

# Doubly effective screen nets

*Innovative nets which are treated to filter out UV light, not only present a physical barrier they disorientate pests such as whitefly, leaf-miner, aphids and red spiders which reduces their ability to attack plants.*

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**T**he use of 50-mesh screens is an integral part of the routine IPM procedures maintained in the greenhouse industry of Israel as well as in other countries around the Mediterranean Basin. They were introduced as a physical barrier after severe outbreaks of silver leaf whitefly, *Bemisia tabaci* Gennadius Bellows and Perring and the tomato yellow leaf curl virus (TYLCV) disease for which this insect is a vector. Over the last few years it has been impossible to grow outdoor tomato crops in Israel, due to the marked increase in the whitefly population and the lack of efficient insecticides to control the pest. The high infection rates with TYLCV often totally destroy tomato and bean crops as these are sensitive hosts.

The blocking effect of these nets stems from the density of their texture, which interferes with the penetration capacity of insects. However, insect-proof screens of 50-mesh density (0.26-mm hole size) that are used routinely in the Israeli greenhouse industry are penetrated by small insects like the western flower thrips. Moreover, these screens cannot seal the

greenhouse hermetically even from the infiltration of larger insects such as whiteflies, leafminers and aphids (Figs. 1, 3, 4). We found that vegetable crops are protected from insect pests and virus diseases when grown in 'walk-in' tunnels covered with UV-absorbing polyethylene films. These covers act as filters eliminating the UV part of the light spectrum between 280 and 380 nm. This filtration effect led to a significant reduction in the infestation of crops grown under these covers from a wide range of insect pests including aphids, whiteflies, thrips and leafminers. We also found that tomatoes and cucumbers grown under these conditions were well protected against infection by the whitefly-borne viruses TYLCV and cucumber yellowing stunting disorder virus (CYSDV).

It seems that the elimination of parts of the UV range of the light spectrum interferes with the 'UV vision' of insects so that they can no longer orient themselves within the crop.

With this knowledge the goal of our study was to improve the performance of insect-proof nets by developing a product, which combines the mechanical

properties of the conventional nets with new optical properties in order to further amplify their blocking capacity.

**Nets tested** - Several types of nets, a 50-mesh 'Anti-virus' net; 30-mesh 'Anti-insect' net; and 16-mesh 'Defense net' produced by Klayman Meteor, were tested in a conventional version and of Israel an "optical" "BioNet" version. This has now been patented by Klayman Meteor. The 'BioNet' hole size is identical to that of the conventional net but the net has the ability to filter out the UV-A and UV-B range of sunlight. It is made of high tensile strength round monofilaments which are UV stabilised and light in weight.

Field experiments on TYLCV-susceptible tomato plants were conducted in the Habshor region in southern Israel. Plants were grown in a complex of 36 'walk-in' tunnels (6 X 6 X 2.7 m) that were covered with the tested nets. Plants were maintained according to routine commercial procedures, except that insecticides were not applied during the experiment. We measured the protection effect of the nets against whitefly *B. tabaci* by means of



The pressure from insects makes it essential to grow tomatoes in greenhouses rather than outdoors.

sticky traps spread of tomato yellow leaf curl virus (TYLCV) disease of visual appearance, leaf miner, red mites, and rust mites by random sampling of leaves.,. The effect of the screen type on population densities of aphids was measured in cucumbers using similar experimental procedures as above. Infestation was measured by random sampling of leaves.

**Reduced infestation** - We found that 'BioNet' 50 mesh screens gave significantly better protection, resulting in less penetration by whitefly and a drastic reduction of infection by TYLCV (Fig. 1). Only 25% of plants grown under 'BioNet' screens were found infected and approximately 90% of the plants reached normal height. A considerable number of whiteflies were trapped under conventional 50 mesh nets and infection rates by TYLCV in the conventional treatment were as high as 80%, 50 days after planting. The 50-mesh 'BioNet' screens reduced drastically the infestation of tomato with red spider mites (*T. telarius*). The average number of mites found on leaves under the BioNet screens was ten times less than under the conventional nets (Fig. 2). Similar populations of the rust mite (*V. lycopersici*) were found under both types of net. The number of leaves infested with the greenhouse leafminer was eight times greater under the conventional 50-mesh screens than under the 'BioNet' screens (Fig. 3). 'BioNet' screens of 16 and 30 mesh was more effective than the conventional nets of the same mesh size, in protecting against aphids.

