnel and equipment can offer. An innovative approach comprising farmer-to-farmer training has also been implemented by the project. The team was informed about the current reorganisation of the extension services, where SNPVs training of farmers would become an integrated part. The team would recommend that the last year of the project be used to investigate how future farmers training would take place within the reorganised extension services and specifically find ways to continue farmer-to-farmer training.

Brigades have also been active in the digging up of eggpods. Incentives for digging of eggpods has up to 1996 been given in the form of sacs of millet from FS. From 1997, an innovative incentive scheme has been established, where the FS, the SNPV, the Commandant de Cercle and the local commercial traders each contribute an equal amount towards an annual prize (free pesticides) for the brigade who dig up the most eggpods. The team would like to praise the local participation and co-operation established through this scheme, but questions the need for the prize being in the form of pesticides, given the IPM approach of the project.

To find whether the project has had a positive impact on food security it would be important to evaluate whether the farmers actually follow the advice given and what effect their action has had on the crops. Since 1989 grasshoppers/locusts have not reached abnormal high population levels, but whether this is due to natural fluctuations or an effect of the grasshopper control measures (such as the digging of eggpods) is impossible to determine. Crop loss assessment have been undertaken on millet in related projects in West-Africa. The in-field trials that will be conducted by the project manager should try to find a system for assessing crop losses under different types of integrated pest treatments. The results from such trials might eventually give a clearer indications of the effects of the methods used.

There has not been any internal or external evaluation undertaken of the project during its eleven years implementation. An evaluation will be undertaken during Autumn 1997, the last year of implementation. The team would recommend that this decision to withdraw totally should be taken only after the conclusions from the evaluation have been presented. Several of the positive aspects of the project (farmer to farmer training, the research component and the also the concrete follow-up by farmers of advice given) needs further assessments. As the Noragric team had a very short time in the field, the team would like to stress the need for the evaluation team to spend considerable time in the field, visiting a larger variety of villages that we were able to and discussing more with the local population about their pest management methods. The team would recommend that the evaluation specifically look into the following issues :

Assess whether farmers follow the IPM advice they receive. What is their attitude to the use and purchase of pesticides ? What is their acquired knowledge about IPM and what measures do they actually implement ?

The functioning of brigades. The criteria for their establishment and the prospect for continuation of their activity without SF's presence in the area.

The physical state of the equipment and the village stores, and the functioning of the system for maintenance of equipment. The problem of access regarding the SNPV pesticide stores should be assessed and practical solutions found.

A review of the responsibilities in case of emergency situations should be undertaken and improvements should be clarified in collaboration with SNPV.

The reorganisation of the extension services and the impact this might have on the continuation of the training of farmers in new innovative IPM methods. Specifically the possibilities for ensuring the continuation of the farmer-to-farmer training.

1. Introduction

The Strømme Foundation's project in Yelimané has received funding through the SSE-Programme since 1986. The main objectives of the SSE-Programme is to contribute to environmental rehabilitation and food security in the Sahel countries that were seriously struck by drought in the 1980's.

After a period of phasing down SF's contribution (both funds and manpower) to the SNPV, SF has decided that they will withdraw from the project by 1997. SF will undertake a evaluation of the project during Autumn 1997.

It was in this context that Noragric wanted to review the project, both to obtain an impression of the achievements made, approaches chosen and the potential impact on SSE-Programme objectives. In addition it wanted to assess the phasing out procedures and the sustainability of the activities. Noragric also hoped to contribute with inputs to the forthcoming evaluation.

A Noragric team, comprising Sidsel Grimstad (Noragric SSE-Coordinator) and Kari Fiskvatn (Consultant Entomologist) visited Mali from the 8th to the 18th of February. (The complete Terms of Reference for the review is attached in annex 1).

The teams local contacts during the review were : Mr. Pablo Sbertoli, Regional Director of SF, Mr. Boubackar Dicko, Project Manager for the Yelimané project, Mr. Chissoko, Acting Director for SNPV and Mr. Koné, Regional Officer for SNPV in Yelimané. Apart from that we had meetings with the local administration, farmers and brigades in the Niougoumera area. (A complete itinerary and list of people met is given in annex 2).

Due to logistical problems the stay in the field was only of 2 days, which is short in order to obtain an overview of the different institutional aspects of the project. This also resulted in a limited area was visited. However, the team had in-depth discussions with Mr. Sbertoli and Mr. Dicko in Bamako and as additional background information the team studied annual reports, mission reports, Mr. Dicko's memoires and related scientific publications. The complete list of documents reviewed is found under references.

2. The Project

2.1 Location and area description

The project is located in the Kayes Region of Mali in the north-western part of the country bordering Senegal and Mauritania. Kayes region is further divided into 3 cercles; Yelimané, Nioro and Kayes. The project has mainly been implemented in Yelimané Cercle and two smaller parts (area under two local offices of the SNPV) in the Kayes and

Nioro Cercle. Within Yelimané Cercle there are 90 villages, with Yelimané as the main administrative centre. According to the "Commandant de Cercle" the last official number of inhabitants from 1996 was about 137,000. The Cercle covers an area of 5,824 km² with an average population density of 23.5 inhabitants/km²

The area is a part of the sahelian zone characterised by poor soil quality and a decreasing cover of shrubs and grasses.

2.2 Agro system / Farming system

The ethnic groups represented in the area are Soninké (dominating), Fulani, Maur and Bambara. Although Fulani and Maur are traditionally transhumant pastoralists, there is a predominance of crop husbandry in the area. During the droughts in the mid- 1970s, the number of livestock was heavily reduced and thus increasing the trend towards settlement and cereal production. But still, in the project zone towards the Mauritanian border, extensive pastoralism is widespread, moving the livestock up north with the first rain and southwards for the dry season.

In the dry season (December - May) many of the younger men emigrate to other African countries and to France for paid income. They normally return to work in agriculture during the cropping season. Remittances from work abroad contribute a substantial income to many households and villages. On the negative side is that a large amount of the male population are not present in the villages in the dry season when a major part of agriculture and plant protection training takes place.

The area comprises the Terekolé valley which is a highly fertile area with large extensively cultivated areas. The total size of the cultivated area in the project zone is unknown but has expanded due to 1) an increasing population, 2) a drier climate - i.e. larger fields are needed to feed a family and 3) technical improvements, e.g oxen - draft power, has made it possible for some families to manage larger fields. Mr Dicko, who started working in the region in -58, has the opinion that the cultivated area has increased by about 35% since then. To give an estimate of the size he said a family of 7 are able to hand cultivate about 4-5 ha i.e. without a plow and draft-oxen, with draft power a family can cultivate 12-15 ha.

Agricultural areas are divided into family fields where men and women work together and private fields with a gender division. According to working time the family fields has the number one priority, since this crop is for feeding the family. The most common crop is different varieties of sorghum and millet. In addition they grow maize, groundnuts, beans and as cash crop: cotton and rice. Shifting and fallow cultivation are the normal methods, with production of beans or groundnuts one year, followed by 2-3 years producing millet/sorghum ending the cycle with 2-3 years of fallow.

The production in the private fields are either for sale or private consumption. Many women do also have their own vegetable gardens in an enclosed area near the village, giving a nutritious contribution to the family menu. Flood recession farming is common

and is expanding. The nature of this farming system includes larger threats from different pests late in the growth season.

2.3 Project description

2.3.1 Project Rationale

The project rationale has changed throughout the years. Its initial phase (1986-89) can be classified as an emergency or relief project with an only a goal to combat the grasshopper attacks with every means available, using external personnel and air-plane spraying.

