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Département amélioration  
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l'innovation scientifique  
Cirad-amis

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**Workshops on basics and practical  
training for the application of LV-  
and ULV-Insecticide with different  
sprayers: Nukus and Tashkent  
(Uzbekistan)**

**(11 – 27 June 2005)**

**Tahar RACHADI**

**CIRAD-AMIS  
Acridologie**

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Septembre 2005**



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## SUMMARY

On the initiative of GTZ, two workshops and field demonstrations took place in Nukus and Tashkent (Uzbekistan) in order to introduce the ULV spraying technique to technicians and administrators involved in locust control. The two workshops emphasise economic, strategic and environmental advantages of the ULV application technique for the control of locust pests in Uzbekistan. Ten participants attended Nukus workshop and sixteen Tashkent Workshop, including four participants from Kazakhstan. The workshop evaluations showed that the participant understood the interest of adopting the ULV spraying technique but they still need more training courses to fully understand and master Controlled Drift Spraying technology.

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**Key words:** Uzbekistan, Central Asia, locust control, workshop, GTZ.

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## 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 (*Dociastorus maroccanus*). The locust problem in Uzbekistan is rather complicated by the fact that the country shares the problem with the neighbouring countries, i.e. Kazakhstan, Tajikistan, Turkmenistan and Afghanistan. Because of the recession of the Aral Sea, the habitat of the Italian locust increased, drawing a major pest to cotton fields in Karakalpakstan in addition to that of the Migratory locust, which affect grain crops such as rice and corn. The economic impact of the locust pests is therefore important since the affected area may be as large as 400 000 ha.

Under the Soviet Union the locust control was centralised. It was based on mechanical control and water based spraying, ground and aerial over large areas. This traditional high volume application is still the only technique used in Uzbekistan. It requires dilution of the active ingredient in water, which is then sprayed at volume of 100 litres per ha or more. This practice requires transporting of large amount of scarce water over long distance of the spraying sites. Moreover much of the liquid applied runs off the plant onto the soil. Thus it has a little or no impact on the pest, but contaminate the soil and the water.

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 and methods effective against locusts but with minimum effects non-target organisms. This means using more suitable pesticides such as IGR's and effective pyrethroids together with ULV spraying. The ULV technology 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. This ULV spraying is used, with success, since the early sixties for the control of the Desert locust. It is the most suitable technique to overcome large infestations, because the breeding capacities of the locusts are faster than the efficiency of 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. The purpose of two workshops is to introduce the ULV technique to the technicians and administrators of Uzbekistan.

## 1. OBJECTIVE OF THE TWO WORKSHOPS

The purpose is to bring the participants to be conversant with the principles of ULV application technique and Controlled Drift Spraying in locust and grasshopper control. It was also essential that the participant participate in finding out the droplet dynamics so as to comprehend its implication in the choice of application modes, the most suitable equipments for different locust targets, and how to adopt the most suitable approach to different situations.

## 2. EXECUTION OF THE WORKSHOPS IN NUKUS AND TASHKENT

The program was implemented including an active participation and the participants. The basic notions, tutorials and practical works were imbricate the participants were able to clearly visualize the spraying parameters. The program was composed of three parts: theoretical notions, calibrations and demonstrations-in-the spot i.e. a reel ULV treatment on a reel target.

## **2.1. The participants**

The participants of Nukus workshop (Appendix 1) were mainly field operators from the Locust Service of Karakalpakstan. The head and the Deputy of the Locust Service also attended the workshop, while those who attended Tashkent works were heterogeneous from employees to the heads of locust services of several Oblasts. There were also four participants from Kazakhstan, three from the MOA and one from a Farmers Association of Kazakhstan. All the participants belong to the Locust Service, which means that Uzbekistan keeps a specific Locust Management System. This is an advantage because the participants are fully involved in the control of locusts, and as such, they are strongly motivated to improve the efficiency of their work.

