

---

Département amélioration  
des méthodes pour  
l'innovation scientifique  
Cirad-amis

---

**Seminar and demonstrations for  
technology transfer of controlled drift  
spraying for locust control in  
Qashkadarya Province - Uzbekistan**

11 avril au 19 mai 2006

Tahar Rachadi

CIRAD-AMIS N° 14/2006

juillet 2006

CIRAD-DIST  
Unité bibliothèque  
Lavalette

CIRAD



\*000081286\*

## CONTENTS

|  |    |
|--|----|
| Summary .....  | 3  |
| Introduction .....   | 4  |
| 1. Locust situation in Qashkadarya during 2006 season .....        | 5  |
| 2. Current equipment and spraying tactics in Uzbekistan .....      | 5  |
| 2.1. Tractors .....  | 5  |
| 2.2. Motorised mistblowers .....                                   | 6  |
| 2.3. Aircrafts .....   | 6  |
| 2.4. ULM .....   | 6  |
| 3. Seminar and demonstrations in Qashkadarya .....                 | 7  |
| 3.1. Participants .....  | 7  |
| 3.2. Indoor seminar .....  | 7  |
| 3.3. Practical works .....   | 7  |
| 3.4. Tutorials .....   | 8  |
| 3.5. Démonstrations .....  | 9  |
| 3.5.1. Qamashi .....   | 9  |
| 3.5.2. Guzor .....   | 10 |
| 3.5.3. Nishon region .....   | 13 |
| 4. Other operations .....  | 14 |
| 5. Discussion on tactics and equipment adopted in Uzbekistan ..... | 14 |
| 5.1. Equipment .....   | 15 |
| 5.2. Strategy .....  | 16 |
| CONCLUSION AND RECOMMENDATIONS .....                               | 17 |

## **SUMMARY**

Seminar and demonstrations were organised under the initiative of the GTZ Project "Sustainable control of locusts in Central Asia" in Qashkadarya Province of Uzbekistan, so as to transfer ULV spraying technique to the locust operator of this province. Several demonstrations were implemented in three regions of Qashkadarya, where infestations of Moroccan locust were heavy this year. The seminar and the demonstrations were successful and the participants were eager use ULV technique and Controlled Drift Spraying tactic.

## **Reference:**

Rachadi T., 2006. Seminar and demonstrations for technology transfer of controlled drift spraying for locust control in Qashkadarya Province – Uzbekistan (11 avril au 19 mai 2006). Centre de cooperation internationale en recherche agronomique pour le développement, Montpellier, France. CIRAD-AMIS n° 14/2006. 19 p.

## INTRODUCTION

Uzbekistan hosts the breeding areas of 3 major locust species: the Migratory locust (*Locusta migratoria migratoria*), the Italian locust (*Calliptamus barbarus*) and the Moroccan locust (*Docostaurus maroccanus*). The locust problems are quite complicated by the fact that Uzbekistan shares them with neighbouring countries. The economic impact of the locust pests is very important since the affected area may be as large as 400 000 ha per year. This year, in Qashkadarya Province, infestations of Moroccan locust covered more than 150 000 ha.

Spaying high volume of water based formulation is still the only technique used in Uzbekistan. This requires dilution of emulsifiable concentrate in water which is sprayed at a volume of 100, or more, litres per ha. This practice requires a heavy logistical support, only to supply large amounts of water over long distance to the spraying sites. Furthermore, considering daily working rate with water based technique with regard to the biological development of locusts, it is not possible to curb the infestations before swarming.

The control of locusts in Uzbekistan can be made more environmentally safer, more effective, and more economical and thus financially sustainable, by the use of appropriate method and pesticides effective against locusts with minimum effects non-target organisms. This means using Controlled Drift Spraying (CDS) tactic with ULV technique. The ULV technology together with CDS tactic minimizes the use of pesticides per unit area, compared with water based method. In ULV spraying, the chemical is dispersed as droplets applied at a volume about 1 litre per ha., or even less. The ULV spraying is used, with success, since the early sixties for the control of the Desert locust, and the Migratory locust in Africa and Madagascar. It is the most suitable technique to overcome large infestations, because the breeding capacities of the locusts are faster than water based spraying.

To overcome this problem, GTZ assists the Government of Uzbekistan to improve the control means capacity by transferring the ULV technology to the locust control operators of Uzbekistan. Two workshops were conducted by the consultant in 2005, one in Nukus and the other in Tashkent, in order to introduce the ULV spraying technique to technicians and administrators involved in locust control. These workshops focussed on economic, strategic and environmental advantages of the ULV application technique for the control of locust pests in Uzbekistan.

