

Activity of biochar on the effectiveness and persistence of some insecticides against *Spodoptera littoralis* (Boisduval) on cotton plants

Ghada N. El-Masry¹, Oiva Niemeläinen², El-Zahi S. El-Zahi¹,
Magdy M. Mohamed³, Kari Tiilikkala²

¹ Plant Protection Institute, Agriculture Research Center, Egypt

² Natural Resources Institute Finland (Luke), 31600 Jokioinen, Finland

³ Field Crops Research Institute, Agriculture Research Center, Egypt

Slow pyrolysis is the method by which agriculture wastes can be processed into value added products such as biochar which has gained importance as a soil amendment. It can increase e.g. soils ability for sorption. For this reason, applications rates of synthetic pesticides that are used as soil treatments to suppress the population of pests should be revised. In Egypt, cotton is susceptible to a wide range of pests, especially the Egyptian cotton leaf worm *Spodoptera littoralis* (Boisd.). A broad amount of pesticides is used for its control. To study the effect of biochar on the effectiveness of pesticides pot experiments were conducted at the Ismailia Agricultural Research Station, Egypt in 2017. Our main aim was to study the effect of mixing biochar with soil on the efficacy of methomyl, imidacloprid, indoxacarb and thiamethoxam applied as soil drenching to cotton plants after 60 days of emergence against *S. littoralis*. All the tested insecticides were applied at the 1) recommended, 2) three quarters of the recommended and 3) half of the recommended concentrations. The 2nd and the 4th instar larvae of *S. littoralis* were used for determination of the efficacy and persistence of the tested insecticides. The obtained results indicated that biochar treatments resulted in the higher effectiveness of the three tested concentrations of each insecticide against the 2nd and the 4th instar larvae of *S. littoralis* compared with the treatments without biochar. The biochar treatments prolonged the effectiveness of the tested insecticides up to 21 days post application, as without biochar the insecticides were effective only 7 days from the application. The lowest concentrations of all the tested insecticides applied to biochar treated soil were more effective than the highest concentrations applied to treatments without biochar in soil. In this study, all low concentrations of the applied insecticides in soil contain biochar showed a high efficiency against *S. littoralis*. For that reason, many positive impacts could be indicated. First, we could reduce the amount of applied pesticide in the same time having a good result for pest management. Second, we could reduce the number of applications of insecticides which has economic value to the farmer. The last but not the least impact is the potential to reduce the environmental risks of pesticides leaching and the sequestration of carbon in the soil. Both of the impacts will be needed in development of climate smart farming systems and IPM programs. The final results of this study suggest that soil amended with low SSA biochar enables cotton growers to reduce farming costs and lower the environment risks through using the least concentrations of the insecticides and smaller numbers of applications to obtain the desirable insect control. Further field studies are required to determine the adequate addition rate of biochar to the different kinds of soils under the open field conditions in order to gain the highest benefits of using biochar in sustainable farming systems.

Keywords. Cotton - Biochar - *Spodoptera littoralis* - Insecticides – Soil.