## **2.2. Basic notions of Controlled Drift Spraying dealt with**

1. Target determination
  - 1.1. Biological target: harmfulness, mobility, vulnerability, size
  - 1.2. Target zone: topography, size, and plant cover
2. Emission and deposit of active ingredient
  - 2.1. Dose
  - 2.2. Volume of application
  - 2.3. Droplet spectrum
  - 2.4. Coverage and deposit of active ingredient
3. Spraying modes
  - 3.1. Hydraulic energy nozzle
  - 3.2. Gaseous energy nozzle
  - 3.3. Centrifugal energy nozzle
4. Droplet transportation modes
  - 4.1. Liquid ejection
  - 4.2. Air stream
  - 4.3. Lateral wind (Controlled Drift Spraying)
5. Calibrations
  - 5.1. Necessity of calibrations
  - 5.2. Basic parameters
  - 5.3. Quantitative calibrations
  - 5.4. Qualitative calibrations
6. Types of sprayers
  - 6.1. Hydraulic sprayers
  - 6.2. Air blast sprayers
  - 6.3. Centrifugal sprayers
  - 6.4. Aerial sprayers
7. Locust spraying procedures
  - 7.1. Basic procedure
  - 7.2. Blanket coverage
  - 7.3. Irregular coverage
  - 7.4. Barrier coverage
8. Checking the quality of sprays
  - 8.1. Required tools
  - 8.2. Droplet collecting
  - 8.3. Field assessment



The course was dispensed in a room of the GTZ office in Nukus, where the whole necessary pedagogic materials were provided, including a slide projector, hand calculators, paper board etc...It should be noted that the participants did not have any single notion on spraying principles especially on ULV technique. They were indeed familiar with water based spraying but they never perform any calibration and therefore calculation of parameters such as the dose and the volume of application are completely stranger to them. Actually they only fill sprayer tanks with a given proportion of an EC formulation and go spraying until the tank is empty. Therefore the real dose is only supposed and is calculated according to the amount of the formulation used. Given this situation, it is very difficult for the participants to shift from passive knowledge to proactive thoughts and the relevant action that follows.

Because they are not familiar with accurate calculations of the spray parameters, the participant confuse the dose, the volume of application the content of active ingredients in a given formulation and the percentage of volume/volume, volume/weight and weight/volume. In spite of the effort to take all the occasion to explain these notions, the confusion is still made by most of them (Appendix) tests before and after the workshops.

There is also a factor, which should not be neglected: it is the translation factor. Beside the fact the translation is time consuming (half of the time), there is no way to check if the notions are quite correctly transmitted and understood, since the interpreters were not familiar with the spraying technique.

## 2.3. Practical works

Normally, for a thorough workshop the following calibrations are developed which require more than one week of field work. :

- Output calibration: for each nozzle of every sprayer;
- Working speed calibrations: for each type of equipment including marching speed of operators;
- Spraying procedure with demonstrations for each type of sprayer, including the measurements of track spacing by operators;
- Maintenance procedure of all equipments.

The allocated to these two workshops did not allow to fulfill the whole program and therefore we only could do **output calibration of ULVA +, Micronair AU8000, and UlvaMast in Nukus**, and Micronair AU8000 and UlvaMast in Tashkent.

We deliberately choose to concentrate the practical work to demonstrate the reliability of Controlled Drift Spraying so as to show the participants how the coverage with small droplets is really effective and allows a wide track spacing, as wide as 60 metres with packssack ULV mistblower.

In both workshops, the participants executed output calibration of the Micronair AU8000, a simple backpack mistblower. In Nukus the Micron Ulva+ was also calibrated. In both workshops the output calibrations and drift demonstrations were fulfilled with sunflower oil although it is a little bit more viscous than the usual ULV products. But it was preferred to diesel because it marks well the oil sensitive papers and thus it is more suitable to illustrate the drift effect.

Output calibrations (flow rate) normally requires the following utensils:

- Measuring glasses of 250 ml for small outputs and 1000 ml for the highest.
- Chronometer or stopwatch
- Funnels
- Tissues, wiping papers, water soap, bucket.

The attention of the participant was drawn to the fact that it is always possible to fulfill the basic calibrations even if some of these instruments are missing. For example, a measuring glass can be made with a plastic bottle, a simple watch as a chronometer and a plastic bottle as funnel etc. The method is normally detailed during a more developed workshop.

In both workshops the drift spraying demonstrations were executed in an open field not far from the workshop classroom centre. Twenty sensitive papers were fixed, every 10 m on 45 cm high pickets, aligned facing the wind. Each paper was numbered so as to know its exact position along the droplet drift line. A whole half a day was devoted to this work. It was not possible to measure the walking speed of each operator but the leader showed it during the field demonstration.