As a result of increased concern for the environmental impact these methods resulted in, the project rationale then changed towards, lower doses of pesticides, more targeted actions and local participation. SF, through its assistance and collaboration with the University of Oslo, took an international lead in using lower doses of pesticides. The aim of the project in 1990 and '91 was to “decrease the crop losses caused by grasshoppers”.

In the latter years (1992- 1997) the main objective of the project has been to promote an integrated approach towards pest control, emphasising awareness among local farmers on what they can do themselves to control the pest problem. Training and information has therefore substituted the massive spraying, and the subjects disseminated include awareness of the life-cycle of grasshoppers and the types of integrated and preventive methods that can be used to reduce the attacks. Many of the measures promoted build on traditional knowledge. This approach is national policy and the Strømme Foundation has been in the lead of promoting a more integrated approach towards pest control. FAO launched in 1996 a large research programme on integrated pest management in Mali which will continue research on integrated methods.

2.3.2 Project Organisation and Management

The Institution responsible for Pest Control measures in Mali is the Service Nationale de Protection Végétaux (SNPV) with its central, regional, cercle and sector offices. The Kayes region is divided into three Pest Control Bases (bases phytosanitaires), Yelimané, Nioro, Kayes.

Each base is divided into sectors, 4 in Yelimané, 5 in Nioro and 5 in Kayes. SF's project covers all 4 sectors of Yelimané and one in each of Nioro and Keyes. Each sector has an office, an SNPV agent with a team that has the responsibility to undertake monitoring of pests, implement major campaigns when needed and undertake training of farmers and farmers brigades.

Each of the Base Phytosanitaire have a regional director and a large central pesticide storage facility. Pesticides are sold from these pesticide stores to representatives from

village committees, never to individual farmers. In addition the Yelimané project has constructed a series of village stores for pesticides, located where there is a civil administrative centre (centre d'état civil), so that the villagers can plan and store pesticides themselves. In Yelimané cercle, 9 such centres are located in Yelimané sector, 4 in Kirane, 2 in Tambakara and 1 in Marena. The team was unable to obtain information as to how many were constructed in the sectors of Nioro and Kayes that participate in the project. These village stores would be supplied with pesticides through purchase from SNPV central stores.

The project has been implemented through the SNPV regional offices in Yelimané. The Yelimané regional office has a Chef de Base and in each sector there is a Chef de Secteur. Within the Yelimané Cercle there are all in all 3 vehicles and 8 motorcycles. In addition there are 3 guards and 3 drivers. At the local level agricultural extension agents assist the SNPV agents in the training of farmers.

In addition, throughout the duration of the project, there has been staff from SF assigned to assist SNPV in the implementation of the project. In the beginning of the project, personnel from the army also assisted in combating the grasshopper upsurge (see table 2 in annex 3 for additional information).

At present there are 5 SF staff assigned to assist SNPV in the area, however they are also involved in other activities in Yelimané which are outside the project. 2 main officers are occupied with the project in addition there is a driver, guard and a handy-man. SF staff have two cars and storehouses, as well as a guest house.

2.3.3 Target Group

The project is targeted to reach the whole population within the project area. There are no specific target group within the population. However, the project has targeted women for the dissemination of information, training and IPM methods as they are often more present during the dry season and they undertake a substantial amount of the agricultural work.

2.3.4 Planning and reporting

Yelimané Cercle has been one of the SFs main centres of activity since their first involvement in Mali in 1985. Other of SF's activities include construction of schools and wells, grain banks and credit systems. During the years the Strømme Foundation has been involved in the area, they have built up a confident relationship to the SNPV, the administration in Yelimané, the Comité de Développement Locale (Local Development Committee) comprising all the major government services in the region and representatives from the people. All SFs activities in the area are discussed and planned with these institutions consent.

SNPV at Cercle level are obliged, according to their job description, to report about potential attacks of pests to SNPV in Bamako, every 10 days in the growing season. In addition monthly reports are given to the central SNPV.

The project manager, Mr. Dicko reports to SF on a quarterly basis during growing season.

SF reports annually to NORAD on the use of money and the progress made.

As far as the team was able to review the presented documentation, there has been no external evaluation of the project during its eleven years of implementation. An evaluation of the project has, however, been scheduled for Autumn 1997.

3. Technical review

3.1 Grasshopper and Locust Pests

Since the projects initial focus was to combat grasshoppers it is important to look into this group of insects. Grasshoppers can be sub-divided into two distinct groups: grasshoppers and locusts.

Locusts have two different morphological and behavioural phases: -the solitary phase with each organism acting individually. During this phase they live in a quite distinct recession area making surveillance possible. Under the right climatic conditions the density increases and at a certain level they enter the next phase -the gregarious phase with a distinct morphological and physiological appearance and behaviour. The densities are now so high there are not enough food in the area and they move on. As larvae they move in hopper bands, while as adults they form flying swarms. The desert locust (*Schistocerca gregaria*) is the most feared locust in Mali, with relatively frequent upsurges and during these outbreaks always bothering the farmers in the Yelimané area.

Grasshoppers do normally not have two phases, they are more stationary although some swarming have been observed and they are more likely to cause annual damage. In general terms one can say that these grasshoppers act and do damage like other types of insect-pests and theoretically can be combated with more targeted and local measures including integrated methods.

3.2 Reported pest problems

The dominating species in the first two years of the FS campaign was the Senegalese grasshopper (*Oedaleus senegalensis*). During the upsurges in 1974/75 and again in 1986 it was observed that this species showed signs of gregarization, thus placing it in an intermediate position between grasshoppers and locusts. In 1988 the feared desert locust was the main pest species. Even the train between Bamako and Dakar was stopped due to

the locusts. There was a growing concern that this would build up to a major outbreak the following year. However, this did not happen and in 1989 the main enemies were grasshoppers not formerly known to be of economical importance. The grasshopper complex consisted of the following species: *Krausella amabile*, *Hieroglyphus daganensis*, *Cataloipus cymbiferus* and *Kraussaria angulifera*. From 1990 and up till today, damage caused by grasshoppers have been moderate.

When the team asked farmers in the area they all agreed that problem number one is to get sufficient amount of rain at the most critical points of the crop cycle. The trend in this sahelian area is a diminishing yearly rainfall. There are also large spatial variations in both rainfall and pest problems. In 1996 there were areas in Yelimané Cercle that got no rain at all.

The next biggest problem are pests. Farmers we talked to mentioned grasshoppers as the pest doing most damage eating the leaves and particularly the grains on the milky stage. The reason why grasshoppers are on their top list might be that grasshopper outbreaks are unfortunately often associated with periods of rain following a drought. In single years, however, there were other pest organisms doing more damage. The farmers also mentioned "larvae" and millipeds eating seeds and sprouts as the seasons initiating pests. This was, however, reduced radically by treating the seeds with Lindane. In 1995 rats constituted the largest threat chewing off the stem and eating the grains as the millet heads lay on the ground, but again spatial variations occurred. Other pest organisms mentioned were:

- * Birds (Quelae): eating grains,
- * Meloid beetles: doing most damage when eating the female flowers giving no grain- production.
- * Larvae (indet.) and millipedes: eating sprouts
- * Ground squirrels: eating groundnut seeds.
- * *Striga* sp.: a weed parasitising on millet roots.

The pest complex of the millet crop cycle has been thoroughly surveyed in a project run by Natural Resource Institute (NRI) in Mourdiah, Mali from 1985-91 (Jago, N.d. et al., 1993). The two areas, Yelimané and Mourdiah are comparatively alike, although Yelimané may be a little drier. These studies confirmed the findings in Yelimané, but in addition also other pests were studied, although not all of them were found equally important.

