



*Colonies of the
scale insect
Neopulvinaria
innumerabilis
on grapevine*

Controlling *populations*

Within the concept of sustainable agriculture, controlling pest populations through non-chemical approaches is the final step of a long process. It encompasses study and analysis of invasive and emerging species and their interactions with other species and abiotic factors in the habitat they colonize. 'Controlling' does not imply complete annihilation of target populations, but establishment of a social, environmental, and economic threshold below which practitioners, agronomists, and growers estimate acceptable losses. Biological control and chemical control can be integrated to reduce pest populations below that threshold.



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Three sustainable pest management practices that are independent and complementary include classical biological control, environmental interactions and agroecology.

Classical biocontrol at Agropolis addresses management of invertebrate pests such as insects and mites by introducing natural enemies and, less frequently, invasive plant management. These introductions are controlled and monitored long-term. In Europe, unlike in the United States, Australia, New Zealand, and South Africa, the study of biological control of plant pests is at a very early stage of development as no enemy has yet been released *in natura*. Thus, most studies in Europe concern with using predators, parasitoids, entomopathogenic fungi and baculoviruses against insect or mite pests. Released in open habitats or in greenhouses, such natural enemies are working as sustainable management tools against pests of economic importance on legumes, cereals, and trees.

Key components of sustainable crop production include safety and environmental quality. In this context, the study of environmental interactions aims at pest management based on consideration of natural elements such as climatic conditions, soil structure, and species complexes, including micro-organisms, that coexist and interact with the crop plant and its associated fauna.

Agroecosystems are now the targets of new economic, social and environmental stakes: to safely produce large quantities of high-quality food; to prevent health and environmental hazards; and to restore ecologically degraded landscapes. In this perspective, agroecology aims to improve animal and plant biodiversity through management of plant populations, whether in cropping systems or natural environments. The idea is also to preserve and conserve native natural enemies and the role of reservoir zones for beneficial fauna is positively considered.

These different management strategies are connected to the public opinion and environmental awareness that spurred legislation calling for the reduction in the use of agrochemical products, which is one of the main ideals of sustainability in crop production.

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