Considerable numbers of aphids were found under the conventional 50-mesh screens despite the relatively large size of these insects (Fig. 4). However, 50-mesh 'BioNet' screens reduced drastically the infestation with aphids (*A. gossypii*) and were significantly superior to the conventional 50-mesh screens in this respect. This result is observed by the high percentage of devastated plants caused by aphids under conventional nets compared with zero devastated plants under 'BioNet' screens.

**Balancing act** - It was also proposed that insects differ in their sensitivity to the elimination of UV from the light spectrum. If so, the UV filtration by the 50-mesh 'BioNet' screens is at a level which is sufficient to interfere with the penetration of whiteflies, aphids, red spider mites and leafminers. However, none of the 'BioNet' screens of 16- and 30-mesh densities was able to reduce the transmission of UV light below the critical level so the protection mechanism of these nets remained a mechanical one. One of the disadvantages of using dense insect-proof screens in greenhouses in hot climatic regions is their contribution to reduction of ventilation and to elevation of temperatures in the structures. We would suggest that greenhouses covered with UV-absorbing films on their roofs can act as effective UV filters which can compensate for large-size holes of low mesh BioScreens. Combinations of this type may provide an improved climatic environment for the plants and protect them from invasion of insect pests and virus diseases. □

Figure 1 - Trapping of *Bemisia tabaci* on yellow sticky traps in 'walk in' tunnels covered with conventional and 'BioNet' screens of 50 mesh size.

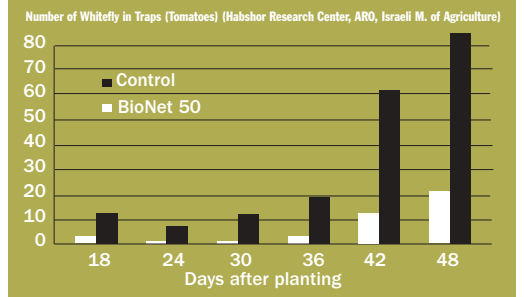


Figure 2- Comparison of conventional and 'BioNet' screen for their effectiveness in protecting tomato crops from infestation with red mites and rust mites

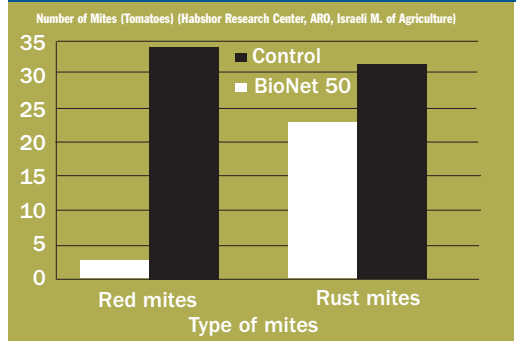


Figure 3 - Comparison of 'BioNet' 50 mesh and conventional 50 mesh net of protection capability against tomatoes insect pests.

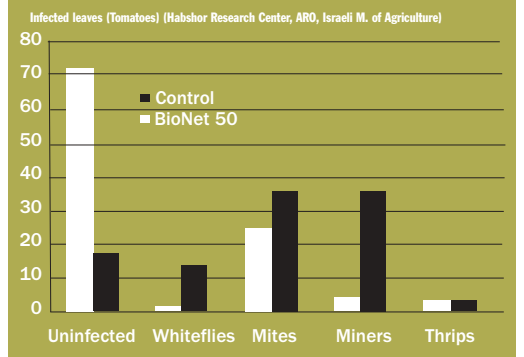


Figure 4 - Trapping of Aphids on yellow sticky traps in 'walk in' tunnels covered with conventional and 'BioNet' screens of 50 mesh size.