The logical consequences of these workshops were to organise on-the-spot demonstrations at operational scale against locusts so as to show the efficacy and the efficiency of the method under field conditions. This was the main objective of the training session organised this year in Qashkadarya Province on hopper infestations of the Moroccan locust.

## 1. LOCUST SITUATION IN QASHKADARYA DURING 2006 SEASON

According to Uzbek locust experts, infestations of Moroccan locusts (DMA) in Qashkadarya were particularly heavy this year. They extended over 150,000 ha. Hatching started by the end of March and the first imagos were observed, on the last treated site, on 25<sup>th</sup> April.

The infestations took two forms:

- **High density hopper bands:** they took the form of very wide dark arches in which the hopper density is extremely high (between 500 and 800 nymphs L2 and L3 per m<sup>2</sup>, and 300 to 500 for older). The high density zone is generally as wide as 1 to 5 metres, while it may extend over 100 metres, sometimes more, marching and shaving the vegetation ahead. The hopper density decrease rapidly rearwards, but remains relatively high along a few dozen metres. The high density hopper bands can be seen from a distance because they are dark and also because there is little vegetation left behind. This kind of infestation was frequent in Qamashi region.
- **Wide spread infestations:** in certain areas (Guzar and Nishon regions), infestations extended over thousands of ha. Infestations were scattered and relatively dense (10 to 100 per m<sup>2</sup>, with many patches of very high density (over 200/m<sup>2</sup>). The high density patches can be seen from a distance, since they are dark in the green or drying vegetation. In drying vegetation areas hoppers clutched on grass straws showing the area bristling with dark sticks within dry vegetation.

## 2. CURRENT EQUIPMENT AND SPRAYING TACTICS IN UZBEKISTAN

Locusts in Uzbekistan are mainly controlled with mistblowers, tractor mounted sprayers and by aircraft.

### 2.1. Tractors

**One hundred and thirty units (130).** They are fitted with an oscillating sprayer, fixed on the hydraulic lifting system, and a two hundred litres tank. No calibration is done and not even possible. The daily working rate of a tractor, according to Uzbek locust experts, amounts to 28 ha resp. 3723 ha, if all of the tractors are in use. This would require more than 372,000 litres of water per day.



## 2.2. Motorised mistblowers

**Two hundred units (200).** They are local made but the model used in locust control is rather weak. Mistblowers can only treat about 4 to 5 ha per day. Like tractors, no calibration is done. The operator walks forward and directs the spray downward while oscillating the nozzle. The spray pass is about 2 metres and the working rate about 4 ha per day.

## 2.3. Aircrafts

4 aircrafts Antonov AN2 were operating in Qaskadarya. Antonov AN2 is an excellent aircraft for locust control, owing to its specifications well suitable for locust control i.e. easy to handle, takeoff and landing on very short distance, long range, good cruising speed and a good useful load. But even for water formulations, the present spraying system is completely obsolete. Insecticides are sprayed at a volume of 100 l/ha with a spray width of appr. 12 m. This results in a daily working rate of about 70 – 80 ha.

It should be noted that aerial spraying operators ignore the influence of atmospheric conditions on droplet dynamics. Thus it was frequent to observe treatment on progress at mid day under a temperature above 30°C. (under shadow). **Spaying under these conditions is useless (and thus costly), since droplets evaporate and seldom impact locust target.**

## 2.4. ULM

**One ULM** was positioned in Nishon region. It was equipped with spinning spray heads rotated by means of fan blades. This might have performed correct spraying. However, a brief investigation revealed that sprays were carried out with water mixtures at 1 l/ha, according to the following parameters: flying speed 90 km/h, track spacing 40 m and an overall flow rate of 5 l/min. These parameters actually correspond to a track spacing of 33 m. Anyway, it was impossible to know how the calibrations were done. Considering the topography of the zone, the flying height should never be below 10 metres, or else risks are important.

The ULM operator pretends to spray ULV with water mixture, which is impossible, given the physics of droplets. Considering the fact that the invoices are made on the basis of number of ha, it is quite obvious that payment is made against a worthless service.

### **3. SEMINAR AND DEMONSTRATIONS IN QAQHKADARYA**

#### **3.1. Participants**

##### **VIP participants of the first demonstration**

M. Rashid Mohammadiev : Hakim of Qamashi region  
M. Shomurad Dunaev : Hakim of Guzor region  
M. O. Isakov : Chief of Plant protection and Agrochemicals Republic Centre  
M. Abdulvahid Ibragimov : Director of Plant protection and Agrochemicals republic Centre.  
M. Nemat Otopov : Chief of phytosanitaria  
M. Nurilla Abdullaev : Chief of plant protection group of Qamashi region  
5 specialists of plant protection of Quaskardarya region.

