Sampling Method

Shortening the sampling time was one of the main objectives. A realistic deadline was set under which two employees were aiming to complete sampling within 90 minutes (180 minutes total). A main grid consisted of 90 units. The grids were observed weekly. More specifically, each grid consisted of 15 rows with a space of 3.4 meters in-between rows. One row was made up of 6 units, with a space of 3 meters in-between units (one unit for 6.4 m^2). A sampling unit is composed of a pair of organ (stem + flower) and the corresponding 'bent shoots'. All observations of the sampling units followed the same protocol. A stem bearing a flower at a harvesting stage was randomly chosen. An observer delicately turned the 4-5 apical leaves over and a second observer slightly tapped the flower twice with a plastic fly swatter. Detected populations on stem and flower were pooled and immediately categorized into the corresponding abundance class system (Tab. 1) established for the main bioaggressors. Precise counts were prohibited. Then the tapping procedure was repeated on the basal foliage. When moving on to the successive sampling unit, observers had to record any presence of bioaggressors on intermediate zones.

	On shoots					On bent shoots
Class (i)	Acari	Aphids	Thrips	Whiteflies	Powdery mildew	All pests
1	no	no	no	no	no	no
2	presence	1 - 3	1	adults	1 leaf	presence
3	lot of	4 - 10	2 - 3	eggs + larvae	> 1 leaf	lot of
4	cobwebbed	11 - 30	4 - 7	widespread	on flower	
5		31 - 100	8 - 15			
i		$[(\sqrt{10})^{i-2} - (\sqrt{10})^{i-1}]$				

Table 1: Definition of the global visual abundance classes system.

Optimizing the Sampling Grid

The main visible pests, which occur in the greenhouse, are acari on bent shoots, and thrips and powdery mildew on stems. In order to decrease the main sampling grid of 90 sampling units (which provided the weekly reference data), we simulated different sizes of sampling grids and compared their partial information against the reference data. For each sampling date, we simulated a sampling grid of a different size, composed of 69, 45, and 27 sampling units that represented 76.6, 50, and 30% of the main grid respectively. For each one of these proportions, simulated grids were obtained by different methods: i) regular depletion of the main grid; ii) full random selection of sampling units. The collected data was compared against the main grid reference data by means of a Kolmogorof and Smirnov 'goodness-of-fit' test (ks.test). This test indicated the probability of a discrepancy in the distribution histograms, which were based on the reference and simulated data. Only one grid arrangement was tested for regular depletion of the main grid. Additionally, we simulated 40 grids by sampling date and collected the minimal *p_value*. Because visual abundance class could be translated into quantitative data for thrips on stems (Boll et al., 2007), a t.test was performed in order to compare mean densities obtained from reference and simulated data. The p_*value* level for significance was set at 0.05. Tests are available through Splus® software. With the greenhouse data that was collected over the studied period, we consulted Taylor's power law (Taylor, 1961), according to which the relationship between mean x and variance S^2 identifies the distribution of thrips over the crop. So, the formula $n=[s/(Px)]^2$ where s is the standard deviation, x is the mean, and P is the standard error as a decimal of the mean (Southwood, 1978) was applied to estimate a realistic sampling grid for the thrips.