The wind speed was measured by an electronic anemometer and by observing the effect of the wind on the vegetation and branches of trees. In both sites, demonstrations were made by knapsack mistblower with Micronair AU8000, a local made mistblower as it is, and equipped with a Micronair AU8000, and finally with a UlvaMast.

Each sprayer was submitted to pre-spraying checking routine. Then a single pass was executed according to a usual working speed, i.e. 3.6 km/h for an operator and 5 km/h for the vehicle with UlvaMast. A few minutes after the passes the participants were invited to observe the impacts of droplets on the collectors. Before the demonstration the participants were rather dubitative. They expressed their surprise when they observed the distance on which the papers were impacted and then their enthusiasm. After the in-the-spot observations of each series, the papers were collected for further comments in the classroom.

## 2.4. Tutorials

The purpose of the tutorials is to treat the data collected from all the calibrations and use them to draw practical abacus that could be used later by the participants or other operators for the real spraying operations.

Normally tutorials comprises three parts:

- **Determination and calculation of the basic parameters:** the fourth interdependent factors which ensure the exact volume of application and thus the correct dose: **Volume** of application (in **l/ha**), the output or **Flow rate** in **l/min**, the working **Speed** (in **Km/h**) and the **Track spacing** (in **m**). The participant invited to determine successively one of those factors when the three others are known.

It should be noted that the participants never did such calculations and therefore a few of them were able to find the right solution, especially because they do not choose the correct measurement units in both workshops.

- **Determination of droplet drift and swath width**

Droplet drift is determined by the wind speed, the emission height and droplet size. The participant were invited to make a few calculations and they were very surprised to notice how far droplets may travel before deposit. Given the swath width and the visual aspect of the droplet deposit, in both workshops, the participants concluded that the track spacing could be about 50 to 60 metres with the Micronair AU8000 and the UlvaMast.

- **Treatment of the data obtained by flow rate calibration**

The results of the flow rate calibrations were used to show the participant how it is possible to draw abacus, which can help operators to read directly the suitable parameters according to different nozzles of every sprayer. A comparison was made between the flow rates with water based spraying and ULV. It showed to the participant that, more that 80% of the hours of aircrafts paid, were for ferry flying. With a cargo of 1000 litres of water based spraying they treat 100 ha, and 1000 ha with ULV formulation.



The attention of the participant in both workshops was drained to the fact that if the flow rate factor is combined with the track spacing of 100 metres, the efficiency of ULV technique is more than 10 times higher than that of water based spraying.

### 3. IN-THE-SPOT DEMONSTRATIONS IN NUKUS

By the end of both workshops the interest of the participant grew stronger. But it was still evident that their conviction will be gained when they see the evidence through a real successful ULV treatment. To overcome this difficulty, the workshop organizers decided to improvise a ULV mixtures with one of the EC formulations available and known as effective against locusts: Adonis.

The first formula was: 1 l of diesel oil + 1 l of sunflower oil and 100 ml of Adonis 200g/l. Spraying 2 litres per ha of this formula means applying **2 g of a.i./ha. We treated about 8 ha in less than one hour** with this formula on a non-cropped field infested with population of migratory locust. The infestation, about 4 to 6/m<sup>2</sup>, was a mixture of all stage from L2 to mature adults.

The second formula was 1 l of diesel oil + 1 l of sunflower oil and 200 ml of the same formulation of Adonis. We applied about **2/ha of this formula on a little more than 8 ha in less than one hour** on a heavy population of Italian locust infesting wild vegetation near a cotton field.

In both sites the results started to show up 24 hours after treatment and the control was complete after 3 days. The participants involved in those treatments showed a very communicative enthusiasm about the success of the demonstration. They communicated the results all other participants through the Locust Service of Karakalpakstan and to the locust Head Quarter in Tashkent.

## CONCLUSIONS AND RECOMMENDATIONS

The two workshops revealed that the locust operators in Uzbekistan knew very little about ULV spraying technique. Furthermore they were not even familiar with any spraying calibrations since water based spraying is very difficult to monitor. However, after both workshops, the efficiency and the economic and strategic advantages of ULV technique are now fully understood in Nukus as well as in Tashkent. The success of the workshops and the demonstrations have aroused their high interest in the ULV technique. As such, the workshops met their objective, which was: to make the participants conversant with principles and techniques of ULV applications for locust control. However, it should be emphasised that they do not, far from it, master the ULV technique. It become now essential, and more than ever, to organise well detailed training courses. Without thorough training, locust operators may, all the same, be tempted to use the ULV method without really master it, and thus, the negative effect will be worsen.