##### **Participants of the training**

M. Nemat Otopov : chief of Phytosanitaria  
M. Saidakbar Isakov : agronomist  
M. Oltinbekov Bahtiyor : Engineer  
M. Iskandar Radjapov : Driver  
M. Ikram Ibbarov : Phytosanitaria Desinfection Group  
M. Murat Toshepov : Phytosanitaria Desinfection Group  
M. Nuriddin Abdullayev : Phytosanitaria Desinfection Group  
M. Yoldash Egaberdiev : Phytosanitaria Desinfection Group  
M. Muradulla Abdullaev : Phytosanitaria Desinfection Group  
M. Suyun Jabbaraev : Phytosanitaria Desinfection Group

#### **3.2. Indoor seminar**

The theoretical part of the seminar was shortened to the minimum necessary for acquiring basic notion of ULV spraying. On the other hand, tutorials on the calculations of basic parameters were detailed because the participants were not familiar with such calculations and they had a tendency to confuse the measurement units of volumes, weight and percentages.

#### **3.3. Practical works**

Practical works were performed at the vicinity of Plant Protection of Qarshi. The participants realised the basic calibrations i.e. flow rate, walking speed and track spacing measures. Four sprayers were calibrated: handheld ULV sprayer, MICRONAIR 1115, ULVA Mast and a mistblower with a MICRONEX spray head.

Each participant also calibrated his walking speed so as to work at 3.6 km/h.

### 3.4. Tutorials

Tutorials developed in two phases. The first consisted in inviting the participants to calculate the basic parameters i.e., doses, volumes of application, flow rates, working speeds and track spacings. The objective was to get the participant accustomed with those calculations with which they are totally unacquainted. They frequently confuse the measure units and reference of each type of platform (a man, a vehicle or aircraft). The second phase consists of processing the data collected during the calibration of sprayers. Participants realised abacus showing different volumes of application, versus different working speeds and track spacings (Tables 3-5).

**Table 1.** Local made mistblower with MICRONEX: volume of application of Adonis 3.75 UL in litre per ha, of different orifice plates according to different track spacings for a working speed of 3.6 km/h. It should be noted that these figures are rather incoherent because the mistblower do not have a steady flow rate. Therefore these figures are only given here examples of calculations.

| Nozzles    |                    | Track spacing |       |       |       |       |       |       |
|------------|--------------------|---------------|-------|-------|-------|-------|-------|-------|
| Orifice n° | output (liter/min) | 50 m          | 75 m  | 100 m | 125 m | 150 m | 175 m | 200 m |
| 80         | 0.420              | 1.400         | 0.900 | 0.700 | 0.560 | 0.460 | 0.400 | 0.350 |
| 68         | 0.400              | 1.330         | 0.890 | 0.660 | 0.530 | 0.440 | 0.380 | 0.330 |
| 59         | 0.300              | 1.00          | 0.660 | 0.500 | 0.400 | 0.330 | 0.280 | 0.250 |
| 49         | 0.250              | 0.830         | 0.500 | 0.400 | 0.330 | 0.270 | 0.230 | 0.200 |
| 39         | 0.200              | 0.660         | 0.440 | 0.330 | 0.260 | 0.220 | 0.190 | 0.160 |

**Table 2.** Vehicle mounted AU8115 sprayer: volume of application of Adonis 3.75 UL in litre per ha, of different orifice plates according to different track spacings for a working speed 10 km/h.

| Nozzles    |                    | Track spacing |       |       |       |       |       |       |
|------------|--------------------|---------------|-------|-------|-------|-------|-------|-------|
| Orifice n° | output (litre/min) | 50 m          | 75 m  | 100 m | 125 m | 150 m | 175 m | 200 m |
| 80         | 0.730              | 0.870         | 0.580 | 0.440 | 0.350 | 0.290 | 0.250 | 0.200 |
| 68         | 0.600              | 0.750         | 0.480 | 0.360 | 0.290 | 0.240 | 0.200 | 0.180 |
| 59         | 0.440              | 0.590         | 0.350 | 0.260 | 0.210 | 0.170 | 0.150 | 0.130 |



**Table 3.** Local made mistblower with MICRONEX: volume of application of FASTAC 15 UL in litre per ha, of different orifice plates according to different track spacings for a working speed Of 3.5 km/h.

| Nozzles    |                    | Track spacing |      |      |      |      |      |       |
|------------|--------------------|---------------|------|------|------|------|------|-------|
| Orifice n° | output (litre/min) | 30 m          | 35 m | 40 m | 45 m | 50 m | 75 m | 100 m |
| 80         | 0.560              | 03.10         | 2.60 | 2.33 | 2.20 | 1.80 | 1.20 | 0.90  |
| 59         | 0.300              | 1.67          | 1.43 | 1.25 | 1.11 | 1.00 | 0.67 | 0.50  |

Other tutorials occurred on the field after other calibrations of the vehicle mounted MICRONAIR AU8115 and ULVAMAST.

