Biological control of the pod borer Maruca vitrata with exotic parasitoids

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Summary

The pod borer Maruca vitrata (Fabricius) causes extensive damage to cowpea, not seldom reaching up to 80% yield loss. Recent advances in its control are based on releases of two specific parasitic wasps which were supplied by the World Vegetable Center labs in Taiwan. Introductions across Benin and Burkina Faso have indicated a reduction in the pod borer population greater than 85%. Releases are carried out in collaboration with national agencies, and normally after two years the parasitoids establish themselves on wild vegetation, from where they move to cowpea fields during the cropping season. This approach is coupled with the use of resistant/tolerant varieties and the application of neem products or other compatible biopesticides to fight companion pests in cowpea such as aphids and thrips, which keep application of chemical pesticides to a minimum or displace them entirely.

Technical Description

Parasitic wasps are reared in the lab using live caterpillars of the pod borer. They are released by national researchers and phytosanitary officers, either on cowpea fields during the cropping season or on wild host plants during the off season. After the releases, populations of the parasitoid get established around the sites, and start to reproduce and spread to nearby regions, colonizing entire cropping areas. Depending on the intensity of the releases it takes 1-2 years before the biocontrol agents start reducing the pod borer population with no further action. Once the natural enemies of pod borers are fully established there will be no need for releasing them again since the resident population will perpetuate across entire agricultural landscapes. In areas where the pod borer is the main pest, parasitic wasps can sufficiently reduce population to keep damage to cowpea under the minimal threshold and hence no further interventions are required. In areas where other pests impact cowpea production, there is need for additional use of biopesticides such as neem products. The biocontrol agents substantially reduce the pest population, leading to surplus yields in cowpea, which are as a ‘bonus’ for farmers because they did not have to carry out any intervention and hence no costs from their sides, just net benefit !

Uses

Legume pod borers are key pests throughout the cowpea cropping areas in West Africa, with increasing importance is localized areas of Zambia and Mozambique in Southern Africa. Field data from releases of the parasitoids in Benin and Burkina Faso indicate that, a reduction of up to 85% of the pod borer population was obtained after 3 years. Limitation of the biocontrol activity may occur when there is a lack of caterpillars of pod borers for the parasitic wasps to thrive on, which can happen under Sahelian conditions where key alternative host plants are not available during the dry season. Another limitation of the biocontrol technology is its incompatibility with the application of most chemical pesticides. This particularly takes place when chemical pesticides are sprayed early in the season, as they kill most of the biocontrol agents before they can parasitize the pod borer. Using parasitic wasps is however highly compatible with most biopesticides such as neem product or entompathogenic organisms (fungi and viruses), so they can easily be integrated in pest management approaches.

Composition

Details of the rearing methodology are given by this comprehensive presentation, which is supposed to be of use for national biocontrol labs https://cgiar-my.sharepoint.com/:p:/g/personal/m_tamo_cgiar_org/EYQ-Q7bwOYNLpXWgP-KhWU0BTslYZygtvShEXA3xJQa9vA?e=kBafXa

Means of application

This approach does not require direct farmer involvement for implementing the technology. However, farmers need to be sensitized that chemical pesticides for other cowpea pests such as aphids, flower thrips and pod sucking cannot be applied in areas where biocontrol agents have been released, but rather have to use biopesticides. Another important point farmers need to be made aware of through sensitization campaigns, is the protection of some of the alternative host plants such as legume trees Lonchocarpus sericeus, Millettia thonningii, Peterocarpus santalinoides and Philenoptera cyanescens. All these species of trees make a superior quality of charcoal for which they get preferentially harvested and have become rare in some areas with high population density.

Agroecologies	All Agroecologies.
Regions	Africa South of Sahara.
Developed in Countries	Benin, Burkina Faso, Niger, Nigeria.
Available in	Benin, Burkina Faso, Mali, Niger, Nigeria.
Solution Forms	Input Supply.
Solution Applications	Insect control.

Agricultural Commodities	Cowpea.
Target Beneficiaries	All farmers.

Commercialization

Commercialization Category

Management technology with limited commercial potential

Startup Requirements

1) Mapping of areas with cowpea yield losses due to pod borer, 2) Raising awareness of national agricultural systems about the use and benefits of parasitic wasps, 3) Put in place conducive national policy for the importation and releases of biological control agents, 4) Establish colony rearing for the biocontrol agents at entomology labs, and 5) Ensure year-round availability of host plants for pod borers to maintain the parasitoid population.

Production Costs

For the moment all production costs are project-based. Assuming that the basic infrastructure such as simple labs with electricity and water supply are available, to install an initial pilot colony of parasitoids will require a startup amount of USD 5,000, and an average of USD 6,000 per year for running costs. This is an estimate per country.

Customer Segmentation

all cowpea farmers near to release regions

Potential Profitability

Releases of parasitic wasps in Benin and Burkina Faso have led to a reduction of 85% in the population of pod borer population. Early findings indicate cowpea yield increases from 40 to 60% as a result of the biocontrol agents, but these are subject the presence of other pests, diseases and parasitic weeds, and soil fertility factors that affect the growth of cowpea crops.

Licensing Requirements

Importation and release permits from national plant health agencies are required for the pod borer biocontrol technology to be used. No commercial licensing is required as the solution has been developed as a public good.

Innovation as Public Good

Biological control agents for cowpea pod borers have been developed by the World Vegetable Center in Taiwan and are disseminated across Sub-Saharan Africa by IITA

under a material transfer agreement. This work was co-funded by the CGIAR Research Program on Grain Legumes and Dryland Cereals (GLDC), the United States Agency for International Development (USAID) under Agreement #7200AA18LE00003 as part of Feed the Future Innovation Lab for Legume Systems Research, and the Bill and Melinda Gates Foundation (BMGF) under OPP1082463. Any opinions, findings, conclusions, or recommendations expressed here are those of the authors alone

Institutions



Accompanying Solutions

Resistant/tolerant cowpea varieties against pests such as aphids, thrips and pod bugs. Biopesticides such as the innovative ‘neem tea bags’ that can be produced and sold as a community-based enterprise like by women groups in Niger.