

Reducing initial Aphid infestation by use of coloured mulch foils and newly developed biodegradable spray-films:

Supplementary 1/5

Materials and Methods

plant row																					drive lane
																					drive lane
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12	<u>12.1</u>	12.2	12.3	12.4	<u>12.5</u>	12.6	12.7	12.8	12.9	<u>12.10</u>	12.11	12.12	12.13	12.14	<u>12.15</u>	12.16	12.17	12.18	12.19	<u>12.20</u>	plant no.
11	<u>11.1</u>	11.2	11.3	11.4	<u>11.5</u>	11.6	11.7	11.8	11.9	<u>11.10</u>	11.11	11.12	11.13	11.14	<u>11.15</u>	11.16	11.17	11.18	11.19	<u>11.20</u>	plant no.
10	<u>10.1</u>	10.2	10.3	10.4	<u>10.5</u>	10.6	10.7	10.8	10.9	<u>10.10</u>	10.11	10.12	10.13	10.14	<u>10.15</u>	10.16	10.17	10.18	10.19	<u>10.20</u>	plant no.
9	<u>9.1</u>	9.2	9.3	9.4	<u>9.5</u>	9.6	9.7	9.8	9.9	<u>9.10</u>	9.11	9.12	9.13	9.14	<u>9.15</u>	9.16	9.17	9.18	9.19	<u>9.20</u>	plant no.
																					drive lane
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8	<u>8.1</u>	8.2	8.3	8.4	<u>8.5</u>	8.6	8.7	8.8	8.9	<u>8.10</u>	8.11	8.12	8.13	8.14	<u>8.15</u>	8.16	8.17	8.18	8.19	<u>8.20</u>	plant no.
7	<u>7.1</u>	7.2	7.3	7.4	<u>7.5</u>	7.6	7.7	7.8	7.9	<u>7.10</u>	7.11	7.12	7.13	7.14	<u>7.15</u>	7.16	7.17	7.18	7.19	<u>7.20</u>	plant no.
6	<u>6.1</u>	6.2	6.3	6.4	<u>6.5</u>	6.6	6.7	6.8	6.9	<u>6.10</u>	6.11	6.12	6.13	6.14	<u>6.15</u>	6.16	6.17	6.18	6.19	<u>6.20</u>	plant no.
5	<u>5.1</u>	5.2	5.3	5.4	<u>5.5</u>	5.6	5.7	5.8	5.9	<u>5.10</u>	5.11	5.12	5.13	5.14	<u>5.15</u>	5.16	5.17	5.18	5.19	<u>5.20</u>	plant no.
																					drive lane
																					drive lane
4	<u>4.1</u>	4.2	4.3	4.4	<u>4.5</u>	4.6	4.7	4.8	4.9	<u>4.10</u>	4.11	4.12	4.13	4.14	<u>4.15</u>	4.16	4.17	4.18	4.19	<u>4.20</u>	plant no.
3	<u>3.1</u>	3.2	3.3	3.4	<u>3.5</u>	3.6	3.7	3.8	3.9	<u>3.10</u>	3.11	3.12	3.13	3.14	<u>3.15</u>	3.16	3.17	3.18	3.19	<u>3.20</u>	plant no.
2	<u>2.1</u>	2.2	2.3	2.4	<u>2.5</u>	2.6	2.7	2.8	2.9	<u>2.10</u>	2.11	2.12	2.13	2.14	<u>2.15</u>	2.16	2.17	2.18	2.19	<u>2.20</u>	plant no.
1	<u>1.1</u>	1.2	1.3	1.4	<u>1.5</u>	1.6	1.7	1.8	1.9	<u>1.10</u>	1.11	1.12	1.13	1.14	<u>1.15</u>	1.16	1.17	1.18	1.19	<u>1.20</u>	plant no.
																					drive lane
																					drive lane

Fig.S1 Planting- and evaluation scheme for an exemplary-plot. All distances are true to scale, one square represents the size of 30 cm x 30 cm. Three dams are shown, containing four plant rows (**1 to 4**, **5 to 8**, **9 to 12**, see left side) each, 20 plants per row, as indicated as 'plant no.' on right side. Single lettuce plants (240 per plot) are indicated by numbers (1-12.1-20, plant no.) for spatial localization within the plot. Underlined numbers show evaluation plants for each plot (n=30). Driving lanes between the dams and other plant-free areas are displayed as empty boxes. Point of compass is north to south (from left to the right). Distance to adjacent plots is 2 meters in each direction. In treatments with sprayable foil (SFB, SFG) the whole area (white boxes) is sprayed, in treatments with PE-foil (PEB, PEG) driving lanes are excluded.

