

Push-Pull Technology, A Strategy For Controlling Agricultural Pests By Using Repellent

Posted on October 5, 2019

Push-Pull Technology and Ecological Pest Management

“Push-pull technology is a strategy for controlling agricultural pests by using repellent” push “plants and trap” pull “plants. For example, cereal crops like maize or sorghum are often infested by stem borers. Grasses planted around the perimeter of the crop attract and trap the pests, whereas other plants, like Desmodium, planted between the rows of maize, repel the pests and control the parasitic plant Striga. Push-pull technology was developed at the International Center of Insect Physiology and Ecology (ICIPE) in Kenya in collaboration with Rothamsted Research, UK and national partners.

Individual resistance to parasites: I identify the animals most sensitive to parasitic infestations, take it into account as a selection criterion within genetic improvement programs, and discard the individuals that are “reservoirs” of parasites. Bulls with greater resistance tend to generate offspring that are also less sensitive.

- Choosing products with a wide spectrum or specific products: The first group attacks more than one parasite simultaneously, for example, internal and external parasites, which is positive in certain situations. However, its excessive use stimulates the formation of resistance.
- Implementation of good livestock practices: the management of cattle within a broad perspective that covers health, nutrition and animal welfare aspects is a strategy to increase productivity because it reduces the stress level of the herd and improves its performance.
- Frequency of application of antiparasitic treatments: “Routine” applications or commercial promotions lead to loss of money because they do not obey the technical criteria based on diagnosis and are not selective or oriented to the groups of animals that really need it. Both the livestock producer and the technical assistant should reflect on the following: When is the best time to do it? Is it really necessary? What are the consequences of not deworming at a given time?

Drosophila suzukii is a serious pest of strawberries, which oviposits in growing fruits. The control strategies are based on foliar applications of chemical insecticides. (Cook et al., 2007) Alternatives to suppress oviposition such as attract-kill and the use of oviposition deterrents were still under investigation. So, in the present work, two types of control were used in combination as a push-pull

strategy, both in the laboratory and in the field. In laboratory trials, both a mass trapping device (pull) and a deterrent to oviposition (push: 1-octen-3-ol) reduced the oviposition of *D. suzukii* and the combination of the two (push-pull) resulted in greater reduction than any treatment alone. In field experiments, the reduction of oviposition in strawberries was observed in the plots treated with the oviposition deterrent (push) or a combination of mass capture and dissuasive devices (push-pull) in comparison with the control plots. The conclusion is that push-pull treatments negatively affect *D. suzukii* both in the laboratory and in the field. In the laboratory, the additive effect of push-pull acted in a finite population, while in the field, the main effect was due to the push effect.

Repellent Plants, Trap Crops, and the Protection of Cereal Agriculture

The group carries out pest and disease control designs of crops, using knowledge about pathogens and pests, such as those for each crop. In these control designs, priority is given to ecological methods (applying natural products, botanical insecticides, attractant plants and/or repellents, natural enemies, cultural techniques, etc.), looking for also that the crop is protected effectively. Bioactive natural products are an alternative to the use of synthetic chemical phytosanitary. The retreat of these chemicals by the EU makes it necessary to seek remains of effective alternatives and relatively low cost. Botanical insecticides and fungicides can be applied in the field (there are already some commercialized ones, and the results are very satisfactory). The investigations which are made indicate that there are different plants that can become viable alternatives to improve the performance and quality of agricultural products without negative impacts on the environment and people.

The idea is to look for plants that have bioactive compounds in pests and pathogens, evaluating both their effectiveness and the best way to apply them in culture. These bioaccumulated plants, in addition to providing a method of control, become a new source of income by acquiring an important added value. (Khan et al., 2014)

Bioactive Compounds and the Selection of Effective Companion Plants

The push-pull strategy was initially incorporated as a tool in the Integrated Pest Management (IPM). The components of this strategy are based on stimuli to manipulate the distribution and abundance of insects, both herbivores and natural enemies, from the use of natural or synthetic semiochemicals. From these, pest insects tend to leave the growing area, either by using a with repellent properties or by the application of semiochemicals (stimulus pushing), migrating to a trap culture with attractive properties or to traps with synthetic semiochemicals (pull stimulus). The use of plants with desirable push and pull properties is more indicated than the use of synthetic products because composing a

diversified system increases the sustainability of the system and the maintenance of natural enemies.

Polyculture is an agricultural practice where natural mechanisms related to the abundance of insects use the push-pull strategy. In this way, it is essential to know the biological diversity and their interactions, as well as the habitat structure. Another step It is important to define, on a scientific basis, the plants that will be part of the target pest. This is a technology that requires a clear understanding of the interaction between plants and insects, allowing the advancement of this strategy in the management of agricultural pests of medical and veterinary importance. This knowledge reliability of the system, especially in relation to the final culture, as well as socio-economic and environmental benefits.

References

Cook, S. M., Khan, Z. R., & Pickett, J. A. (2007). The use of push-pull strategies in integrated pest management. *Annual Review of Entomology*, 52, 375–400.

<https://doi.org/10.1146/annurev.ento.52.110405.091407>

Khan, Z. R., Midega, C. A. O., Pittchar, J. O., Pickett, J. A., & Bruce, T. J. A. (2014). Push-pull technology: A conservation agriculture approach for integrated management of insect pests, weeds and soil health in Africa. *International Journal of Agricultural Sustainability*, 12(2), 162–170.

<https://doi.org/10.1080/14735903.2013.862157>