Regarding the participant from Kazakhstan, the representative of the Farmers Association seems to be the most motivated. In all his interventions he stressed on their willing to organize more detailed workshops in Kazakhstan for the farmers.

Considering the fact that the locust control operators in Uzbekistan are now really aware of the interest they can get from ULV technique, they are eager to take the best profit from further and thorough training courses. The workshops to be organized next year should be prepared taking into account:

- The session will be mainly practical, although basic notions should be well understood
- It would be advisable if at least one aircraft is equipped with ULV spraying system in one of the regions where aircrafts are used
- The number of participants should not exceed 12 for each session so as to allow working in groups of three participants.
- One half of each session should be devoted to training in the spot i.e. put the participant in a real situation of locust treatment.
- Beside ULV technique, the maintenance of the equipments and phytopharmacy notions as well as safety measures should also be developed in each session.
- The sessions should take place in the very beginning of the control operations, that is to say beginning of April.

## APPENDIX 1: Participants of the workshops in Nukus and Tashkent Oblast

Participants - WS Tashkent Oblast, Gasalkent 21.06.05 – 24.06.05

	Name / Ф.И.О.	Institution / Должность
1.	Kambulin Vladimir Камбулин Владимир	Coordinator of the Locust project in Kazakhstan
2.	Darinow Aujeshan Даринов Аuezхан	Deputy of Kazak SFK (Farmers Association, Kazakhstan)
3.	Jusypova Gulnara Юсупова Гульнара	Expert of the Department of Registration, Ministry of Agriculture (Kazakhstan)
4.	Pchelnikowa Tatjana Пчельникова Татьяна	Head of the Administration of the Ministry of Agriculture (Kazakhstan)
5.	Berdibaew E. Бердибаев Э.	Head of locust service Bastanlik Oblast
6.	Bobobekow Kalandar Бобобеков Каландар	Deputy of Centre of Plant protection and Agrochemicals of the Rep. of Uzbekistan
7.	Ergaschew Orifjon Ергашев Орифжон	Head of locust service Syrdarja Oblast
8.	Halikulow B. Халикулов Б.	Employee locust service Kashkardarja Oblast
9.	Haytmuradow Arslanbek Хайтмуратов Арсланбек	Head of locust service Surchandarja Oblast
10.	Husakulow O. Хужакулов О.	Head of locust service Kashkardarja Oblast
11.	Isakow Odilhon Исаков Одилжон	Expert of the Centre of Plant protection and Agrochemicals of the Rep. of Uzbekistan
12.	Jarlakobow Sch. Ярлакабов Ш.	Head of locust service Nawoi Oblast
13.	Maksudow B Максудов Б.	Employee of the locust service Tashkent Oblast
14.	Oltinbekow Umar Олтинбетов Умар	Head of the locust service Tashkent Oblast
15.	Ostonow Mansur Остонов Мансур	Head of the locust service Buchara Oblast
16.	Shaunarow M. Жайнаров М.	Employee of the locust service Dschisak Oblast

**List of participants - Applikation Workshop 14 - 17 June 2005. Nukus**

	<b>Name / Given name Ф.И.О.</b>	<b>Institution Должность</b>
1.	Ablakumow Abdisattar Аблакимов Абдисаттар	Locust service «Schahaman»
2.	Beknijasow Askar Oralbaewitsch Бекниязов Аскар	Locust service «Kungrad»
3.	Kulshanow Kamal Kanatullaewitsch Кулжанов Камал	Locust service «Ali-Aul»
4.	Samahow Murat Orasbaewitsch Самахов Мурат	Locust service «Tahta-Kupir»
5.	Saparbaew Tuelbay Сапарбаев Туелбай	Locust service «Schege»
6.	Sulkhanderow Ibraim Berdibaewitsch Зульханодеров Ибраим	Locust service «Baschirschiel»
7.	Sultamuratow Baymurat Султамуратов Баймурат	Locust service «Aspantay»
8.	Turimbetow Kenshimurat Abillaewitsch Турымбетов Генжемурат	Locust service «Kasak-Daria»
9.	Dshiamuratow Koschkinbay	Head of the Locust service of Karakalpakstan, Nukus
10.	Seytimbetow Chamid	Deputy of the Locust service of Karakalpaksten, Nukus