### 3.5. Démonstrations

Demonstrations were implemented in 3 regions of Qaskadarya:

#### 3.5.1. Qamashi

**First demonstration** was performed in the presence some Officials and the participants. The infestations in the choosen spot was composed of patches of hopper bands of 3<sup>rd</sup> and 4<sup>th</sup> instars, which do not fit wide track spacing sprays (barrier). Hence, it was decided to undertake a blanket treatment with fipronil at a relative high dose (2 g/ha) so as to chow the VIP participants how far droplets may travel before impacting the vegetation, and how high the working rate with hand held ULV sprayers. Considering the high effectiveness of fipronil at **2 g/ha**, the dose was too high but the results convincingly demonstrated the advantages of the ULV Technique.

It was also the occasion to demonstrate to the trainees how to choose the spraying direction with regards to the wind direction, to organise the flagging, the working speed of a man, how to move correctly while spraying and how to manipulate correctly the hand sprayer.

Two quadrates of two ha each were sprayed with Adonis (fipronil) at the dose of about 2 g/ha. In the afternoon, i.e., about 4 hours after treatment there already was approximately 30 % kill. This so high death ratio, just a few hours after treatment, means that the dose is too much high. Therefore it was decided to spray fipronil at doses lower than 1 g/ha. There were no living locusts left in the spot 4 days after treatment. This is another evidence that the dose of 2 g/ha of fipronil is too high.

## **Second demonstration**

The area is a succession of quasi parallel ground folds and relative valleys covered with green grass.

The infestations were composed of numerous hopper bands, the density of which may attain a few thousand hoppers/m<sup>2</sup>. They were close enough to each other to constitute good target for barrier treatment of 1,000 m, with an aircraft. Since there are vehicle tracks on the hill tops quasi parallel, two spray passes that might cover an area as wide as 250 metres according to the wind speed and the hill height.

The vehicle mounted MICRONAIR AU8115 was calibrated to spray according to the following parameters: output: 0.650 l/min; working speed: 10 km/h ; the track spacing varies from 180 to 250 metres according to the topography and the track on the hill tops. 20 litres of an extemporaneous mixture composed of 1 l of Adonis 7.5 + 1 l of sunflower (hence 3.75 g of fipronil per litre) were sprayed.

Considering the distance downwind, in which dying locusts were found, it is reasonable to consider the swath width is sometimes over 250 metres. Therefore the overall dose of the covered area is less than **0.6 g a.i/ha**.

The mortality observed 3 days after treatment was estimated by the visiting team at, approximately 60 %. On the last visit of the expert team, the death rate was about 90%, meanwhile the mortality was still on progress.

### **3.5.2. Guzor**

**First demonstration:** Seven participants attended this demonstration.

The area is relatively flat and the vegetation (grass) was drying except a steppe of *Peganum harmala* in a pseudo valley. There were non continuous infestation on the surrounding hills and heavy and continuous hopper band in the valley were hopper were either marching or roosting on the green vegetation. The hoppers were all in the late fifth instar and there even were the beginning of imaginal moulting.

The infestation was rather dense over a large area, with many very dense patches. The hills that framed the valleys were less sloppy in this area which made is suitable for low dose barrier treatment.

**The spray parameters** were: product, Adonis 3.75 g/l; flow rate 0,65 l/min; working speed 10 km/h but actually varied from 8 to 11 because of the rough topography, track spacings were (according to GPS tracks, and way points), 310, 228, 233,190, 260,186,105,180 metres. Considering these parameters, the treated area is about 77.7 ha (fig ...). Hence the dose **was 0.48 g/ha**.

