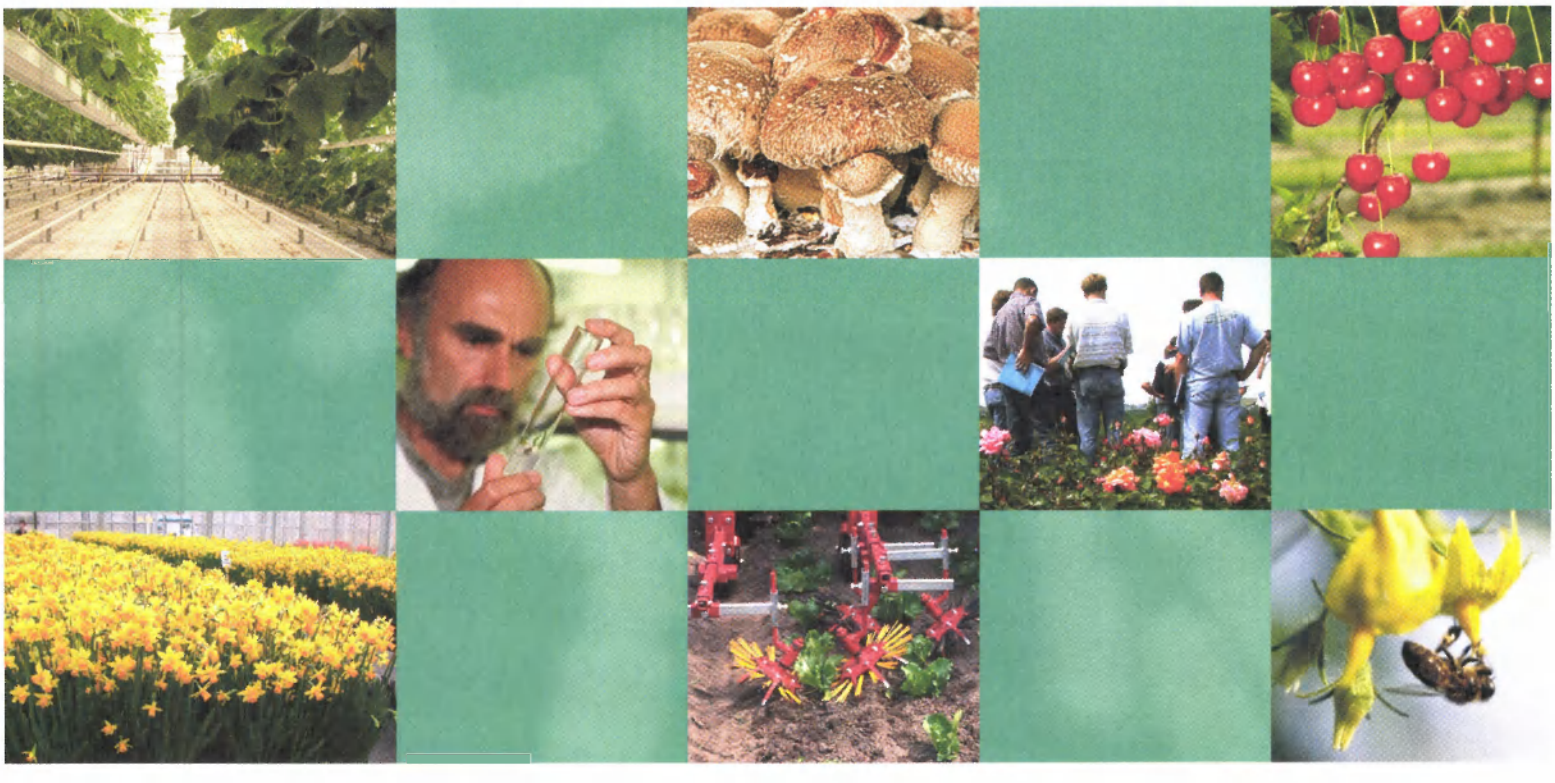
APPLIED PLANT RESEARCH
WAGENINGEN UR

# Testing of phytotoxicity of EOS-oil in tulips

A.Th.J. Koster, J.P.M. Wijnker



Applied Plant Research
Research Unit Flowerbulbs
December 2006

PPO no.3234020600

# Testing of phytotoxicity of EOS-oil in tulips

A.Th.J. Koster, J.P.M. Wijnker

Applied Plant Research
Research Unit Flowerbulbs
December 2006

PPO no.3234020600

This research has been carried out in order of Makhteshim Agan Benelux & Nordic


Project no. 3234020600

Applied Plant Research (Praktijkonderzoek Plant & Omgeving B.V.)
Flowr bulb Research Unit
Address : Prof. van Slogterenweg 2, Lisse, The Netherlands
: P.O. Box 85, 2180 AB Lisse, The Netherlands
Tel. : +31 252 - 46 21 21
Fax : +31 252 - 46 21 00
E-mail : aad.koster@wur.nl
Internet : www.ppo.wur.nl

# Table of contents

**page**

# 1 Introduction

To prevent the spreading of viruses by aphids in bulbous crops, mineral oil is applied by spraying the crop weekly from the beginning of May till the end of September. To test the phytotoxicity of new formulations of mineral oils in bulbous crops, tulip is a very suitable testing crop. Therefore trials with the new mineral EOS oil were carried out with tulips. The trials were carried out in two different tulip cultivars and the new oil was compared with Luxan olie H, the mineral oil that is most commonly used.
The pyrethroid Decis was also involved in this research. This compound is used widely in all bulbous crops to prevent spreading of viruses by apihds as well. The effect of spraying with pyrethroids alone results in moderate virus control whereas combining of pyrethroids and mineral oil results in much better virus control and is therefore preferable.