## APPENDIX 2 : Questionnaire before and after the Workshop

### Basics and practical training for the application of LV- and ULV-Insecticides with different sprayers Nukus 14.6. – 17.6.2005

(in total 7 resp. 8 forms were filled; non answered questions were considered as wrong)

(results before in red, results after in green)

#### 1. ULV-Insecticides are formulated in which solvent ?

water	
alcohol	
oil	x

(6 wrong answers, 1 correct // present knowledge = 14.28 %)

(1 wrong answer, 7 correct // knowledge increased to 87.50 %)

#### 2. Please estimate, how many droplets/cm<sup>2</sup> are necessary to achieve an efficient control of locusts ?

2	
5	
10	
20	x
50	
100	

(7 wrong answers // present knowledge = 0.00 %)

(6 wrong answers, 2 correct // knowledge increased to 25.00 %)

#### 3. Please estimate, how many droplets at an average size of 50 µm do fall on 1 cm<sup>2</sup> ?

20	
50	
100	
150	x
300	

(6 wrong answers, 1 correct // present knowledge = 14.28 %)

(8 wrong answers (this question should be treated to get an imagination of droplet sizes. The results, therefore, shouldn't be considered too seriously)



4. Please estimate, how many droplets at an average size of 100 µm do fall on 1 cm<sup>2</sup> ?

10	
20	x
50	
100	
200	

(6 wrong answers, 1 correct // present knowledge = 14.28 %)

(7 wrong answers, 1 correct (here again - this question should be treated to get an imagination of droplet sizes. The results, therefore, shouldn't be considered too seriously))

5. Please estimate the range of the droplet spectrum of ULV-Insecticides ?

1 - 20	
20-50	
30 - 100	x
70 - 120	
> 120	

(6 wrong answers, 1 correct // present knowledge = 14.28 %)

(6 wrong answers, 2 correct // no increment of knowledge)

6. A hopper band (1 ha) is to be treated with 1 l/ha Fastac ULV at an average droplet size of 100 µm. Proposed, that the droplet size is reduced to 50 µm ---- could than be treated an hopper band consisting of

the double size (2 ha)	x
the quadruple size (4 ha)	
the eightfold size (8 ha)	
Or still only a 1 ha hopper band ?	

(1 wrong answers, 6 correct // present knowledge = 95.00 %)

(3 wrong answers, 5 correct // no increment of knowledge)

7. Locusts are controlled with the HV- or ULV Method. Please relate the following characteristics to the respective method.

	HV	ULV
High concentration of active ingredient		X
Particular formulation		X
Particular sprayers		X

(4 persons with no correct answer, 3 persons with 1 correct answer, no person with 2 or 3 correct answers // present knowledge = not existing)

(2 persons with no correct answer, 3 persons with 1 correct answer, 1 person with 2 correct answers, 2 persons with 3 correct answers // knowledge increased)

**8. Please cross those parameters , which determine the drift of droplets of ULV-Applications (max. 3 answers possible) ?**

Emission height	x
Droplet size	x
Wind speed	x
Concentration of active ingredient	
Formulation solvent	
Temperature	

(3 persons with no correct answer, 1 persons with 2 correct answers, 3 persons with 3 correct answers // present knowledge = about 50 %)

(2 persons with no correct answer, 6 persons with 3 correct answers // knowledge wow !!)

**9. Please estimate at which height airplanes at a given wind speed of 4 m/sec should conduct ULV-Applications.**

< 5 m	
5 – 20 m	x
> 20 m	

(6 wrong answers, 1 correct // present knowledge = 14.28 %)

(7 wrong answers, 1 correct // knowledge not increased)

**10. Please estimate if with an increased emission height above ground the drift of droplets will be:**

reduced	
increased	x

(4 wrong answers, 3 correct // present knowledge = 57.15 %)

(2 wrong answers, 6 correct // knowledge level increased to 75 %)

**11. Please estimate at which wind speed (m/s) ULV-application should be conducted.**

2 – 5 m/s	x
5 – 10 m/s	
Windstille	
> 5m/s	

(7 correct answers // knowledge present) - (8 correct answers)

**12. Please estimate how much distance (at least) should be between an area treated with an ULV-insecticide and adjacent waters (lakes etc.) to avoid a contamination of these waters ?**

	50m	100	200	400	800	1600	3200m
knapsacksprayer			x				
Vehicle mounted sprayer					x		
Sprayer fixed to an airplane						x	

(5 persons with no correct answer, 2 persons with 1 correct answer // present knowledge = they didn't listen during Ralf's workshop).