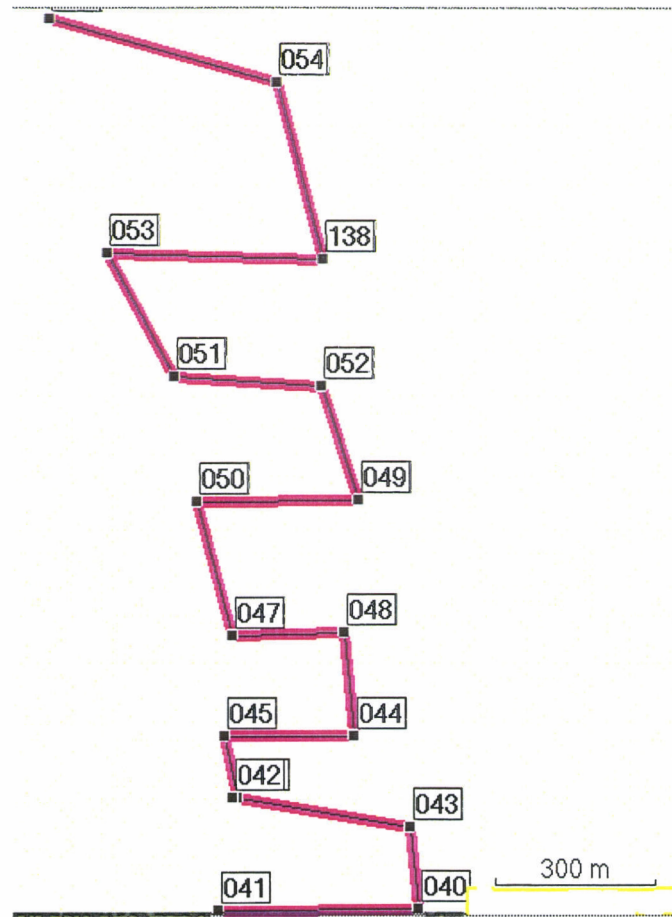


Figure 1. GPS tracks of the 1<sup>st</sup> demonstration in Guzor region

### Second demonstration

The habitat composed of rather sloppy hills which however allowed the vehicle to pass diagonally. The infestation was a unique and vast hopper band, composed of 4 and 5<sup>th</sup> instars, which extended over several dozens of ha. Except on hollows and bottoms, the vegetation was beginning to dry. A few imaginal moultings were observed.

The treatment started at 14 h 30 and ended at 15 h 20 under the following atmospheric conditions: wind speed 2-5 m/s; temp 27°C; RH 25%; light clouds. The spray parameters were: flow rate 0.65 l/min; working speed 10 km/h (actually 8 to 12); targeted track spacing was 150, but actually the average was 137 metres according to GPS tracks and way points. Considering these parameters the treated area is 60 ha, and the working rate is 90 ha per hour, preparation not included. The quantity of the mixture sprayed was 20 l which contained 75 g of fipronil sprayed. Therefore the real dose was 1.25g/ha.

One day after there was mortality estimated at 50 %, and the majority of survival showed symptoms of intoxication. Mortality was reaching 100 % five days after treatment.

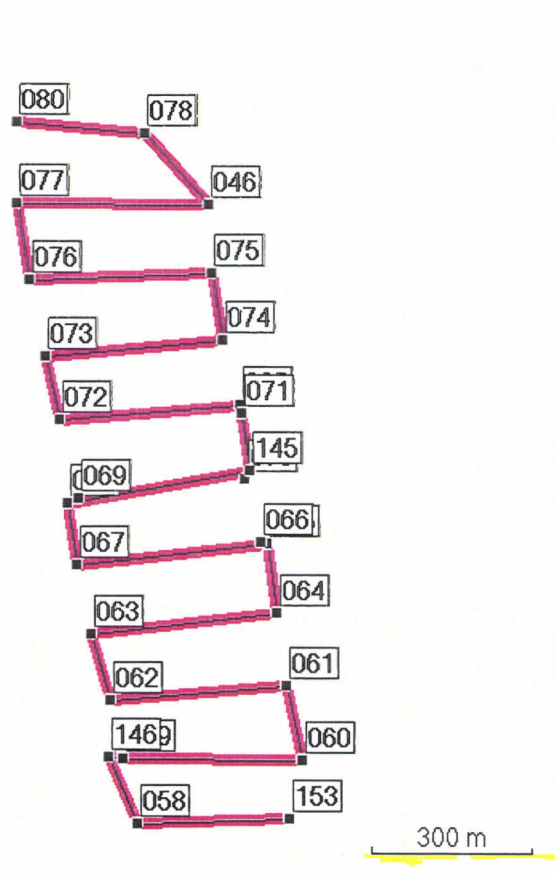


Figure 2. GPS tracks of the second demonstration in Guzor region

### Third demonstration

The site is only a few hundred metres upwards of the preceding site. The spray was performed according the same parameters. The treatment started at 16:30 and ended at 16:45 under temp 29°C, wind speed 3.5 m/s, RH 22%.

The area treated was 29.9 ha according to GPS tracks and waypoints; the average track spacing was 179 metres. The other treatment parameters were the same as above but the dose is lower: **0.83 g/ha**.

The results were similar to that of the preceding demonstration.