3.2 Crop protection measures

3.2.1 Chemical treatments

In this chapter we concentrate on the small scale chemical treatment the farmers/brigades are able to do themselves. When talking to the SNPV representative Mr. Bowraima Koné in Yelimané we learnt that they only distribute powdered pesticides to the village stores. The reason for this is mainly that the powdered pesticides used (mainly Sumithion 3 - 5%) have a much lower concentrations of active ingredient than liquid pesticides

(Fenitrothion 50%). Thus the powder needs less precise measuring for preparing the right dosage and the quantity of powder needed is much easier to handle even with simple measuring equipment. In every village there are knapsack sprayers for farmers to borrow. The maintenance of this equipment is considered easy and is a part of the training programme.

There is also a more traditional method to distribute the powder without the use of "advanced" technical equipment. The method is simply to fasten a small bag of powder to the end of a stick and then carefully hit the bag with another stick while walking. With all spraying it is important to always have a main direction up-wind, crossing the field back and forth with a proper swath distance. In this way the farmers will minimise their own contact with the pesticide.

When the grasshopper density exceeds 10 per m² over a larger area, SNPV will normally initiate an operation involving the brigades. During these campaigns, liquid Fenitrothion and Malathion, are normally used and brigades participating will then learn to handle this type of pesticides.

In the training programme the farmers / brigades learn how to mix the chemicals into the right dosages, and they are told to put plastic bags on their hands, a turban to cover mouth and nose, shoes and full covering clothes and preferably use some kind of glasses. The chances of overdosing are less now because:

- they have to buy the pesticides themselves and they are expensive
- because of training they are more aware of the health and environmental hazards of careless utilisation
- and finally they have observed themselves that overdosing is harmful to the crop (burn marks).

For a further reduction in the use of pesticides a new distribution method is being tested. Millet chaff mixed with water and pesticides are turned into moist pellets for distribution in the fields. It has been reported that several pest organisms, grasshoppers, birds and rodents included, will preferably eat the moist bait. With this method, Mr. Dicko claims it is possible to reduce pesticide dosage down to 5 g a.i./ha. However, no scientific analysis have been made at this point.

3.2.2 Traditional methods

There is still a wide selection of traditional methods in use. Some of them seem a bit doubtful, while others may have a promising potential for use in IPM. However, to summarise some of the traditional methods that have been used in the area:

- Birds: Glue on resting branch
- Poison in artificial water pools
- Destruction of nests
- Slingshot
- Explosives

-Rodents: Poisonous bait

The whole village joins in a round up
Smoking them out of their tunnels and killing them

-Grasshoppers: Destruction of eggpods

Bare soil as a barrier to the juveniles

Marching hoppers trapped in ditches and buried

Adult grasshoppers are attracted to light during the night - light traps i.e.

Fires and mechanical destruction. (This does also work for
Meloid beetles)

Some traditional methods have still not been completely abandoned, although they may have the opposite of the wanted effect. A widespread method is to initiate bush-fires to kill grasshoppers. The effect is most likely that flying grasshoppers escape and find the vegetated areas that are left i.e. the crop fields.

Farmers are also recommended to clear the field of crop residues as soon as possible, to prevent grasshoppers moving into the field laying eggs. However, the current method may have an effect on the millet stem-borer (*Coniesta ignefusalis*), with the sun exposure killing the larva in the stem. Crop residues are also used for animal fodder, fencing and roofing of houses. Since grasshoppers according our information are by far the most feared pest compared to the millet stem borer, this seem sensible. Experience over time will tell.

3.2.3 Integrated Pest Management (IPM)

Integrated Pest Management, involves reducing the use of pesticides to a minimum through using knowledge about the biology of the pest organisms and their predators (beneficial organisms) as a source for developing alternative methods to pesticides to defeat the pests. Knowledge of the pest level threshold, when it is «economically» wise to treat is important in IPM and through the biological knowledge it is possible to time a pesticide treatment within the season and maybe also within the day.

The Project Manager, Mr. Dicko, has worked and lived in the area since 1958. Most of the time (up till 1986) he worked for the Organisation Commune de Lutte Antiacridienne et de Lutte Antivaira (OCLALAV) being their man in the field combating birds and grasshopper pests and undertaking research on particularly the latter.

As a basis for further development of IPM in the area he made the following observations: Some plants attract grasshoppers (and other pests) while other plants are not touched at all. Initially Mr. Dicko concentrated on the untouched plants for extraction of the toxic ingredient. After thorough consideration he decided to leave this strategy since he did not know anything about the toxicity of the products.

He thereafter started working with the appetizing plants. Although he has tested his theories for a couple of years he introduced his method to other farmers for the first time last year. He asked farmers to sow maize (appetizing plant) in the area between the bush and the millet/sorghum field. Around the field they were instructed to make a 2-3 m band of bare soil (as taught in the training course). Close to the harvest time he asked the farmers what had happened. The maize were completely gone, while the millet/sorghum had minor grasshopper damage. (It should be noted that stressing the plants to a certain extent by means of grazing, causes an increased plant production). Anyway, if chemicals are applied it should be sufficient to treat the maize-field. The millet chaff pellets with pesticides could be adequate or not necessary at all.

To improve the effect of using appetizing plants he suggests to add some repulsive plants in-between the crop. Light traps by means of fires in the trapping field could also enforce the effect. In case of larger upsurges of grasshoppers this method is not likely to be sufficient. In the future Mr Dicko wishes to make more thorough studies to investigate other combinations and options of plants to optimise the effect. A combination of cultivating a fast-growing millet and slow-growing maize are considered and also growing pumpkins in-between the maize.

It is recommended that some assistance is given to structure the layout and registration of results from his in-field trials and research. This should primarily be through contact with Malian researchers and research stations, or as a second solution, Noragric could try to promote M.Sc. Candidates to undertake field work in the area.

3.3 Storage facilities

3.3.1 Condition of chemical stores

In November 1996 the Norwegian environmental organisation, Bellona, was hired by the Strømme Foundation to make an inventory of SNPV pesticides in the stores throughout Mali. SNPV participated, and so did also some of the village store managers. The purpose was to detect what pesticides were stored, which were outdated and illegal, which were stored in an unsatisfactory manner and finally which would need to be slipped out and destroyed under special treatment.

Since Bellona is undertaking this survey of what pesticides are found in the different stores, conditions of storing facilities and destruction methods, we leave the conclusions to them and their coming report (expected first half 1997).

3.3.2 Management and use of village stores

Pesticide distribution has been organised through large central stores managed by SNPV and through established village stores managed by a village committees. Only representatives of groups of farmers or village committees can purchase pesticides directly from SNPV central stores, not individual farmers. Individual farmers would buy pesticides

from the village store at a slightly higher price than SNPV prices and the margin would be set aside for a fund to cover running costs and new purchases.

The reason for establishing village stores is mainly to increase the pesticide availability for the farmers. As a part of the new strategy, pesticide treatment is only supposed to take place when the pest damage has reached a certain level. In case of a grasshopper outbreak a quick and easy access to pesticides may be necessary. The organisation and management of the village stores seemed to vary widely. An initial revolving fund that had been put in place by SF in the form of a grant of pesticides is not available today and has been proven difficult to maintain. However, in some villages the money for purchase of pesticides was undertaken through collection among interested farmers. This is probably a more sustainable model and could be used for future farmer-to-farmer training.

Talking to the Yelimané village store manager: He told us that pesticides were always available in the local store but the main seasons are the beginning and the end of the rainy season. Although they may, farmers do not normally act individually when buying pesticides.

Several farmers pointed out the problem of access to the SNPV pesticide stores. This problem should be discussed with SNPV in the last year of the project. The physical conditions of the SNPV pesticide stores seem poor, a subject which will be thoroughly covered in the coming report from Bellona and thus will not be further mentioned here.