(3 persons with no correct answer, 4 persons with 1 correct answer, 1 person with 1 correct answer// knowledge (I am not sure if this topic was treated in your presentation again)).

**13. Wieviel ha koennen im HV- Verfahren bei einer Aufwandmenge von 100 l/ha bzw. im ULV-Verfahren bei einer Aufwandmenge von 1 l/ha mit einer Tankfuellung mit den folgenden Spritzgeraeten behandelt werden (je Applikationsmethode und Geraet nur eine Antwort moeglich) ?.**

HV - Applikation						
	< 1 ha	5 ha	10 ha	20 ha	100 ha	500 ha
knapsacksprayer						
Vehicle mounted sprayer						
Sprayer fixed to an airplane						

ULV - Applikation						
	< 1 ha	5 ha	10 ha	20 ha	100 ha	500 ha
knapsacksprayer						
Vehicle mounted sprayer						
Sprayer fixed to an airplane						

(I suggest to take this question out of the questionnaire – it is not correctly formulated)

**14. A hopper band of 10 ha should be treated with Fastac. Proposed, that the recommended dosage of Fastac is 100 gai/ha and 1 l Fastac contains 50 gai – how many liters of Fastac are necessary to treat the hopper band?**

5 l	
10 l	
15 l	
20 l	x
40 l	

(7 wrong answers // no knowledge present (very dissapointing, but not surprising)

(7 wrong answers, 1 correct // no improvement (this topic needs to be repeated again and again)

**15. Which parameters have to be determined to apply the calculated amount of insectide (from question 14) evenly to the hopper band (max. 3 answers possible)?**

Track spacing	x
Emission height	
Working speed	x
Wind speed	
Flow rate	x

(4 persons with no correct answer, 3 persons with 2 correct answers // present knowledge = very little)

(2 persons with no correct answer, 3 persons with 1 correct answers, 3 persons with 2 correct answers // knowledge increased but still not satisfactory)

**16. Please estimate, if with an increased flow rate the amount of Fastac to be applied to 1 ha has to be:**

reduced	
increased	x

(3 wrong , 4 correct answers // present knowledge = about 50 %)

(5 wrong , 3 correct answers // they still didn't get it, no clue)

**17. A hopper band has to be treated with Fastac ULV. Therefore the knapsack sprayer has to be calibrated. Since Fastac is not immediately available, could the calibration also be done with:**

Water	
Diesel	x
Not possible	

(5 wrong, 2 correct answers// present knowledge = very little)

(2 wrong, 6 correct answers// knowledge improved)

**18. During a spray operation there is a strong wind blowing from the north to the south. In which direction would you proceed to achieve an efficient control fo locusts and simultaneously to avoid a contamination with the insecticide ?**

From the north to the south	
From the south to the north	
From the west to the east	x

(4 wrong, 3 correct answers// present knowledge = little)

(3 wrong, 5 correct answers// knowledge improved but they should know it)

**19. During a spray operation there is a strong wind blowing from the north to the south. At which point would you commence with the operation ?**

In the south	x
In the north	

(6 wrong, 1 correct answers// present knowledge = not really existing)

(4 wrong, 4 correct answers// knowledge better but there is still room)

**20. Since a few years the so-called barrier treatment is used as a mean in the control of locusts to achieve a sufficient control of locusts whilst reducing the amount of insecticides. Which insecticides are suitable for a barrier treatment (max. 3 answers) ?**

DDT, Lindan	x
Carbophos	
Fastac	
Adonis	x
Dimilin	x

(4 persons with 1 correct answer, 3 persons with 2 correct answers// present knowledge = need to be improved (suggestion: DDT, Lindan shouldn't be included –no crosses were made there)).

(1 person with no correct answer, 7 persons with 2 correct answers// knowledge improved but they still crossed Fastac – it has to be advised during the next workshop that pyrethroids are not suitable for barrier treatment).