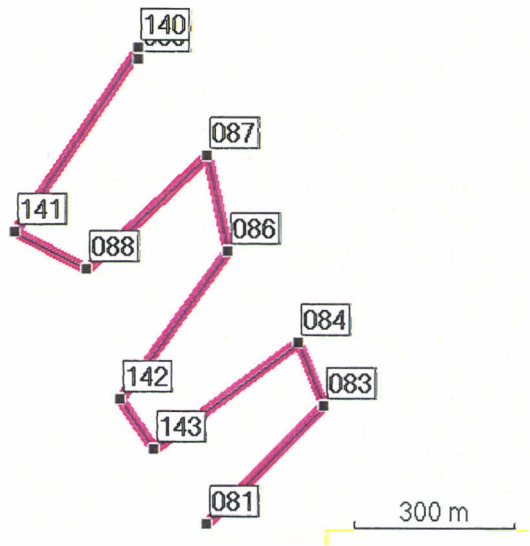


Figure 3. GPS tracks of the 3<sup>rd</sup> demonstration in Guzor region

### 3.5.3. Nishon region

The site was hilly and the hills were relatively lower than in Quamachi and Gozor. The vegetation was mainly grassy and almost completely dry. The infestation was wide spread over a very large area (we were not able to delimit it). The mean hopper density was about 50 nymphs/m<sup>2</sup>, but there were many patches of very high density (above 500 nymphs/m<sup>2</sup>). The hoppers were in the 5<sup>th</sup> instar and the beginning of imaginal moulting.

Two demonstrations were realised in this area, one with Fastac and the other with Adonis.

#### Fastac demonstration

The parameters for Fastac spray were : working speed 10 km/h, track spacing 50m, and the flow rate 0.825 l/min, which correspond to 1 l/ha, and thus to **15 g** of alpha-cypermethrin per ha. The flagging was operated by the participants. It was correctly executed but was not very accurate. About one third of the spray was performed in the morning and the rest, late in the afternoon. Approximately 200 ha were sprayed with FASTAC 15 UL.

Before starting the afternoon spray, we observed a very conspicuous knockdown effect. It looks that they left the area. This effect was spectacular since on one side of the last spray track of the morning, the infestation is obvious and on the other side nothing except a few dead fledglings. Hence it seems that alpha-cypermethrin has a very strong repellent effect.

One day after treatment many long observations transect, showed that the treated area was cleared from locusts. Scattered dead locusts were visible everywhere except some living hoppers. Thus the mortality can be estimated (roughly) between 80 to 90 %.



### **Adonis demonstration**

The parameters for Adonis demonstrations were: flow rate 0.66 l/min 3.75 g/l mixture working speed 10 km/h, track spacing 150 m. The dose was raised up to **0.9 g/ha** to satisfy to Uzbek farmers and district officers who were afraid that the slow effect might let some locust fledge and escape. The area treated was theoretically 137 ha; a lack of batteries of the GPS receiver did not allow the accurate calculation of the sprayed area.

One day after treatment the mortality ranged between 30 and 70%. The highest was downwind in the vicinity of the spraying tracks. The fipronil effect i.e., dead and dry locust corpses, freshly dead, dying and symptoms of intoxications were observed in all sprayed area.

The whole areas treated either with Fastac and Adonis were cleared from locusts and no regrouping of hoppers were observed, meanwhile in many places treated previously with traditional method of water based formulations (tractors and aircraft) we observed numerous of dead locusts, but on the same places there were still heavy infestations composed of very active hoppers and many fledglings.

## **4. OTHER OPERATIONS**

It was planned, after Qashkadrya operations, to undertake similar demonstration in Tashkent region. But it was not possible to find any infestation in a place where it was allowed to operate. It only was possible to do some calibrations and to review calculations of basic parameters with some participants of the last year training session.

## **5. DISCUSSION ON TACTICS AND EQUIPEMENT ADOPTED IN UZBEKISTAN**

The Moroccan locust is univoltine. The hatching begins by the beginning of April according to the average temperature. There are 5 instars hoppers and the hopper development takes 40 to 55 days. It seems that this year it only took 40 days. Egg laying was observed only two weeks after the beginning of fledging.

The insect has a strong gregarious aptitude. The importance of infestations this year, results in the formation of huge swarms as reported by the end of May. Normally swarms do not fly very far compared to the Migratory locust. But the breeding areas are always not far from crop fields. The Moroccan locust is multivorous. It attacks wheat, barley, corn, forage crops, cotton, grape etc., including leaves, stalks and grains. Trees might be completely defoliated.

