1. Describe niches where biological control products might have an advantage over chemical products.  Explain what they are and why they work.

In situations where a pest has developed a resistance to chemical products, using the chemical product no longer works to the degree you want it to. Introduction of a biological control product may help to control this pest without the use of the chemical they are resistant to. In situations where chemical products are not available, a biological control can be useful to control disease. An example would be root diseases. You cannot easily spray a chemical product onto the root of a plant so introduction of a predatory nematode or an antibiotic producing microbe might be useful to control your pest.

1. Describe how one can manipulate the rhizosphere microbial communities to favor biological control of a pathogen.

In wheat take-all, if you continuously crop wheat for a period of five years, you will see a steady decline in the incidence of take-all and a rise in yield. This is due to a shift in the microbial community in the soil. The lesions created by the take-all are colonized by *Psuedomonas* spp. which produce antimicrobial compounds. These antimicrobial compounds reduce the efficacy of the wheat take-all disease which leads to increased yields.

1. What are the management strategies on which biological control is based on?

Biological control is based on conversion or enhancement, introduction, and augmentation. Enhancement involves the modification of the environment to bolster the number of naturally occurring enemies of a pest. Introduction involves introducing a natural enemy in order to control an introduced pest. Augmentation involves adding a natural enemy to control a natural pest.

1. Is the use of non-registered biological products for disease control in agriculture legal?

The use of non-registered biological products for disease control in agriculture is not legal. The EPA requires registration to ensure the biocontrol product is not harmful to humans in any way. Use on agricultural lands will require this EPA registration or an experimental registration if it is to be used for field tests. The use of unregistered biological products can be used on non-public lands.

1. Write a brief abstract of the publication by Quesada-Ocampo on *Phytophthora capsici*linked here: LinaMaria\_Ph\_capsici\_inCreeks.pdf (Links to an external site.)Links to an external site.

*Phytophthora capsici*, a common pest of cucumber, has been thought to overseason in irrigation water. Irrigation with contaminated water can lead to inoculation of a field and cause major loss to yield. In this study, 106 *P*. *capsici* isolates from a creek used for irrigation and a field adjacent to the creek were evaluated using polymorphic nuclear loci. Bayesian analysis showed four clusters present in the isolates which fluctuated in frequency depending on the year. Data collected on phenotypic data showed variation as well, preferring phenotypes resistant to mefenoxam in later years. Analysis of mating types A1 and A2 revealed even ratios in middle years and preference towards A1 in 2001 and A2 in 2006.