1st Evaluation (alate aphids only!)

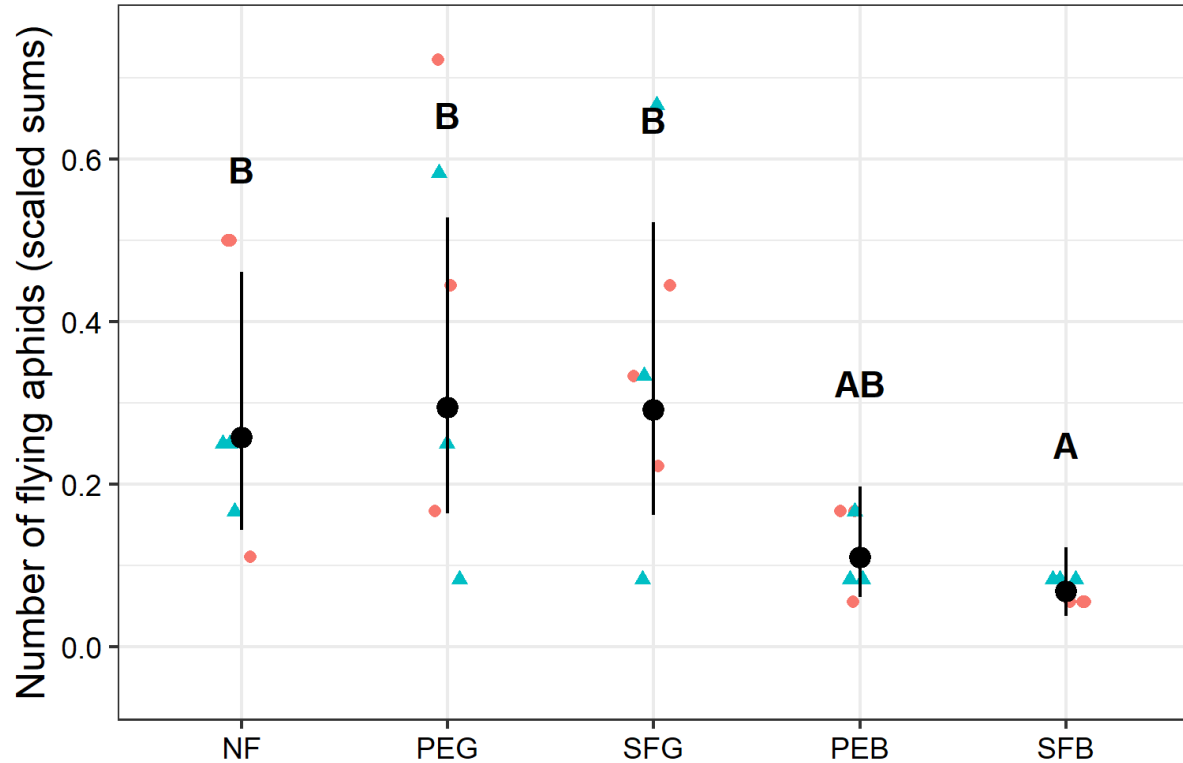


Fig.S2 Scaled sums of the total number of alate aphids per location in each plot (May 16, 2018). The sums were scaled to be $(y+1)/n$. Dots indicate sums from the border plants, triangles indicate sums from the centre of a plot. The black dots are model based least square means of the scaled sums and their 95% confidence intervals (black bars). The letters indicate significant differences ($\alpha=0.05$) between logarithmized means. Treatment code in **Fig.2**

Figure S2 shows the number of alate aphids found on the lettuce plants in the first evaluation (non-destructive) for each treatment, separated into outer- (dots) and inner-plants (triangles) and as least square means with confidence interval, over all repetitions. Highest least square mean is shown by treatments PEG (0.294), SFG (0.291) and NF (0.257), PEB showed 0.110. The treatment SFB (0.068) was statistically different from all other treatments. P-values for the ANOVA are given in the online content 3 (**Tab.3**). The mean comparisons (contrasts) were run as differences on the log-scale. Therefore back transformation results in the ratio between the means of the scaled sums. These ratios, their standard error and the corresponding p-values are given in **Tab.5**.