# 2 Experimental Lay-out

## 2.1 General information

| | | |
|---|---|---|
| Project number/Trial number(s) | : | 32 340206 00/ Iv06t3, Iv06t4 |
| Title/ aim or Goal | : | Comparison of two formulations of mineral oil on phytotoxicity in the production of tulips |
| Project leader | : | A.Th.J. Koster |
| Project member(s) | : | J.P.M. Wijnker, H. van Aanholt |
| Experimental Description | : | 27 March 2006 |
| Standard Operating Procedures | : | SOP02 and SOP04 |

## 2.2 Data Field Trial Iv06t3

### 2.2.1 Experimental data

| | | |
|---|---|---|
| 1. | Crop | : Tulip |
| | - cultivar | : Christmas Marvel |
| | - plant size | : 8-10 |
| | -Pretreatment bulbs | : no |
| | -Standard desinfection bulbs | : yes |
| 2. | Disease-, pest-, weed pressure | : n/a |
| 3. | Location | |
| | - greenhouse/field | : field, PPO Lisse |
| | - soil type | : sandy soil |
| | - previous crop | : Narcis |
| | - standard fumigation of soil disinfection | : no* |
| | **if yes, name chemical and dose | : |
| 4. | Plot size (bruto area/surface.) | : 2.75 $m^2$ |
| | - netto surface. | : 1.5 $m^2$ |
| | -number of bulbs | : 160 |
| | - bulbweight | : 192 gram |
| | - number of replications | : 4 |
| 5. | Trial data | |
| | - infection | : n/a |
| | - soil treatment(s) | : n/a |
| | - chemical application | : see § 2.2.2 |
| | - planting date(s) | : 17th of November 2005 |
| | - plant depth | : 10 cm |

6. Observations

I. Efficacy : n/a

II. Phytotoxicity :
- emergence : no
- stand( crop) : yes
- die back or decrease : yes
- yield : yes

Observation scales 'phytotox.' : 0-10 scales, where 0 =none or excellent, 10 = 100% affected or bad