3.4 Content of Training Programme of Farmers

The training that took place up till 1992 concentrated on recognising the different grasshopper species, learn about their biology (i.e. about larval development and number of generations per year) and how to treat them chemically. Then a small revolution occurred in 1992 and the training was concentrated around Integrated Pest Management methods (IPM). In principle this means to use as little pesticides as possible, only treat when absolutely necessary and concentrate on preventive measures and physical and technical methods. To achieve this, knowledge about the pest organisms biology and of their enemies (beneficial organisms) is necessary.

They are also taught about pesticide treatments, how to attain the right dosages, safety precautions, acceptable climatic conditions for spraying, spraying methods, thorough cleaning of both themselves and clothing after spraying, and they learn at what pest level they should spray. Regarding timing for treatment before harvesting this was said to be about 2-3 weeks, but in addition people did not think it was economically viable to spray the the crop close to the harvest. Additional information was that millet and sorghum heads are stacked and left in the sun for drying about two weeks before further handling and the sun will rapidly degrade any pesticide remnants in the crops. Although rarely used, chemical treatment of vegetable gardens, are under stricter rules. In the training programme they also learn about the negative environmental impact through the use of pesticides.

The training programme also contains these issues:

- Cultivation prior to sowing
- How to treat the seeds (using Lindane!)
- Proper field clearing - weeding and tidying of the field
- Cleaning a 2-3 m band between the different fields and the bush, to make a barrier against crawling grasshopper larvae
- Organising mechanical destruction of grasshopper larvae with everyone joining
- Using mechanical or repulsive methods against Meloid beetles and other flower eating insects
- Hand-pulling the weed *Striga* sp. before flowering
- Removing plants infested by mildew and other plant diseases
- Removing eggs/young birds 15 days after initiation of the nestbuilding (Quela birds)
- Selecting the next years seeds thoroughly

The training programme also focus on the importance of the farmer to farmer training. This must clearly be of particular importance in the villages where men are off earning an income during the dry season when the courses take place. The best brigades are used actively in teaching others. An example of this is the women brigade in Niogomera.

The activities during the year:

Phase I, from December till May training of brigades, increasing their awareness of the need for preventive control of pest organisms. Brigades do also locate and destroy eggpods.

Phase II, from June till November i.e. the rainy season and the growth season, the farmers /brigades have to actively defeat whatever pest that strikes their field. In the end of this period there should normally be a need for repairing and maintaining the spraying equipment.

The IPM approach disseminated through the training programme seems well suited to the reported pest problems in the area, and appropriate for the farmers economy.

3.5 Environmental and health risks

Since the initial stages of the project where aircraft spraying was widely used and up to now where pesticides are used in only limited scale, it must be assumed that both environmental and health risks have been reduced. The considerate reduction in the use of pesticides has and will definitely reduce the risks further. Increasing the farmers awareness through training and introducing alternative technical and preventive measure methods are also large contributions. The largest health risk is probably connected to the work in the pesticide stores (Bellona in prep.) and to treatment in a careless manner. It

has to be noted that handling powdered pesticides is anyway risky since the powder easily is inhaled.

The team is of the opinion that the Yelimané Grasshopper Control Project has developed in a very positive direction towards a more integrated pest management strategy with a high degree of local participation. This has reduced the need and use of pesticides to a minimum and thus the environmental and health risks.

4. Institutional review

4.1 Services Nationale de Protection de Végétaux (SNPV)

SNPV is the implementing institution of the project. Their responsibility is the surveillance of pests, organisation of crop protection activities, control of inputs used in agriculture and training of farmers in crop protection.

Apart from financial “emergency” assistance during serious attacks and the funding SNPV receives through different NGOs such as the SF, the institution relies heavily on a major grant in the form of pesticides from the Japanese bilateral aid. SNPV states that 80% of their total pesticide supply stems from this grant. The grant is given under the condition that the pesticides are to be sold at 2/3 the market price (1/3 subsidies) and income should be used for financing SNPV activities and local development activities. The team did not get a clear impression of how the development activities was organised in the field.

Several farmers and the SNPV stated however, that farmers, were not prepared to pay even the subsidised price for the pesticides. This could be due to several reasons; that they are used to receiving pesticides for free during campaigns and through NGOs and also that they evaluate the damage done to the crop not being adequate to support the cost of treatment. See further discussion on the use of incentives below.

While the team was in Mali, in February 1997, a major re-organisation of the central level of the Agricultural Sector was taking place. The current Ministry of Agriculture and Animal Husbandry and its underlying Directorates, of which SNPV is one, would be renamed “Ministry of Rural Development and Environment” (MDR&E) and thus merged with the Ministry of Environment. The main objective is to streamline the different services into areas that have a somewhat similar target group or tasks.

The former six different departments in the two ministries, would be merged into three new departments :

- 1) “Services National d’Appuie de Monde Rurale”
- 2) “Services Nationale de l’Aménagement”

3) “ Direction Générale de Contrôle et Legislation”

The first department would be the overall responsible for the rural development, herein included agricultural extension and training of farmers (also in issues regarding crop protection). It would also include the responsibility for the monitoring of pests and control measures. A major part of the former SNPV would as such lie within this directorates mandate.

The second directorate would be responsible for civil works and infrastructure development.

The third directorate “Direction générale de contrôle et législation” would have national responsibility for control and legislation regarding food and inputs in agriculture. This directorate would have a separate “Division de l'étude et contrôle phytosanitaire” where part of the old SNPV responsibilities lies. The main guidelines and regulations regarding control of food and inputs are given through International and Regional regulations submitted from FAO and CILSS.

The team did not get the full picture of whether the reorganisation process had also taken place at a local level. However, during our meeting with the Local Development Committee in Niogomera, the representatives from the extension services and the regional SNPV representative indicated that there was going to be several changes in responsibilities for the different services. The team got the impression that already collaboration with the other agricultural services functioned well and there was some level of co-ordination through the local development committee.

The change which was described to the team, and which might affect the Yelimané project, is that all extension activities (including former SNPV responsibilities of training brigades in pest control and integrated methods) would be underlying the agricultural extension services. The SNPV officers would thereafter only be involved in the monitoring and surveillance of crop damage, initiating campaigns against attacks and having tasks within food and input control.

The agricultural extension services operate using the so-called Training and Visit system (T&V), using a selection of contact farmers for dissemination of new technologies and methods. This differs largely with the SNPV/SF extension strategy, where all farmers in each village have been offered training and advice. An innovation that SF has introduced is the farmer to farmer visits, where farmer brigades have been used to train other brigades. Such methods are often very valuable and can give better results than large-scale technical training.

It is evident that the large-scale training programme that the SNPV/SF project has introduced has required a certain level of logistics, resources and manpower. When SF withdraws its funding from SNPV, it is unlikely that SNPV can continue the training activities at the same level. However, the positive side of the reorganised extension

services might provide more cost-efficient use of vehicles and resources and thereby ensure some continuation of training in crop protection measures.

In the last year of the project SF should look into the different systems and find a solution for the merging of these two different extension systems. The team would like to emphasise that it would be very important to find a way to continue the farmer-to-farmer visits.

A major concern of the team is the lack of capacity from SNPVs side to deal with serious attacks. This became evident during the incidence in 1995-96, the outbreak of a minor locust upsurge revealed the weaknesses of the SNPVs emergency control systems. There were no funds or pesticides in store to manage the outbreak and the equipment that had been distributed (knapsack-sprayers) were not in order and availability of spareparts were not adequate. This resulted in an extra-ordinary application for funds from NORAD in order for NORAD to cope with the situation.