1st Evaluation (alate and apterous aphids)

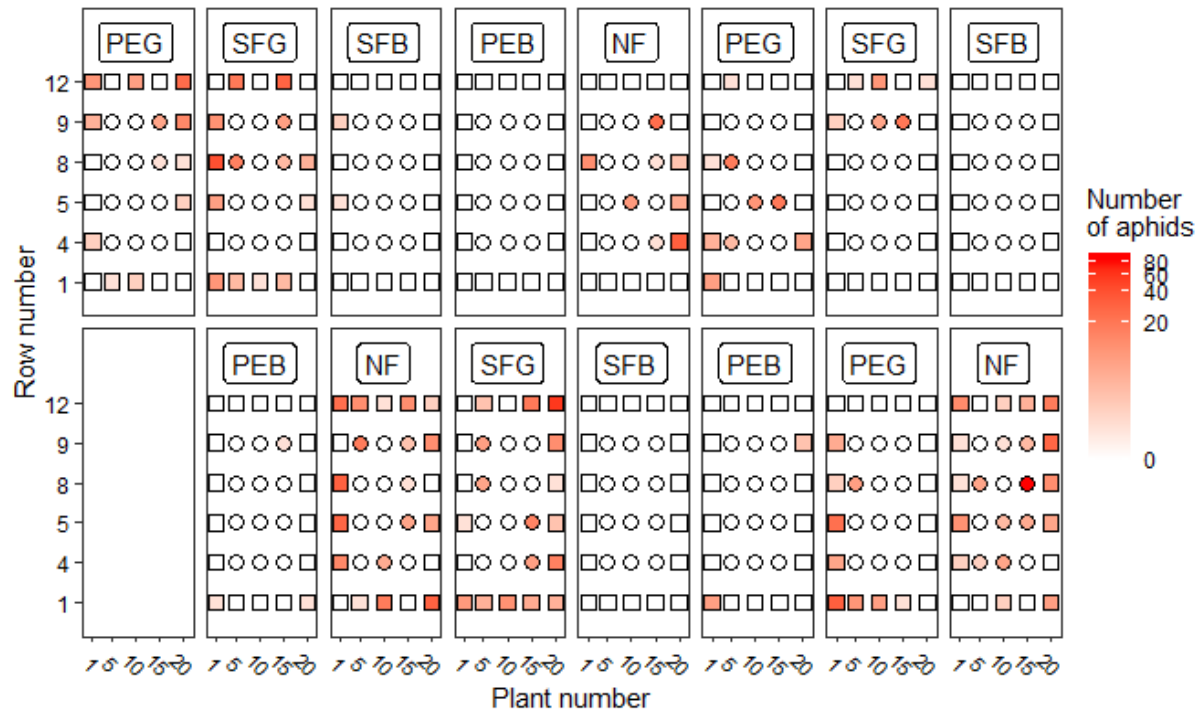
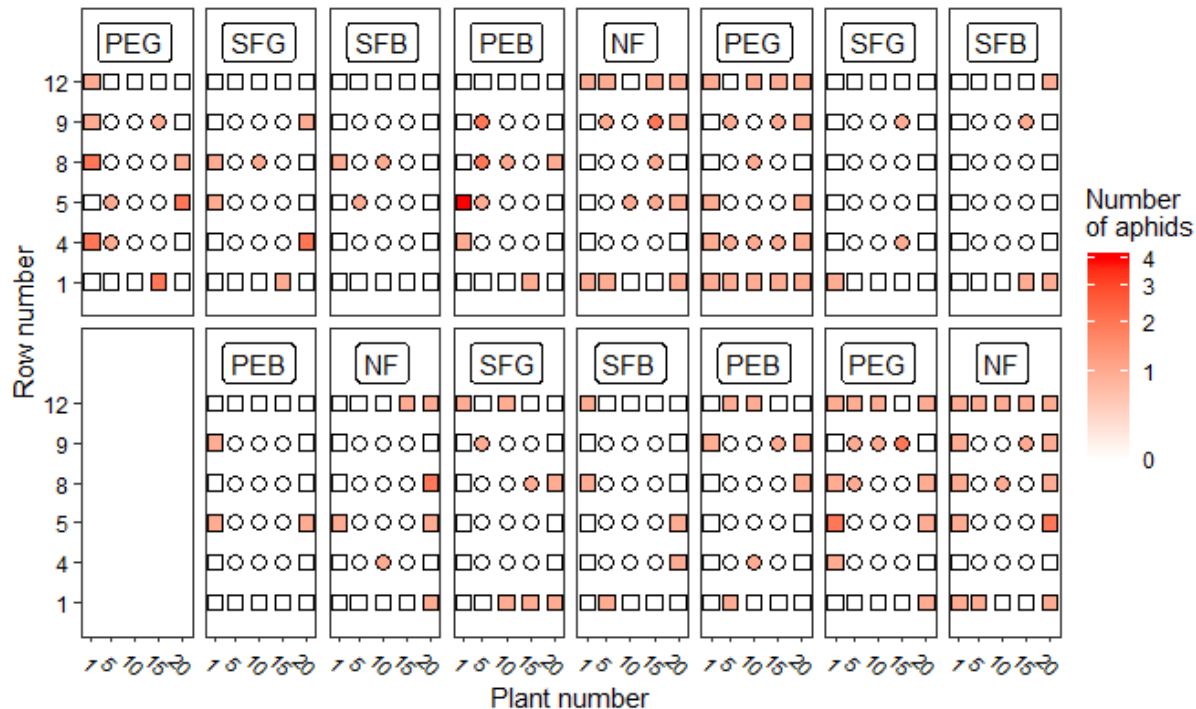