## 2.2.2 Treatments

**1. Number of treatments and coding (assigned treatment number)**

| Treat.# | Product | Name active ingredient (a.i.) | % a.i. | Formulation | Dose in kg, l/ha or % | Mode of application/ timing |
|---|---|---|---|---|---|---|
| 1. | Decis | deltamethrin- | 25 g/l | SC | 0.4 l/ha | Weekly |
| 2. | Luxan Olie H | mineral oil | 800 g/l | EC | 12,5 l/ha | Weekly |
| 3. | EOS oil | mineral oil | 825 g/l | EC | 12. l/ha | Weekly |
| 4. | Luxan Olie H + Decis | mineral oil deltamethrin | 800g/l 25 g/l | EC SC | 6,25 l/ha 0,4 l/ha | Weekly |
| 5. | EOS oil + Decis | mineral oil deltamethrin | 825 g/l 25 g/l | EC SC | 6 l/ha 0,4 l/ha | Weekly |
| 6. | EOS oil + Decis | mineral oil deltamethrin | 825 g/l 25 g/l | EC SC | 3 l/ha 0,4 l/ha | Weekly |

**2. Application of treatment**

Spraying:
-sprayer type : Veeze hand-held sprayer with 3 nozzles
- nozzle type : Lechler AD110 03 VS
- pressure : 3 bar
- volume : 500 l/ha
- Spraying-surface : 2,20 m x 1,25 m

| Trt. nr. | Treatment | Amount of carrying fluid in ml/treatment | Amount product added in ml/g | Amount of spray mixture (carrying fluid) in l/treatment |
|---|---|---|---|---|
| 1. | Decis | 1000 | 0.8 | 550 |
| 2. | Luxan Olie H | 1000 | 25 | 550 |
| 3. | EOS oil | 1000 | 24 | 550 |
| 4. | Luxan Olie H + Decis | 1000 | 12.5 0.8 | 550 |
| 5. | EOS oil + Decis | 1000 | 12 0.8 | 550 |
| 6. | EOS oil + Decis | 1000 | 6 0.8 | 550 |

Spraying date: 02-05-2006; 11-05-2006; 17-05-2006; 27-05-2006; 02-06-2006; 08-06-2006.

### 2.2.3 Plot Plan

| Repetition A | Repetition B | Repetition C | Repetition D |
|---|---|---|---|
| 3 | 5 | 4 | 2 |
| 2 | 3 | 5 | 6 |
| 1 | 2 | 1 | 1 |
| 4 | 1 | 2 | 3 |
| 5 | 6 | 3 | 5 |
| 6 | 4 | 6 | 4 |

## 2.3 Data Field Trial lv06t4

### 2.3.1 Experimental data

1. Crop : Tulip
   - cultivar : Negrita
   - plant size : 8-10
   -Pretreatment bulbs : no
   -Standard disinfection bulbs : yes

2. Disease-, pest-, weed pressure : n/a

3. Location
   - greenhouse/field : field, PPO Lisse
   - soil type : sandy soil
   - previous crop : Narcis
   - standard fumigation of soil disinfection : no*
   **if yes, name chemical and dose :

4. Plot size (bruto area/surface.) : 1.875 $m^2$
   - netto surface. : 1.875 $m^2$
   -number of bulbs : n/a
   - bulb weight : n/a
   - number of replications : 4

5. trial data
   - infection : n/a
   - soil treatment(s) : n/a
   - chemical application : see § 2.3.2
   - planting date(s) : 17th of November
   - plant depth : 10 cm

6. Observations
   I. Efficacy : n/a

   II. Phytotoxicity :
   - emergence : no
   - stand( crop) : yes
   - die back or decrease : yes
   - yield : no

   Observation scales phytotox.' : 0-10 scales, where 0 =none or excellent, 10 = 100% affected or bad

   idem, efficacy : 0-10, where 0 = 100% diseased or no effect, 10 = healthy or 100% control