The project should, in the forthcoming evaluation, look into the issues of emergency preparedness among SNPV and the brigades and assess what can and should be done within the SNPV to improve this situation. Especially this goes for the maintenance of equipment which has been a responsibility of the project.

4.3 Farmer Brigades

Farmer brigades have been established in all villages of the project area, more than 90 villages, and all brigades have been through training more than once. In each village there may be more than one brigade and in addition some extended families constituting "brigades". There are both male and female brigades and the reason for this gender division is that although they do some work in concert, the majority of the work is separate, cultivating different crops in different fields. The training programmes take place during the dry season in many villages only women, children and elder are the only ones left in this period. The digging of eggpods is a typical women's task, as this activity can take place during the dry season. Women's brigades have also been used for innovative farmer-to-farmer training activities.

It remains somewhat unclear to the team how the brigades function, are organised and what responsibilities they have. From the reports reviewed the team has the impression that a brigade can comprise anything from the whole village to only two family-members, and as such there seems to be a varying degree of organisation and cohesion in each village. SF has stated that throughout the project they gained the experience that using the extended family as a unit for a brigade was more feasible, which is probably the reason for the difference in size of brigades. In the long run these units may seem small for efficient training purposes and organisation of larger campaigns. The project should use this last year to examine how the village-brigade can be organised in case of larger campaigns being needed.

In some of the villages visited there were conflicting signals as to how and how many people had received training and support. There also seemed to be several problems regarding the maintenance and training in maintenance of the equipment needed for campaigns, knapsack-sprayers. Intentionally the project has trained village mechanics (often younger engine-interested men) to be able to undertake basic maintenance of this equipment. However, due to the large migration of men during parts of the year, the maintenance skills are not kept in the village and new people have to be trained every year. This problem has been described in an evaluation of a similar project in the Mopti region undertaken in 1996 (Baumgart and Dembélé).

4.3 Use of incentives

During the initial years, the project could be characterised as a relief project. Activities were considered a necessity to deal with the acute food-deficit in the area. Food for work was therefore used to undertake the ground operations. As the problems facing the farmers were acute and food-shortage was a problem due to the large attacks this seems to be an understandable strategy for implementation.

The first strategy was to give farmers pesticides for free, but later this idea has been abandoned (from 1994). Sprayers and pumps (a total of 500) were also being distributed for free to the villages from the early nineties. The selling of pesticides is supposed to be SNPV's task (750 FCFA per kg). From 1993-94 to 1996 the Strømme Foundation sold pesticides from SF's store in Niogomera (managed by Mr. Dicko) for less than half the price (350 FCFA per kg) of what they were sold for through SNPV. In addition the Foundations store has probably been more accessible, and of course more attractive since they have sold the pesticides cheaper. On the market there are also pesticides illegally smuggled/imported from Mauritania and Senegal. The size of this trade is unknown. SNPV in Yelimane will as of 1997 alone be responsible for distributing and selling pesticides to the village stores. The prices will then be standard, 2/3 of the market value, same as what they are sold for through SNPV all over the country.

The digging of eggpods was also initially rewarded by means of food. Eggpods delivered to Mr Dicko gave millet in return, one sack of eggpods for ½ sack of millet. According to SF staff this practice has ended and as from 1996 no incentive has been given to the digging of eggpods. Instead they have initiated a competition, with a prize to the brigade who has collected the largest amount of eggpods. The last two years the winner has been the female brigade in Niogomera. The prize is established with contributions from the Local Development Committee, the local merchants, SNPV and SF and is given in the form of free pesticides.

The team would recommend that the SF and SNPV considers giving the prize in another form than pesticides, as this might not in all years be a very useful prize. Maybe a trip to visit another farmers brigade (including per diems), millet or even money would be more appropriate.

The team would like to stress that it approves of the phasing out of the incentives that have been given in the form of pesticides and food. This practice is not a sustainable system and the farmers emphasis of using these measures will only be proved efficient if they continue to take on these tasks because they find it does give them adequate returns in their fields.

The reorientation that SF has given the project, where emphasis has been given to integrated methods and through innovative methods of reducing the use of pesticides to a minimum gives the farmers options of low-cost crop protection measures which in the long run are the most sustainable. The need for pesticides is thus so small that farmers most probably can afford it even at ordinary markets rates.

4.4 Phasing out strategy

During the years the Strømme Foundation has been involved in the area, they have built up a confident relationship to the administration in Yelimané, the village councils and to SNPV. In the communication between the involved parts there has been a request from the people in Yelimané to get help in combating grasshoppers. The methods have changed from large-scale operations to make farmers able to take responsibility themselves for protecting their crops with assistance from the local SNPV.

The Strømme Foundation has throughout the project had a team of very dedicated staff assigned to assist the SNPV in the project implementation. Their role has been partly a support in kind such as supply of incentives (food-for-work), pesticides, equipment and construction of village pesticide stores, and partly through providing means and innovative methods for the undertaking of training of farmers. The emphasis on incentives and the donation of inputs gave the project and SF an image as a relief project which would not provide a sustainable solution to the pest problem.

Throughout the years and specifically the last years SF has gradually withdrawn from subsidised and free incentives. The team however, got the impression that even in 1996, SF had sold pesticides at half the market price which is lower than the SNPV-price, and also that some degree of incentive had been given for the digging of eggpods.

SF stated that as of from 1997 no such incentives were to be given, thus forcing the farmers to face the actual costs of pesticides. Currently, according to SFs own statement, there are only small amounts of pesticides left in the SF central store, which are left-overs from distribution made last year. These would be sold at the same prices as SNPV.

This reorientation has been followed up by a strong emphasis in training by SF, promoting a high degree of local participation and awareness of the problems and means of handling them. Innovations like farmer-to-farmer visits have been made possible through the support of the SF-staff and resources.

Currently SF staff are involved in contributing to the refresher-training courses that are held for the brigades in the area, and more actively in the undertaking of in-fields trials of new methods of integrated pest management.

The team commends that SF withdraws from activities concerning supply and distribution of inputs. However, it would like to emphasize the importance of continuing the support the current activities in developing integrated pest management methods. The team would urge SF to make resources available for the continuation of these trials.

There has not been any internal or external evaluation undertaken of the project during its eleven years implementation. An evaluation will be undertaken during Autumn 1997, the last year of implementation. The team would recommend that this decision to withdraw totally should be taken only after the conclusions from the evaluation have been presented. Several of the positive aspects of the project (farmer to farmer training, the research component and the also the concrete follow-up by farmers of advice given) needs further assessments. As the Noragric team had a very short time in the field, the team would like to stress the need for the evaluation team to spend considerable time in the field, visiting a larger variety of villages that we were able to and discussing more with the local population about their pest management methods. The team would recommend that the evaluation specifically look into the following issues :

Assess whether farmers follow the IPM advice they receive. What is their attitude to the use and purchase of pesticides ? What is their acquired knowledge about IPM and what measures do they actually implement ?

The functioning of brigades. The criteria for their establishment and the prospect for continuation of their activity without SF's presence in the area.

The physical state of the equipment and the village stores, and the functioning of the system for maintenance of equipment. The problem of access regarding the SNPV pesticide stores should be assessed and practical solutions found.

A review of the responsibilities in case of emergency situations should be undertaken and improvements should be clarified in collaboration with SNPV.

The reorganisation of the extension services and the impact this might have on the continuation of the training of farmers in new innovative IPM methods. Specifically the possibilities for ensuring the continuation of the farmer-to-farmer training.

5. Impact of project

5.1 Impact in relation to the SSE-Programme objectives

The overall objective of the SSE-Programme is to improve the food security situation and to contribute to the rehabilitation of the environment.

Food security

The rather specialised objective of reducing crop losses due to grasshoppers attacks evidently would have a positive impact on the food security situation.