Fig.S3 Heatmap for the total number of aphids (alate and apterous) (May 16, 2018) with overview over all evaluated lettuce plants (n=450). Five treatments with three replications each on 15 randomized plots (n=30 per plot). Total number of aphids (alate and apterous) found in the 1st evaluation is represented by increasing colour hue. Evaluated plants are indicated by plant number (x-axis) and row number (y-axis). Outer plants at the edge to bare soil are shown as square dots, plants surrounded by other plants, as round dots. Orientation is north to south (from left to right). Treatment code in **Fig.2**

Figure S3 shows the total number of aphids (alate and apterous) for every evaluation plant in the first evaluation by increasing colour hue. In all treatments, more alate aphids on outer plants than on plants in the centre of the plots were counted, but the ANOVA (**Tab.9**, online resource 4) did not show statistical significance (p-value=0.19) for a location effect neither on average, nor within the plots (p-value=0.95). As for the total number of aphids, only the treatment effect was significant (p-value=<0.001). The mean ratios of counted aphids between inner and outer plants for each treatment are given in **Tab.13** (online resource 4). Number of infested plants was 47 (52%, NF), 30 (33%, PEG), 37 (41%, SFG), 5 (6%, PEB), 2 (2%, SFB).



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Fig.S4 Heatmap for the total number of aphids (June 22, 2018) with overview over all evaluated lettuce plants (n=450). Five treatments with three replications each on 15 randomized plots (n=30 per plot). Total number of aphids (alate and apterous) found in the 2nd evaluation is represented by increasing colour hue. Evaluated plants are indicated by plant number (x-axis) and row number (y-axis). Outer plants at the edge to bare soil are shown as square dots, plants surrounded by other plants, as round dots. Orientation is north to south (from left to right). Treatment code in **Fig.2**

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Figure S4 shows the total number of aphids (*N. ribisnigri*, only 1 alate individual) for every evaluation plant by increasing intensity of the colour in the second evaluation. In all treatments, more alate aphids on outer plants than on plants in the centre of the plots were counted, but the ANOVA (**Tab.15**, online resource 5) did not show statistical significance (p-value=0.067) for a location effect neither on average, nor within the plots (p-value=0.91). The mean ratios of counted aphids between inner and outer plants for each treatment are given in **Tab.6** (online resource 3). As for the total number of aphids, only the treatment effect was significant (p-value=0.025). Number of infested plants was 36 (40%, NF), 44 (49%, PEG), 17 (19%, SFG), 19 (21% PEB), 12 (13%, SFB).

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2nd Evaluation (beneficials)

Tab.S1 Total number of beneficial insect species found on ice-lettuce heads in the 2nd evaluation.
Treatment code in **Fig.2**

Treatment	Beneficial		
	<i>C. septempunctata</i> (imago)	<i>O. laevigatus</i> (imago)	Syrphidae (pupa)
NF	12	6	11
PEG	3	8	11
SFG	6	7	6
PEB	6	1	6
SFB	-	2	1