## 2.3.2 Treatments

**1. Number of treatments and coding (assigned treatment number)**

| Treat.# | product | Name active ingredient (a.i.) | % a.i. | Formulation | Dosis in kg, l/ha or % | Mode of application/ timing |
|---|---|---|---|---|---|---|
| 1. | Decis | deltamethrin | 25 g/l | SC | 0.4 l/ha | Weekly |
| 2. | Luxan Olie H | mineral Oil | 800 g/l | EC | 12.5 l/ha | Weekly |
| 3. | EOS olie | mineral oil | 825 g/l | EC | 12 l/ha | Weekly |
| 4. | Luxan Olie H + Decis | mineral oil deltamethrin | 800 g/l 25 g/l | EC SC | 6,25 l/ha 0,4 l/ha | Weekly |
| 5. | EOS olie + Decis | mineral oil deltamethrin | 825 g/l 25 g/l | EC SC | 6 l/ha 0,4 l/ha | Weekly |
| 6. | EOS olie + Decis | mineral oil deltamethrin | 825 g/l 25 g/l | EC SC | 3 l/ha 0,4 l/ha | Weekly |

**2. Application of treatment**

Spraying:

-sprayer type : Veeze hand-held sprayer with 3 nozzles
- nozzle type : Lechler AD110 03 VS
- pressure : 3 bar
- volume : 500 l/ha
- Spraying-surface : 1,5 m x 1,25 m

| Trt. nr. | Treatment | Amount of carrying fluid in ml/treatment | Amount product added in ml/g | Amount of spray mixture (carrying fluid) in l/treatment |
|---|---|---|---|---|
| 1. | Decis | 1000 | 0.8 | 375 |
| 2. | Luxan Olie H | 1000 | 25 | 375 |
| 3. | EOS olie | 1000 | 24 | 375 |
| 4. | Luxan Olie H + Decis | 1000 | 12.5 0.8 | 375 |
| 5. | EOS olie + Decis | 1000 | 12 0.8 | 375 |
| 6. | EOS olie + Decis | 1000 | 6 0.8 | 375 |

Spraying date: 02-05-2006; 11-05-2006; 17-05-2006; 27-05-2006; 02-06-2006; 08-06-2006.

## 2.3.3 Plot Plan

| Repetition A | Repetition B | Repetition C | Repetition D |
|---|---|---|---|
| 3 | 1 | 5 | 4 |
| 5 | 6 | 3 | 3 |
| 2 | 2 | 1 | 5 |
| 6 | 5 | 6 | 1 |
| 4 | 4 | 4 | 6 |
| 1 | 3 | 2 | 2 |

# 3 Results

All results were analysed with Genstat release 8.11

## 3.1 Crop stand

On the 22nd of May and the 12th of June the plots of both trails were assessed on percentage green leafarea and phytotoxic effects of the treatments. The results are given in table 1.

Table 1: The average percentage of green leaf area per treatment (10=100% green, 0=no green leaf area) on 22nd of May and 12th of June and the phytotoxic effects (10=much, 0=none) of the treatments on the leafs on the 22nd of May in both trials.

| Treatment | % green leaf area on | | | | Phytotoxic effect on 22nd of May | |
|---|---|---|---|---|---|---|
| | 22nd of May | | 12th of June | | | |
| | lv06t3 | lv06t4 | lv06t3 | lv06t4 | lv06t3 | lv06t4 |
| 1. Decis | 9.25 a | 10.00 a | 4.50 a | 7.75 a | 0.00 e | 0.00 d |
| 2. Luxan Olie H 12.5l/ha | 6.75 c | 5.25 d | 2.00 c | 2.25 d | 8.25 a | 9.00 a |
| 3. EOS oil 12 l/ha | 7.50 bc | 6.75 c | 2.25 c | 2.25 d | 7.00 b | 8.25 a |
| 4. Luxan Olie H 6,25 l/ha + Decis | 7.50 bc | 7.00 c | 2.50 bc | 3.50 c | 6.75 b | 6.75 b |
| 5. EOS oil 6 l/ha + Decis | 8.00 b | 7.75 b | 2.25 c | 3.75 c | 5.50 c | 6.50 b |
| 6. EOS oil 3 l/ha + Decis | 9.00 a | 8.00 b | 3.25 b | 5.00 b | 2.50 d | 4.50 c |
| *F.prob* | *<0.001* | *<0.001* | *<0.001* | *<0.001* | *<0.001* | *<0.001* |
| *L.S.D.* | *0.826* | *0.5209* | *0.790* | *0.6153* | *1.157* | *0.826* |