The Moroccan locust situation in Qashkadarya province was serious this year. The hopper bands were wide spread and very dense since hundreds of km<sup>2</sup> were infested. It clearly appeared that huge swarms were to be expected. This is not surprising since all the rangelands, especially on the mountain feet, constitute of favourable habitats i.e. several thousand hectares. The only limiting factors are

unfavourable ecological conditions. The development is favoured by spring rainfall with abundant ephemeral vegetation. It was conspicuous to see how the drying of the grass coincides with emergence of flying adults.

It was therefore obvious that with the tactics and equipment adopted in Qashkadarya, the locust situation would never be controlled because of the heavy logistics it requires and a very low working rate. Since the breeding areas are not far from crop fields, the damages could be very serious when the infestations are heavy like this year.

## 5.1. Equipment

Except, perhaps, with aircraft no calibration had ever been done. It should be noted that with this kind of ground equipment, it is really quite impossible to undertake any reliable calibration. Spray operators contented themselves by spraying areas where they see heavy infestations, and neglect where locust densities look less high, although dangerous because the remaining hoppers soon regroup to maintain their gregariousness. They swarm later in the season and transmit their gregariousness to next generation, the following season. We thus observed many treated sites, either by ground equipment or by aircraft, where there were numerous dead insects but still dense hopper bands or wide spread infestations.

Under these conditions of low working rate and very low efficiency of treatment, it is impossible to curb infestations, like we observed the present year, without the help of natural conditions such as a strong drought of the vegetation at the early stages of hoppers.

On the basis of information provided by Uzbek partners, a comparison between the working rate of equipments presently used and what it is possible with ULV equipments, is shown by the following table:

Table 4: Comparison between the working rate of equipment presently used and the ULV sprayers

| Current equipments |        |                           |          | ULV equipments |              |           |
|--------------------|--------|---------------------------|----------|----------------|--------------|-----------|
| Equipment          | Number | Working Rate/day per unit | Total    | Equipment      | Working rate |           |
|                    |        |                           |          |                | Blanket      | Barrier   |
| AN2                | 4      | 120                       | 480      | AN2            | 5 000        | 25 000    |
| ULM                | 1      | (700?)                    | 700 ??   | ULM            | 2 700        | 6 000     |
| Tractor            | 130    | 28.6                      | 3718     | V. M.S         | 150          | 600       |
| Mistblower         | 201    | 4.0                       | 804      | Mistblower     | 15           | 75        |
|                    |        |                           |          | Handheld       | 10           | 50        |
| <b>Total</b>       |        |                           | ha 5 702 |                | 7 875        | ha 31 725 |

For the ULV equipments, the following parameters were taken:

- 4 Aircrafts : working speed ,180 km/h; track spacing, 100 and 500 metres
- 5 ULM: working speed, 90; track spacing, 100 and 500 metres
- 6 Vehicles mounted sprayer: WS, 10 km/h; track spacing, 50 and 200 m
- 7 Mistblowers: working speed, 3.6 km/h; track spacing, 20 and 75 m
- 8 Handheld ULV: working speed, 3.6 km/h; track spacing, 10 and 50 m.

Even if the equipments presently in use are fully efficient, it is interesting to notice that only one ULV equipment of each kind, would have a daily working rate higher than 30,000 ha. The difference between the working rate of the method so far used in Uzbekistan and the ULV is so conspicuous that some peoples don't believe it is possible.

Infestations observed this year in Qashkardarya showed that the potential threat of Moroccan locust is very important. Uzbek partners were particularly aware of the fact since the participant of the training session was often urgently called to leave interrupt their participation because of some urgent intervention somewhere.

## **5.2. Strategy**

The anti-locust strategy in Uzbekistan is based on the use of water based mixtures which requires a minimum of 100 l/ha, with a consequence a heavy logistic and a very low working efficiency. Consequently treatment progress is much lower of hopper development. That inevitably leads to the formation of swarms which leave dry grass and invade crops that are just a few km afar.

As a consequence of the strategy, the spray equipments used in Uzbekistan are designed to spray water based mixtures. But even for applying correctly water emulsions these equipments are not suitable.

Except the ULM, none of the equipment used meets the requirement of locust control. The technique is obsolete and do not allow any sort of calibration. Actually no calibration is done. Operators only spray until tanks are empty. Treated areas are estimated by dividing the total amount of sprayed liquid, by the volume of application. In these conditions the working rate is derisory with regards to the dispersal and the large stretch of infestations.

