

[Episode 20] Sheets that lure pest with colors to trap and kill them

Outcome Example of Bio-oriented Technology
Research Advancement Institution

January 15, 2021 issue



The Hyogo Prefectural Research Institute for Agriculture, Forestry, Fisheries, Hamamatsu University School of Medicine, and Daikyo Giken Kogyo Co., Ltd. (Zama City, Kanagawa Prefecture) developed a revolutionary pest control sheet that efficiently kills pests simply by hanging it inside a greenhouse. This invention was born as a result of research on the visual behavioral characteristics of insects flying toward the boundaries (edges) created by differences in brightness or color. In recognition of its excellent practicality, it was awarded the “2020 MONODZUKURI Innovative Parts and Components Award (MONODZUKURI Life Civilization Institute Chairman's Award)” (sponsored by the MONODZUKURI Conference and Nikkan Kogyo Shimbun).

[Skillful use of the behavioral characteristics of pests]

Many insects rely on sight to survive. This color sheet was created by skillfully utilizing the visual behavioral characteristics of insects. Small pests do not fly aimlessly, but fly toward a specific target while controlling their attitude. Junya Yase, a researcher at the The Hyogo Prefectural Research Institute for Agriculture, Forestry, Fisheries, observed which parts of the patterned sheet had the most pests flying nearby, and found that many pests gathered around the patterns. It was found that pests use the borders (edges) created by patterned colors and the background (backdrop) as a visual target. This phenomenon is referred to as the "visual edge effect".

Therefore, with the cooperation of Daikyo Giken Kogyo Co., Ltd., yellow sheets printed with many shaded diamond patterns (Fig.1) and yellow sheets without diamond patterns were installed in a tomato cultivation greenhouse. An investigation regarding which sheet type could catch more pests was conducted. The diamond-shaped edge pattern mimics the leaves of a plant. Both sheets are



Fig.1
Insect trapping sheet with diamond edge pattern
(Provided by Daikyo Giken Kogyo Co., Ltd.)



Fig.2
Whitefly
(Provided by Junya Yase [including Photographs 4 and 5])

coated with an adhesive that insects become stuck to. The results of experimentation revealed that sheets with an edge pattern caught more whiteflies (Fig.2) than sheets without the pattern. By simply adding an edge pattern to a conventional sheet, the effect of attracting pests increased.

If so, how many edge patterns should be drawn on the sheet? As a result of the experiment using whiteflies, it was found that a sheet with a length of 260 mm and a width of 115 mm with 26 edge patterns had the highest trapping rate. Based on the relationship between the reflected wavelength and insect trapping efficiency, it was found that it was best to draw a specific greenish pattern on a sheet with a yellow background.

[Awarded the MONODZUKURI Innovative Parts and Components Award]

Thus, Last Boss R Type, an adhesive insect trap sheet is sold by Daikyo Giken Kogyo Co., Ltd. since 2019, was born. It is easy to use, need only to be hung from the ceiling inside the house (Fig.3). Since it is a release paper that peels off the surface when used, the sticky material does not stick to the hands, and being paper, it is easy to dispose of.



Fig.3
Greenhouse with edge color sheets
(Provided by Daikyo Giken Kogyo Co., Ltd.)

These practical advantages were highly evaluated, and this product was awarded the "2020 MONODZUKURI Innovative Parts and Components Award" (MONODZUKURI Life Civilization Institute Chairman's Award). In order to support the improvement of the competitiveness of Japanese product creation, this award recognizes parts and materials that are "unsung heroes" contributing to the development of industry and society.

According to Yase, a researcher who investigated the effect of controlling whiteflies, "because the edge patterned sheet catches the whitefly parents, the number of larvae generated in the greenhouse was reduced to one-fourth the number when there were no sheets."



Fig.4
Leaf miner fly



Fig.5
Thrips

This insect trapping sheet can also be used for trapping leaf miner flies (Fig.4), thrips (Fig.5), and Japanese beetles. The optimum number of sheets to be placed is 200 to 500 sheets per 10 ares, and the sheets are sold at around 55 to 60 yen per sheet. It is also a great advantage that the sheets can be used in combination with insect repellent nets, light irradiation, pesticides, etc.

URL for the "Episodes" series

<https://www.naro.go.jp/laboratory/brain/contents/fukyu/episode/index.html>

<Project name>	Cross-ministerial Strategic Innovation Promotion Program (SIP) “Technologies for creating next-generation agriculture, forestry and fisheries”
<Project period>	FY 2017 to 2018
<Title>	Development of novel integrated plant protection techniques for sustainable agricultural production
<Leading research institutes>	The Hyogo Prefectural Research Institute for Agriculture, Forestry, Fisheries, Hamamatsu University School of Medicine, Daikyo Giken Kogyo Co., Ltd., etc.