On the 22nd of May there is an effect of the different mineral oils on the percentage of green leaf area. The Luxan Olie H has less green leaf area in both doses compared to the EOS oil in the trial with Negrita (lv06t4). In the cultivar Christmas Dream (lv06t3) there's the same tendency but the differences are not significant. The data on phytotoxicity in Christmas Dream show there is an effect of the type of oil on phytotoxicity. Luxan Olie H has a significantly higher phytotoxic effect in both doses. In Negrita (lv06t4) there is no significant effect of the oil type on phytotoxicity, although there is an effect on the green leaf area in this experiment.
On the 12th of June the differences in the green leaf area between the applied oils were gone.
On this date there was a clear dose-effect relation of both oil types on green leaf area of Negritta. There is a clear difference between the two cultivars in their reaction to mineral oil. Cultivar Christmas Dream seems to be less affected by application of mineral oils than Negritta

## 3.2 Yield

After harvest the bulbs of experiment lv06t3 were weighed, graded and counted. In table 2 these results are shown. Unfortunately the bulbs in this trial splitted up extremely. Normally planting material (bulb-circumference < 10 cm) makes up approx. 30% of the yield-weight. In this experiment the planting material made up 80% of the yield weight. Saleable bulbs have a circumference of 10 cm or more.

Table 2: The average total harvested weight and the average weight of saleable bulbs (circumference ≥10 cm)per treatment of Christmas Dream (lv06t3).

| Treatment | Total harvested weight (gr) | Relative weight | Total weight of saleable bulbs (gr) |
|---|---|---|---|
| 1. Decis | 5896 a | 100.0 | 911 a |
| 2. Luxan Olie H 12.5 l/ha | 5575 c | 94.6 | 568 c |
| 3. Mabeno EOS oil 12 l/ha | 5608 bc | 95.1 | 654 c |
| 4. Luxan Olie H 6,25 l/ha + Decis | 5703 abc | 96.7 | 822 ab |
| 5. EOS oil 6 l/ha + Decis | 5535 c | 93.9 | 714 bc |
| 6. EOS oil 3 l/ha + Decis | 5785 ab | 98.1 | 881 a |
| *F.prob* | *0.014* | | *0.002* |
| *L.S.D.* | *202.7* | | *161.2* |

The effect of the spraying of mineral oil in a dosage of 6 l/ha and higher has a negative effect on the yield of tulips. The high dose of the EOS oil (6 and 12 l/ha) had a negative effect on bulb yield. For Luxan Olie H bulb yield was significantly lower at a amount of 12,5 l/ha.
Considering bulb yield there are no significant differences between the two oil types.

# 4 Conclusions

Crop stand

- In the trials spraying of different mineral oils on tulips resulted in phytotoxic effects and had a negative effect on the green leaf area. The higher the dose applied the less green leaf area or the more phytotoxic effect.
- Half way the growing season Luxan Olie-H showed a more negative effect on the green leaf area and more phytotoxic effects than Mabeno EOS oil. Later in the season differences in green leaf area disappeared between the two mineral oils.

Bulb yield

- Both mineral oils cause a loss of yield in tulips in a dose of 6 l/ha and higher.
- There were no significant differences between the Luxan Olie-H and EOS oil in their effect on bulb yield.

