Reducing Botrytis in greenhouse crops:

periodic UV-light treatment in tomato plants

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Wageningen, 26 October 2006

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The treatment and data collecting in this research were conducted by a grower, under guidance of Clean Light BV. Wageningen University conducted the (statistical) analysis of the data.

Introduction

Greenhouse growers in The Netherlands, and indeed throughout Europe, face a dilemma in the control of pathogenic fungi on their crops. Their customers demand a product that is free of fungi, while on the other hand, their customers demand a minimal level of pesticide residue (MLR) on the final product, thus severely limiting the options available to the grower in controlling the fungus.

In this light, various systems are being developed in Wageningen to assist the growers in controlling fungal growth with minimal or no use of fungicides.

One such method is the use of low dosage ultraviolet light. This patented method, owned by Clean Light BV of The Netherlands (PO Box 271, 6700 AG Wageningen, www.cleanlight.nl), is based on the principle that both fungi and green plants are sensitive to ultraviolet light, but that there is a vast difference in lethal dose between fungi and green plants: Fungi can be killed with a very low dose, while green plants can tolerate much higher doses of ultraviolet light without showing signs of stress. This stands to reason given the observation that green plants survive, and indeed thrive, in full sunlight, while most fungi species only survive in surroundings that are sheltered from direct sunlight. The method then, is based on supplying a dose of ultraviolet light to the fungus that is a) high enough to kill the fungus, while b) low enough, so as not to harm the plant.

Scope of Research

The research described in this report was conducted in the months of August and September 2006, at a commercial greenhouse in The Netherlands. This particular operation produces tomatoes in large glass greenhouses.

Clean Light and Berg Products (Burg. Crezeelaan 42, 2678 KZ, De Lier, The Netherlands, www.bergproduct.com) jointly supplied a robotic cart that was equipped with suitable ultraviolet lights. The grower sent the cart down certain aisles, at specified times each week, and recorded the treatments and the results, expressed in the number of new Botrytis spots in each aisle. These data were handed over to Wageningen University for conducting the (statistical) analysis.

Materials and Methods

The cart was equipped with six ultraviolet lights (UV c) disinfection lights, as produced by Philips. Each light was mounted in a fixture, so that 3 lights shine to each side of the aisle. The UV light was focused on the stems of the tomato plants (about 25 to 75 cm above ground level).

The cart was equipped with an adjustable speed button. The grower chose to operate at the highest speed, i.e. supply the lowest possible dose. The speed setting of 10 corresponds to

approximately 15 meters per minute. Each aisle is approximately 80 meters in length. The lights shine continuously, both on the way out, and on the way back to the main path.

Aisle 222 was treated one time per week.
Aisles 223, 224, and 225 were neither treated, nor sprayed. They were `control`

Aisle 226, 227, 228, and 229 were UV-light treated, more or less according to the recommendation, three times per week.

Five times during the trial, a worker would walk through each aisle, locate new fungal spots, and treat them manually with a chemical, thus eliminating that spot. The number of new spots was carefully noted on the data sheets, and in fact present good indication of the efficacy of the treatment.

Results

Table 1. Observed new Botrytis spots in time for 3 conditions: Aisle 222, treated once a week with UV-light, Aisles 223, 224, 225 were neither treated nor sprayed (control) and Aisle 226, 227, 228 and 229, were treated with UV-light, more or less, according to the recommendation, three times per week.

Aisle	*2 Aug.*	*16 Aug.*	*28 Aug.*	*27 Sept.*	*5 Oct.*	*Total*
222	*0*	*1*	*1*	*0*	*6*	*8*
223	*0*	*0*	*4*	*3*	*4*	*11*
224	*0*	*2*	*4*	*3*	*2*	*11*
225	*3*	*0*	*1*	*3*	*3*	*10*
226	*2*	*2*	*3*	*1*	*6*	*14*
227	*2*	*0*	*0*	*0*	*0*	*2*
228	*2*	*1*	*3*	*2*	*3*	*11*
229	*1*	*0*	*1*	*2*	*6*	*10*
Total	*10*	*6*	*17*	*14*	*30*	*77*

Due to the experimental setup, there are only two aisles, namely 227 and 228, where plants received UV-light from both sides. Furthermore, only aisle 223 and 224 where real controls, as aisle 225 received from one side UV-light from the treatment in aisle 226. Plotting the cumulative average data from these 4 aisles (223, 224, 227 and 228) resulted in a clear

difference between control and UV-light treated plants in increase in Botrytis spots during the two months of the experiment.

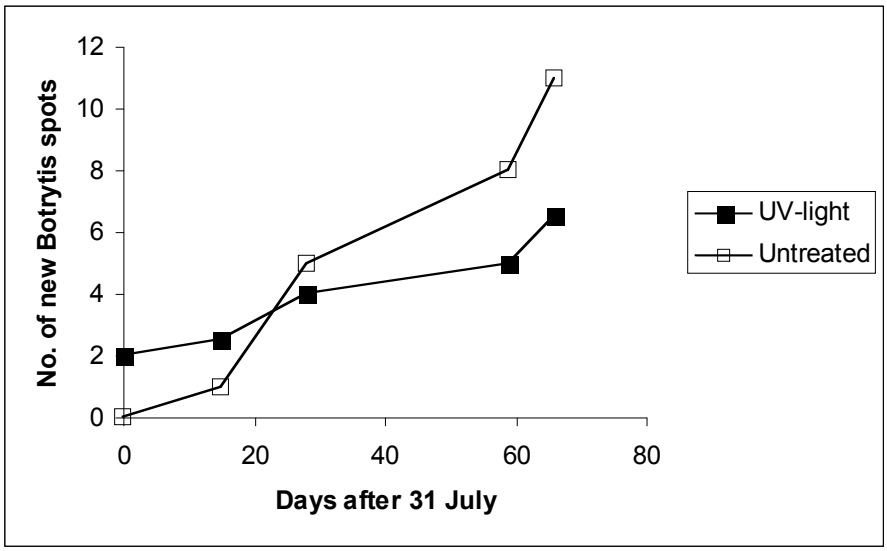

Fig. 1. Cumulative number of new Botrytis spots as observed in an untreated control (aisles 224 and 225) and in plants treated with UV-light 3 times per week (aisles 227 and 228).

Analysing the data for these 4 rows in a t-test (independent samples) resulted in a higher average number of new botrytis spots for the untreated control (2.2) compared to UV-light treated plants (1.3), this difference was statistically significant at the 10% level (P= 0.096). Given the low number of repetitions in this experiment (only 2) it is reasonable to test at 10% level instead of the more commonly used 5% level.
It is clear from Table 1, that in the last 10 days (27 Sept.-5 Oct.) a lot of new Botrytis spots were observed, both for the control and for the UV-light treated aisles. This may be due to the fact that the grower stopped with picking leaves, and hence UV-light could no longer reach the stems as these where 'hidden' behind the leaves.

Conclusion

The data show a clear tendency that treatment of tomato plants with UV-light reduces the occurrence of new botrytis spots on the stem, when applied three times per week. UV-light treatment of the crop seems a useful addition to other methods of crop protection.