It is clear that in the first years of serious upsurges of attacks that the massive spraying must have reduced the damage done by the grasshoppers and as such improved the food security situation that year.

However, in the later years of the project when the attacks were of a smaller scale and the focus of the project were more on making the local population able to deal with their pest problems themselves, the direct impact on food security is difficult to measure.

According to the population, they seem to be very confident that the methods they now use, including the digging of eggpods have had an impact on their crops. However, there are many other external limiting factors for obtaining food security such as rain, erosion, deforestation etc, and thus evaluating whether it is the climate or IPM measures that has improved the situation is very difficult. Secondly, it is still unclear whether the farmers follow the advice given, and thirdly there are many uncertainties around the biological and climatical factors that induce upsurges of grasshoppers.

The team would however, like to stress that making the population aware and giving them knowledge of how to deal with the problems within their own fields should give them more resilience towards future pests.

Environmental rehabilitation

The project has gone through some several stages with regard to impact on the environment. The initial stages which were more emergency type operations, included considerable dosages of pesticides spread in a somewhat un-targeted way which reportedly gave harmful environmental effects. Although not scientifically documented, the population reported that bees/honey and snakes disappeared from the area. The University of Oslo, with its contribution of recommending reduced doses of pesticides were important steps in a more environmentally friendly way of handling the problems. The latter years emphasis on more integrated methods have reduced the use of pesticides to a minimum and thus the potential detrimental effects on the environment. According to the population, bees have re-established.

The field trials of new and innovative methods, including the use of traditional and poisonous plants are interesting. However, in an environmental perspective, great care must be used also with so-called natural poisons, as they might be just as detrimental to the natural environment as synthetically produced pesticides.

5.2 Impact in relation to the projects overall objectives

As the project rationale has changed during the course of the project, the assessment of impact in relation to project objectives necessarily changes as well. The project objectives the latter years have been twofold; (i) to decrease attack and thereby increase harvests through specific measures such as eggpod-digging and targeted spraying and, (ii) to make the local farmers able to handle their pest problems through integrated methods and knowledge of the different pests (training of farmers in integrated pest management).

The impact of the project on the pest attacks and crop losses include such a lot of variables (climate specifically precipitation, grasshopper biology, other pests etc) there is generally a need to use scientific methods over a longer period to assess whether one specific activity has had an impact. This has not been done in the project. However, in the in-field trials which are planned to be undertaken by the project manager, there might be a scope to make simple assessments on crop losses. In the next chapter this issue is discussed.

Each year since the early 90-ies it has been reported that a considerable amount of grasshopper eggpods have been dug up and destroyed. The amount is likely roughly measured, but still there is no reason to discredit the numbers.

Concerning the effect of digging up and destruction eggpods no scientific analysis have been made. But there is a general scientific opinion that removing eggpods from the fields and their close surroundings may have an effect under Sahelian conditions (Berger, L and Associates, Inc. 1991). This also seemed to be the experience of farmers using the method. It is time consuming work, but since this is done by the brigades during the dry season it is easier to find time.

The different species of grasshoppers have different preferences for egg-laying sites. This is common knowledge by the farmers in the region today. In the wind shade of trees they find eggpods from *Cataloipus cymbiferus* and *Acorypha glaucopsis* which need more time (about 30 min.) for egg-laying and are in danger of being blown away. The Senegalese grasshopper needs only about 10 min. for egg-laying and prefers sandy soil. During the harmattan period, sand is often blown away and the eggpods from this species are exposed and large amounts are easily collected. Since the amount of eggpods dug up every year constitute a considerable amount, 30-40 tons each year, the possibilities of using this extra protein in poultry breeding should be examined.

The indirect impact of the project on farmers ability to handle their pest problems themselves should be assessed as to whether the farmers have obtained the adequate level of knowledge to act independently on the occurrence of attacks. The team got the impression from the somewhat superficial and short visits we made to the villages that knowledge about methods and the biology of pests was quite high among the brigade-members.

Since we were not present during the rainy season, we could not observe ourselves how farmers acted and to what extent the farmers actually follows the advises given during the training. To find out whether this part of the programme really has had an influence on farming in the area, observations of farmers/brigades during the cropping season is necessary. There should be a particular close look on how pesticides are handled, e.g. the application of pesticides on crops taller than 30 cm is considered by experts to have a negligent effect on pests.

From this season onwards, the farmers have to buy pesticides without subsidies from the FS. Whether people are interested in using money on pesticides or choose to use their money for other causes remains to be seen. In the NRI project in Mourdiah this was investigated and it was found that the farmers did not prioritise pesticide treatments. Their strategy was to employ people to weed and establish far more fields (geographically widespread) than necessary and then abandon those that were too heavily attacked by pest organisms. This is of course a «rich» mans strategy and may not apply to the farmers in the Yelimané area.

The team would like to recommend that these issues be looked further into when an evaluation of the project be undertaken.

5.3 Potential Methods for Crop Loss Assessments

There are two ways this can be measured:

1) The scientific way, which demands specially instructed personnel to collect samples and special expertise to analyse the data. Methods to assess crop losses in millet exist and is handy when results are wanted for one season. The simplest method is to use already existing fields and record size of damage on a number of selected milletcandles (Kogo, S.A. and Krall, S., 1996 and Wewetzer, A., et al. 1993). It is possible to separate damages caused by different pests. This will give a picture of the situation in an area in one year. However, there are of course limitations to the methods. The crop loss is only estimated from the crop that made it to the ripe stage. Large losses may have occurred before this stage.

2) Following farmers and their fields from year to year. The farmers follow and work with their crops along the season and observe attacks and identify pests, they have first hand information about what happens in their field. Systematic collection of their information about precipitation, pests and attacks in different stages of the crop cycle, actions taken before and after attack, final size of crop etc., will give useful information as to what farming methods give the best results.

The different methods do not exclude each other, but with their possibilities and limitations they complement one another. There should be a scope for both being applied in further research in the Yelimané region. The scientific method demands some input from researchers in the setting up of the trials, this competence could be sought

preferably from Malian researchers at the central level or working in the close by research station.

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Annex 1

Terms of Reference

SSE-project no. 001 - 233

Integrated Pest Management Of Grasshoppers In Yelimané

Implemented by Pastor Strømme's Memorial Foundation

1. Background

The project was initiated in 1987 on the basis of the need for a more integrated and appropriate use of pesticides towards grasshopper attacks in farmers fields in Mali. Previously grasshoppers attacks had been followed up by massive aeroplane spraying of pesticides by external personnel. The new approach in Pastor Strømme's Memorial Foundation's (PSM) project included two main changes in management of pests :

Improved and more integrated techniques;

Reduced use of pesticides through a combination of only using pesticides when and where needed from knapsack-sprayers and through digging up eggpods in order to reduce multiplication

Local participation;

Farmers have been organised in brigades and trained in correct pesticide-use and where and how to dig up and destroy eggpods

The project has also provided pesticide-stores through-out the area, of which the management has been handed over to the brigades. The stores have been supplied with pesticides partly through PSM and partly through the local Plant Protection Authority.

Implementing agency in the field has been the local Plant Protection Agency (SNPV).

The project has according to PSM progressed in a satisfactory way; a massive amount of eggpods (30 tons) has been dug up and destroyed and around 100 brigades have been organised and trained of which 14 are women brigades. The project had a well-defined implementation period is to be phased out, with full responsibility handed over to the local PPA within 1997. The practical consequence of the handing-over includes that the local Plant Protection Agency will be responsible for the supply of pesticides, repair of sprayers and continued training of farmers. The farmers will thus be organised in groups and purchase pesticides from the PPA. Farmers/brigades who have received training will continue to use their knowledge in appropriate use of pesticides and the digging of eggpods. The farmer brigades will also be responsible for the management of the local stores of pesticides.

