Abstract

Suitability of biofuel crops as hosts for larvae of western corn rootworm, Diabrotica virgifera virgifera

One of the most important biofuel crop is maize. To reduce negative effects of a large scale and continuous cultivation of maize a number of alternative plant species have been suggested. Although there are a considerable number of studies evaluating the economic, environmental or social aspects of their cultivation, direct or indirect effects of these plants on agricultural pests are rarely investigated. In particular, whether these plants are suitable hosts for the larvae of the western corn rootworm (WCR), Diabrotica virgifera virgifera LeConte – a serious pest of maize, is unknown.

In a series of greenhouse experiments the host status and quality of 49 plant species and varieties for the larvae of WCR were evaluated, including 16 forage grasses (e.g. a number of Lolium and Festuca varieties), six switch grass varieties (Panicum virgatum), 18 Sorghum species/varieties, Miscanthus x giganteus (Mxg), five other Miscanthus genotypes and three broadleaf species. To assess the host quality of these plants for the development of WCR the number of surviving larvae, the head capsules widths and their dry weights were recorded.

Of the 22 forage and switch grasses examined 16 hosted WCR larvae. However, the percentage of larvae that survived for 18 days, their dry weights and head capsule widths were significantly less than that recorded for larvae that developed on maize roots. The roots of most (i.e. 15) of the 18 Sorghum species or varieties tested were unsuitable for the development of WCR larvae. The opposite was true for the Miscanthus species tested. The number of larvae recovered from Miscanthus x giganteus roots, their dry weight and head capsule widths were the same as those recorded for larvae reared on the maize control. The other Miscanthus genotypes were less suitable than Mxg, but still more suitable than all the forage and switch grasses tested. In accordance with all previous studies, which examined hosts other than maize, no larvae developed on the three broad leaf species.

The quality of most of the tested ‘alternative hosts’ for WCR larvae is considerably less than that of maize. This resulted in fewer larvae becoming established and surviving and a prolonged larval development, as indicated by smaller head capsule widths and reduced dry weights. Based on the results the majority of the forage and switch grasses tested are not suitable for eradicating small and recently established populations. Despite of this these grasses can be used as an alternative to maize and as part of a crop rotation strategy when D. v. virgifera is established. The low host quality of these grasses will result in a decreasing population size of D. v. virgifera and a diversification of biofuel crops.

All Sorghum varieties tested were not suitable hosts for WCR larvae. Therefore, if grown in rotation with maize, Sorghum provides a highly effective and ecological friendly way of controlling WCR and is highly productive.

The tested species of Miscanthus, especially M. x giganteus, were good hosts for WCR. The long crop cycle of Miscanthus rhizomes of up to 20 years would appear to provide an excellent and long lasting source of high numbers of WCR adults, as continuous maize production does. However, this depends on the egg laying behaviour of the female beetles. Only if they will lay their eggs in established Miscanthus stands the life cycle of the beetle will be completed.