Table 5. Comparison costs of treatment by water mixtures and ULV according to 2006 situation in Qashkadarya

| Type of equipment | Treated area (ha) | Cost per ha (kg cym) | Total cost (kg cym) | Equivalent (in kg euros) |
|-------------------|-------------------|----------------------|---------------------|--------------------------|
| Anonov AN2        | 3 600             | 8 700                | 31 320              | 20.88                    |
| ULM               | 16 800            | 5 600                | 94 080              | 67.72                    |
| Tractors          | 61 354            | 3 017                | 185 105             | 123.40                   |
| Mistblowers       | 19 390            | 2 667                | 51 713              | 34.47                    |
| <b>Total</b>      |                   |                      | 362 218             | 246.47                   |

## CONCLUSION AND RECOMMENDATIONS

Infestations of the Moroccan locust were very heavy this year in Qashkadarya Province. Hopper bands were very dense and covered about 150,000 hectares. This situation was very worrying since all the breeding areas were at the reach of flying swarms, and the emergence of flying adults coincide with the drying of the vegetation in the breeding areas. Due to the intensity of infestations this year, there is a very high risk of similar or even heavier invasion next season. It only depends on ecological conditions.

The training session organised in Quarshi and the demonstrations performed in Qamashi, Guzor and Nishon regions met their objective since the participants are now conversant with the principles and the use of ULV technique and Controlled Drift Spraying. At the end of the training sessions and demonstrations, they enthusiastically continued under way and treated 16,000 hectares in two weeks, only with two vehicle mounted sprayers.

In the extent of 2006 infestations, it will be wise to expect serious outbreak of the Moroccan locust next season. The intensity of infestations will only depend on the ecological conditions.

The demonstrations of this year showed that all the products used are effective, but the doses should be refined. Fipronil was very effective all the doses tested: 2, 1.25, 0.90, 0.83, 0.60 and 0.48 g a.i. per ha. Alpha-cypermethrin (FASTAC) was tested at only 15 g and was effective. It was not possible to make any demonstration with IGR's and, considering the good results of these products against other locusts, it is recommended to include them in the future testing program.



## Recommendations for future program:

1. Training sessions held revealed that locust control operators to be trained are chosen without any criteria. Thus trainees did not have homogenous background nor the same basic education. Locust control in Uzbekistan is going a permanent task. For the coming raining sessions, trainees should be selected in this prospect. **They should be relatively young, with a good education level so as to understand the necessary calculation principles.**
2. The future training program should not aim to train all the locust control peoples. It will be much better if it aims to train **a core of trainers**. In this case it is more opportune to select one very motivated agent from each Province and organise a thorough training with simulations and demonstrations. For such training, the number of participants must not exceed twelve. The program of such training should be defined precisely.
3. Beside the lack of training, which is now in progress, the Locust Management System in Uzbekistan suffers also from the lack of co-ordination between the neighbouring countries. It is therefore very important to negotiate with neighbouring countries a co-operation agreement, allowing the neighbouring teams of every two countries to undertake early detection of hatching and control of hopper bands.

It should be noted that each country suffers the whole problem has only a part of the solution. Therefore it is not possible to control correctly in-coming swarms without a real collaboration between the concerned countries. **Anyway the best method to combat swarms is to combat hopper bands.**

4. Given the preceding considerations, GTZ might contribute :
  - On the basis of the 1<sup>st</sup> and 2<sup>nd</sup> recommendations GTZ action would consist, for the two coming seasons, to train a core locust control team,
  - To encourage the Governments of Uzbekistan, Kazakhstan and Turkmenistan, when it is politically possible, to build up a co-operation agreement.
  - To prepare and execute an integrated control operation at the level of Qashkadarya Province:

It will consist of taking in charge the whole control operations in Qashkadarya Province, using exclusively Controlled Drift Spraying tactics. This operation will require mainly (the details will be determined later) :

- An aircraft or ULM equipped with ULV spraying system : It should be noted that air spraying needs a good ground support which can only be provided by a specialised an air spraying company.
- Four vehicle mounted sprayers, or 10 if no aircraft is used.



- 10 handheld ULV sprayers.
- This operation might be more efficient if one or two aircrafts are used.
- Ground support for aerial operations.

➤ d. Experimentations of the most suitable products

The demonstrations also showed that there is a strong need to determine right doses for each of the products that can be used i.e. fipronil, teflubenzuron and pyrethroids (deltamethrin and alpha-cypermethrin). Therefore it is recommended to undertake scientific experimentations using different doses and track spacings, so as to determine the lowest and most effective dose of each compound. The participation of the manufacturer will be required.

5. Chemical companies should be encouraged to develop their products especially IGRs since the market Central Asia (Kazakhstan, Uzbekistan, Turkmenistan, Kirghizia etc..) might be estimated up to more than 4 million ha for the least. The consultant has already contacted two companies for their possible participation.