# Appendix 1 Raw data of Iv06t3

## Crop observations

| Cultivar: | Christmas Dream | Iv06t3 | 3234020600 | |
|---|---|---|---|---|
| | | % green leaf area | | Phytotoxicit |
| Trt! | Rep! | 22 may | 12 june | 22 may |
| 1 | a | 9 | 4 | 0 |
| 1 | b | 10 | 4 | 0 |
| 1 | c | 9 | 5 | 0 |
| 1 | d | 9 | 5 | 0 |
| 2 | a | 7 | 2 | 8 |
| 2 | b | 6 | 2 | 8 |
| 2 | c | 6 | 2 | 9 |
| 2 | d | 8 | 2 | 8 |
| 3 | a | 8 | 3 | 7 |
| 3 | b | 8 | 2 | 6 |
| 3 | c | 7 | 2 | 8 |
| 3 | d | 7 | 2 | 7 |
| 4 | a | 8 | 3 | 5 |
| 4 | b | 7 | 2 | 7 |
| 4 | c | 7 | 3 | 7 |
| 4 | d | 8 | 2 | 8 |
| 5 | a | 8 | 2 | 6 |
| 5 | b | 8 | 3 | 5 |
| 5 | c | 8 | 2 | 5 |
| 5 | d | 8 | 2 | 6 |
| 6 | a | 9 | 3 | 3 |
| 6 | b | 9 | 3 | 3 |
| 6 | c | 9 | 3 | 2 |
| 6 | d | 9 | 4 | 2 |

## Yield

| Cultivar: | Christmas Dream | Iv06t3 | 3234020600 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Trt! | Rep! | weight <10 | nr. 10-11 | wght 10-11 | nr 11-12 | wght 11-12 | nr. 12-13 | gew 12-13 | nr. 13-> | wght 13-> | Fusarium |
| 1 | a | 5123 | 30 | 549 | 8 | 186 | 2 | 56 | 0 | 0 | 1 |
| 1 | b | 4836 | 46 | 824 | 11 | 258 | 3 | 89 | 0 | 0 | |
| 1 | c | 4982 | 33 | 595 | 9 | 206 | 1 | 26 | 0 | 0 | |
| 1 | d | 4999 | 31 | 585 | 9 | 208 | 1 | 27 | 1 | 35 | |
| 2 | a | 5039 | 19 | 340 | 6 | 144 | 0 | 0 | 0 | 0 | |
| 2 | b | 5221 | 24 | 446 | 11 | 246 | 2 | 54 | 0 | 0 | |
| 2 | c | 4833 | 16 | 293 | 3 | 73 | 0 | 0 | 0 | 0 | |
| 2 | d | 4938 | 24 | 438 | 11 | 236 | 0 | 0 | 0 | 0 | |
| 3 | a | 5076 | 24 | 438 | 5 | 112 | 0 | 0 | 0 | 0 | 1 |
| 3 | b | 4945 | 34 | 619 | 12 | 273 | 2 | 55 | 0 | 0 | |
| 3 | c | 4933 | 25 | 440 | 4 | 90 | 0 | 0 | 0 | 0 | |
| 3 | d | 4864 | 27 | 494 | 4 | 93 | 0 | 0 | 0 | 0 | |
| 4 | a | 4821 | 39 | 691 | 8 | 176 | 1 | 32 | 0 | 0 | |
| 4 | b | 5040 | 37 | 651 | 10 | 218 | 1 | 30 | 0 | 0 | |
| 4 | c | 4689 | 23 | 421 | 13 | 296 | 2 | 54 | 0 | 0 | 1 |
| 4 | d | 4974 | 25 | 470 | 8 | 191 | 2 | 58 | 0 | 0 | |
| 5 | a | 4869 | 21 | 338 | 10 | 221 | 1 | 31 | 0 | 0 | |
| 5 | b | 4962 | 35 | 650 | 9 | 210 | 0 | 0 | 0 | 0 | |
| 5 | c | 4790 | 24 | 426 | 11 | 248 | 0 | 0 | 0 | 0 | |
| 5 | d | 4661 | 24 | 429 | 12 | 278 | 1 | 26 | 0 | 0 | |
| 6 | a | 5057 | 27 | 486 | 10 | 228 | 1 | 28 | 0 | 0 | |
| 6 | b | 4903 | 38 | 693 | 7 | 160 | 1 | 28 | 0 | 0 | |
| 6 | c | 4920 | 39 | 707 | 12 | 261 | 0 | 0 | 0 | 0 | |
| 6 | d | 4737 | 32 | 580 | 15 | 353 | 0 | 0 | 0 | 0 | |