2. Scope of Work

In view of the ongoing process of phasing out the project, Noragric has suggested a review of the project. The purpose of this review would be to assess the achievements made and the sustainability of the organisations and activities initiated. PSM has also requested that the team discuss new approaches to pest management.

More specifically Noragric would undertake the following tasks :

2.1 Familiarise itself with the project objectives, activities and modes of implementation in the field. Particular attention should be paid describing the institutional arrangements, farmers organisations and the use of incentives.

2.2 Review the levels of pesticides in use, health risks in relation to current pesticide use and the pesticide store management practices.

2.3 Review of results compared with the initial targets for the project.

2.4. Describe the beneficiaries of the various project activities (number, geographic distribution, duration of project assistance)

2.5 Describe and assess the participation and responsibility of women in the project.

2.6 Assess to the extent possible the impact of project activities

2.7 Assess the sustainability of project activities, organisations and input supply following the phasing out of external assistance: for instance, the viability of farmers organisations and their management of pesticide stores; and, the Plant Protection Agency's capacity to follow-up activities initiated by the project

2.8 Describe possible strategies for reducing environmental risks.

2.9 Discuss the potential for developing improved plant protection practices.

List of people met and itinerary

| | |
|--------------------|---|
| Sunday 9. February | Arrival Bamako |
| Monday 10. | Meeting with Resident Representative of Strømme Foundation, Mr. Pablo Sbertoli Lunch with Researcher at Institut Economie Rurale (IER) Mr. Doumbia Researcher at |
| Tuesday 11. | Mr. Abrahamane Diallo SSE-Research Co-ordinator Meeting with Societé Nationale de Protection Végeteaux Director and Chef de Surveillance et de Action Mr. Moussa Cissoko Chef de Division de LutteAntiacridienne Mr. Tamade Diallo Meeting with GTZ, Mrs. Sabine Diallo Meeting and reading at FS headoffice. |
| Wednesday 12. | Fly to Yelimane Meeting with the Commandant de Cercle in Yelimane, Mr. Sien Doumbia And all members of the Comité de Développement Visit in Niogomera and the Womens Brigade in Niogomera |
| Thursday 13. | Visit the village of Kodje and Dogobara Field trip with the Womens Brigade of Niogomera Meeting in Niogomera with : Mr. Sien Doumbia, Commandant de cercle Mr. Bouraima Koné Chef de Service, SNPV, Yelimané Mr. Dosson Traore, Ing. Agro, Chef secteur agriculture Mr. Sadio Niakite, Repr. Chambre d'Agriculture, Yelimané Mr. Kassoum Sidibe, Vétérinaire et Ingenieur d'élevage, Chef de sécteur élevage, Yelimané Mr. Amioko Diallo, Ingenieur de Eaux et Foret, Chef service REFH Mr. Dadio Konare, Ingenieur Agronome, ADR, Mr. Modibo Konte, Ingenieur Agronome, ADR, Mrs. Bintou Mangara, Animatrice, ADR Mr. Brahima Kanoute, Tech.SupGenie Rural, ADR, Mr. Pablo Sbertoli, Repr. Régional, FS Mr. Boubacar Dicko, Coordinateur, FS Mr. Mamadou Kamara Assistant, FS Mrs. Kari Fiskvatn, Entomologiste, Noragric Mrs. Sidsel Grimstad, Coordinatrice, Noragric |

Friday 14. Visit Kadigatou Nimaga
Meeting with Responsible for Village Pesticide Store in
Yelimane
Meeting with Mr. Bouraima Kone, SNPV
Return to Bamako with Airplane.
Meeting with Mr. Boubacar Dicko, Coordinator FS

Saturday 15. Meeting with Mr. Boubacar Dicko
Dinner with team from Bistandsnemnda
Jens Stangeland

Sunday 16. Meeting with Mr. Boubacar Dicko
Meeting with Pablo Sbertoli

Monday 17. Meeting with all SSE-NGOs in Mali
Mr. Mons Sydness. AEN
Mrs. Fatoumata Cissé, AEN
Mr. Phillip Vernon, CARE
Mr. Aly Djiga, CARE
Mr. Pablo Sbertoli, FS

Tuesday 18. Meeting with Mr. Boubacar Dicko
Meeting with SNPV, cancelled.
Departure

Annex 3

Brief Project History

This part of the report builds upon material from annual reports from SF and also communication with the Foundations representative in Yelimané, Mr. Boubacar Dicko. The facts and figures from the implementation period has been summarised in the tables 1 and 2.

The pest problem

The Yelimané Grasshopper Control Project was initiated as a result of an upsurge of grasshopper attacks as of from 1986 after the droughts in beginning of the eighties. The grasshopper pest threatened to destroy the harvests when there finally was a climatic favourable environment for cultivating again. The Malian call for international assistance received response from many international and bilateral donors. The Strømme Foundation (SF) was given substantial funds through the SSE-Programme from the Norwegian Ministry of Foreign Affairs (MFA) to participate in the joint effort to reduce the damaging attacks. The campaigns were organised and implemented through the central and local offices of the Services National de Protection Végétaux (SNPV) (National Plant Protection Agency). Right from the start there was a division between donors in geographical areas, where SF got the responsibility for funding the activities in the Yelimané area.

Throughout the ten years of active involvement in grasshopper control activities the rationale and need for SFs active involvement has changed. While in the initial phase emphasis was on combating and reducing the massive attacks by airplane spraying, a new and more environmentally sensitive approach gradually evolved, first through reducing doses and more targeted spraying from ground level, then through involving and organising the population itself to make them able to resolve minor attacks by themselves.

The last years of the project has reduced the emphasis on chemical treatments and focused on integrated and traditional methods to combat pest problems. This change has been parallel to the grasshopper pest problem was substantially reduced after 1989, most probably this is due to a combination of a change in climatic conditions being unfavourable for massive upsurge of grasshoppers and due to the actions taken within the project.

Activities undertaken

In the beginning of the 1980's there was a serious drought in the Sahel zone and in 1985 the Strømme Foundation got involved in the distribution of emergency food among starving people in the Kayes Region of Mali. Mr. Boubacar Dicko was hired as the Foundations representative in Yelimané. He was responsible for co-ordinating the

distribution of grain. Since then he has used his long experience in the combat against grasshoppers and all his other useful talents for the Strømme Foundation. The year after, in 1986, they were again involved, with local representatives of the national Plant Protection Agencies (SNPV) as their Malian counter-part, this time to combat an upsurge of grasshoppers that started the year before and seriously damaged the crop. An upsurge of grasshoppers after a drought period is unfortunately not unusual but nevertheless it may be dramatic for the people concerned. Nationally the crop loss due to grasshoppers may not be larger than due to other pest organisms. But on a local scale the damage may be devastating. A largescale spraying operation was needed to prevent damage in 1986 but was delayed because of SNPV lacking pesticides and finances. A donors meeting was held and financing from several bilaterals, UN-organisations and NGOs contributed to fund a major operation (the Norwegian Government through the SF). However, the distribution of pesticides, aviation fuel, petrol and other necessities were hindered by late arrival of promised financial aid and later also by poor roads. The spraying was mainly done by aircraft and trucks. A total area of 510,000 ha was treated in Mali and Mauritania and of this the Strømme Foundation was responsible for the treatment of 200,000 ha in the Kayes - Yelimané zone. Large-scale treatments with helicopters were also the main method used in 1987-89.

Aircraft spraying is known for indiscriminate spraying. The swaths are less accurate and while some areas not treated at all, other areas may be hit twice.

During this period there was a growing concern in the Norwegian Ministry of Development about the possible environmental impact of these large-scale treatments. The University in Oslo was engaged to study side effects of the spraying in the Kayes Region. This was followed up with infield testing of the possibility of using reduced dosages. Ottesen and Sømme (1987) concluded in -87 that dosages most likely could be reduced and still give a satisfying mortality rate of grasshoppers. Their preliminary studies also showed that some arthropod groups were more susceptible to pesticides than others. They recommended further and more thorough studies to find the effect of reduced dosages on both grasshoppers and non-target arthropods. This was followed up in 1988 and -89.

The most common pesticide through the campaign was Fenitrothion (an organophosphate) with a recommended dosage of 200-350 gram active ingredient per hectare (g a.i./ha). It was found a sufficient mortality of grasshoppers with a dosage of 150 g a.i./ha. The dosage has later been further reduced, for lower instars (larva stages) of the target grasshoppers and in scarcely vegetated areas. Pesticides are expensive - reducing dosages to the half by adding a vegetable oil (Codacide) and water, made the spraying fluid cheaper. Impact on some non-target arthropod groups were lower with reduced dosages. (Ottesen et.al, 1987) Large areas were treated with an average dosage of 150 g a.i./ha in 1987 and the Strømme Foundations campaign was the most cost-efficient of the spraying operations in Mali.

One of the visiting team members were present in Niogomera in 1989 as a student from the University in Oslo. We were then quite shocked to see how carelessly the pesticides

were treated both during handling and storing. Pesticide left-overs were dumped in a small pond in the courtyard and safety precautions during the pesticide mixing were limited to the use of rubber gloves. Pesticide barrels, empty or full, lay around in the courtyard. It was therefore uplifting to be back in Niogomera in 1997 and see the changes.

Local participation

The large-scale treatments with foreign personnel, workers from SNPV central and the military pacified the local population. The first brigades of younger men were therefore established in 1987 in 40 villages to execute ground operations. Some brigades were equipped with knapsack-sprayers and were trained in how to use the sprayer. Pesticides were premixed to the right dosage. Other brigades were taught how to undertake grasshopper surveillance, investigating eggpod sites.

Traditionally farmers preferred to see an instant kill, and to make sure of that, overdosing was more the rule than the exception. FAO initiated in 1989 a study in Senegal to find the ecological impact of the recommended and the double dosage of the most commonly used pesticides. The reason for choosing these dosages was the fact that overdosing was a common practice - making sure a proper kill (Everts, J. W., ed., 1990). There was also ignorance among the foreign spraying personnel, spraying "their" village to have a bugfree night. A pilot was also spraying a river for a whole day, following orders (Pers. obs. Fiskvatn)

In the first years of the large scale operations, people reported to Mr. Dicko that bees had disappeared and honey production reduced. Snakes were also seen more rarely, making most people happy. But all in all, the local population was concerned.

The large-scale operations in Mali came to an end in 1989 since the predicted Desert Locust outbreak failed. The Strømme Foundation was still involved in the area, but the project took a new direction. The population had to learn how to cope with the problems themselves. Questions that were asked: What did farmers do before the anti-grasshopper campaigns. Did "traditional" methods make sense in a pest control aspect? Could improvements be made? Grasshoppers are not the only problem - farmers must be able to deal with whatever pest that strikes them.

A turbulent period in Mali followed. Riots started in June 1990 and was followed by a coup d'état in march 1991 where president Traoré was overthrown. Although there was civil unrest in other parts of the country, in Yelimané - Kayes the situation was relatively calm and a democratisation and decentralisation process was moving. Nevertheless it seems to have had an influence on the project and two years (1990-91) followed with relatively moderate activity. Although the establishment of brigades accelerated. Women were regarded particularly important since they are doing a major job in the fields and the female labour force are also considered more stable. It was also an absolute necessity

in some villages due to lack of male labour (they were abroad earning income). The project therefore changed its focus towards training and making farmers self-reliant on methods and equipment (knapsack-sprayers).

The process towards a more environmentally sound approach continued with a stronger emphasis on integrated pest management methods, dealing not only with grasshoppers but also with other pests that damaged the crops. The methods promoted were often based on traditional knowledge and demanded a minimum of pesticides and were thus very cost-efficient. The project has during the last years trained all brigades in all villages in these methods, offering farmer-to-farmer training and refresher-courses for the villages that received training first.

In the season 1994-95 there was an attack of Locust reported by the SNPV. Several teams were sent out for registration of attacks and to organise targeted ground-based spraying, using village and SNPV brigades. However, due to the SNPV lack of resources, storehouses lacking sufficient pesticides and the equipment (knapsack-sprayers) lacked spare parts, an additional application for extra funds (NOK 500.000) was made and approved by NORAD. This proves that whenever an emergency situation occurs the system for using the brigades and the pesticides and equipment available is not intact.

| Year | Treated area (ha) | Spraying method | Chemical/ dosage | Comments |
|------|-------------------|--|---|---|
| 1986 | 200,000 | Airplanes/cars | Fenitrothion 250 g a.i./ha | |
| 1987 | 150,000 | Airplanes/Cars/ Knapsacksprayers | Fenitrothion 175-200 g a.i./ha Unden (2%) | Reduced dosages UOs first involvement |
| 1988 | 200,000 | Helicopters/ Cars/ Knapsacksprayers | Fenitrothion app. 120 g a.i./ha Malathion | Reduced dosages/ Environmental studies, UO |
| 1989 | 200,000 | Helicopter/Cars/ Knapsacksprayers | Fenitrothion Lambdacyhalothrin Sumithion | Reduced dosages/ Environmental studies, UO |
| 1990 | 60,000 | Knapsacksprayers | Fenitrothion Sumithion | |
| 1991 | 30,000 | Knapsacksprayers | Fenitrothion Sumithion | |
| 1992 | 20,000 | Knapsacksprayers | Fenitrothion Sumithion | |
| 1993 | 19,000 | Knapsacksprayers | Fenitrothion Sumithion | |
| 1994 | | Knapsacksprayers | Sumithion | |
| 1995 | | Knapsacksprayers | Sumithion | |
| 1996 | | Knapsacksprayers | Sumithion | |

Table 1

| Year | Budget (NOK) | SF employees | SNPV employees | Farmers training | Brigades | Pesticides#) sold/given | Comments |
|------|------------------------|---|-----------------------|-------------------------|---|------------------------------------|---|
| 1986 | 8,975,000 + 500,000 | 15 | 15 | | | | |
| 1987 | 8,000,000 | | | | First brigades established in 40 villages | | Incentives: Food |
| 1988 | 12,500,000 | 28(?) | 13 | | | | |
| 1989 | 12,000,000 | 26 (4 teams and 7 employees in Bamako) | 10 (3 field-teams) | | | | |
| 1990 | 1,713,000 | 4 fieldteams, 50% from each institution | | | Brigades established in 120 villages | | |
| 1991 | 1,100,000 | | | | | | |
| 1992 | 1,620,000 | | | 35 reviving courses | 10 new brigades | | |
| 1993 | 1,700,000 | 10(?) | | Courses in 100 villages | 108 brigades and extended families | | |
| 1994 | 1,500,000 | 10(?) | | 1240 persons * | 72 for men 18 for women | 22,260 kg distributed | *In addition 2 workshops were held in Niogomera |
| 1995 | 1,010,000 | 10(?) | | 50 courses | | 14,480 kg powder 5,000 kg fluid | |
| 1996 | 680,000 | 7(?) | | | 32 for men 14 for women | 8,200 kg powder 600 l fluid | |
| 1997 | 450,000 | 5(?) | | | | | |

#) It should be noted that the powdered pesticides have a lower concentration than fluid

Table 2