# Appendix 2 Raw data Iv06t4

**Crop observations**

| Cultivar: | Negritta | Iv06t3 | 3234020600 | |
|---|---|---|---|---|
| | | % green leaf area | | Phytotoxicity |
| Trt! | Rep! | 22 may | 12 june | 22 may |
| 1 | a | 10 | 7 | 0 |
| 1 | b | 10 | 8 | 0 |
| 1 | c | 10 | 8 | 0 |
| 1 | d | 10 | 8 | 0 |
| 2 | a | 5 | 2 | 9 |
| 2 | b | 5 | 3 | 9 |
| 2 | c | 6 | 2 | 9 |
| 2 | d | 5 | 2 | 9 |
| 3 | a | 7 | 2 | 9 |
| 3 | b | 6 | 3 | 8 |
| 3 | c | 7 | 2 | 8 |
| 3 | d | 7 | 2 | 8 |
| 4 | a | 7 | 3 | 7 |
| 4 | b | 7 | 5 | 7 |
| 4 | c | 7 | 3 | 7 |
| 4 | d | 7 | 3 | 6 |
| 5 | a | 8 | 3 | 7 |
| 5 | b | 8 | 5 | 5 |
| 5 | c | 8 | 3 | 7 |
| 5 | d | 7 | 4 | 7 |
| 6 | a | 8 | 4 | 5 |
| 6 | b | 8 | 6 | 5 |
| 6 | c | 8 | 5 | 4 |
| 6 | d | 8 | 5 | 4 |

# Appendix 3: Application data

| Trialnr.: lv06t3 and lv06t4 | Carried out by: H. van Aanholt |
|---|---|

| spray-nr. | spray-date | spray-time fr. – till | Order of spraying treatments | temp. at 1,5 m height (°C) | cloudiness | wind-direction | windspeed at 2 m height (m/sec) | rain (mm) | | | cropdata | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1 day before | during | 1 day after | wetness | stage | length (cm) |
| 1 | 02-05-06 | 13-15 | 1-6-5-3-4-2 | 17 | Slightly | SW | 2 | 7 | 0 | 0 | Dry | Just headed | 25-30 |
| 2 | 11-05-06 | 9-10 | 1-6-5-3-4-2 | 22 | None | E | 0-1 | 0 | 0 | 0 | Dry | | 30 |
| 3 | 17-05-06 | 15-16 | 1-6-5-3-4-2 | 19 | Half | W | 0-1 | 0 | 0 | 0.6 | Dry | | 30 |
| 4 | 27-05-06 | 4-15 | 1-6-5-3-4-2 | 16 | Fully | SW | 0-2 | 11.4 | 0 | 3.8 | Dry | | 30 |
| 5 | 02-06-06 | 6-7 | 1-6-5-3-4-2 | 14 | Half | W | 0-1 | 0.9 | 0 | 0 | Dry | | 30 |
| 6 | 08-06-06 | 17-18 | 1-6-5-3-4-2 | 19 | none | NNW | 0-2 | 0 | 0 | 0 | Dry | Dying back | 30 |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |