

2. Pesticides have been utilized for many years to increase food production and control pest populations. Pesticide use can be both beneficial and harmful to humans and other organisms.
- (a) Pesticide use has advantages, disadvantages, and unintended consequences on human health. **Describe** one benefit to human health that can result from the use of pesticides.
- (b) **Identify** one way chemical pesticides can enter the human body.

Cotton farmers in the southern United States used a chemical pesticide to control an insect cotton-crop pest over a 40-year period. To study the effectiveness of the pesticide as an insect pest-control strategy, traps were placed in treated cotton fields and the number of pests captured were compared to application rates for the pesticide. The results of the study are shown in the table below.

| Year | Grams of Pesticide Applied per Hectare | Number of Crop Insect Pests Captured |
|------|--|--------------------------------------|
| 1960 | 0                                      | 700                                  |
| 1975 | 500                                    | 2                                    |
| 1980 | 500                                    | 3                                    |
| 1985 | 500                                    | 8                                    |
| 1990 | 550                                    | 14                                   |
| 1995 | 600                                    | 83                                   |
| 2000 | 700                                    | 150                                  |
| 2005 | 800                                    | 405                                  |
| 2010 | 900                                    | 727                                  |
| 2015 | 1,000                                  | 1,100                                |

- (c) Use the data in the table to answer the following questions.
- (i) **Identify** the year when the pesticide was most effective at reducing the size of the pest population.
- (ii) **Describe** the change in the number of crop insect pests in the cotton fields over time.
- (iii) **Explain** how the change in the cotton-crop pesticide effectiveness between the initial application in 1975 and the latest application in 2015 illustrates genetic resistance in pests, based on the data in the table.
- (d) **Describe** TWO effects of pesticide use, other than death, on nontarget wildlife.

- (e) There are many problems associated with the repeated application of chemical pesticides to reduce pest populations.
- (i) Crop rotation is often used to reduce pesticide use. **Describe** the process of crop rotation.
- (ii) **Propose** one reasonable method, other than crop rotation, of reducing the use of pesticides in agricultural practices while still maintaining a high crop yield.
- (iii) **Justify** how the method proposed in (e)(ii) would provide a benefit to humans.

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**Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.**

**Question 2: Analyze an Environmental Problem and Propose a Solution****10 points**

- (a)** Pesticide use has advantages, disadvantages, and unintended consequences on human health. **Describe** one benefit to human health that can result from the use of pesticides. **1 point**

Accept one of the following:

- Control disease vectors, such as mosquitos, ticks, rats, mice that can spread diseases to humans/between humans.
- Reduce exposure to stinging insects that carry disease.
- Increased food production leads to decreased famine/increased availability of food, improving human health.

**Total for part (a)** **1 point**

- (b)** **Identify** one way chemical pesticides can enter the human body. **1 point**

Accept the following:

- Inhalation/Breathing (in aerosols and powders)
- Drinking water contaminated by runoff (from farms, yards, golf courses, etc.)
- Consumption of food (pesticide residue on or in food eaten by consumers)
- Dermal absorption/through skin during application of pesticide

**Total for part (b)** **1 point**

- (c) (i)** **Identify** the year when the pesticide was most effective at reducing the size of the pest population. **1 point**

- 1975

- (ii)** **Describe** the change in the number of crop insect pests in the cotton fields over time. **1 point**

Accept one of the following:

- From 1960 to 2015 the number of pests captures increased from 700 to 1100.
- The number of pests was high before the pesticide was used, then it dropped dramatically after the first application and then increased again over time.
- The number of pests went from 2 captured in 1975 to 1100 captures in 2015.

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- (ii) **Propose** one reasonable method, other than crop rotation, to reduce the use of pesticides in agricultural practices while still maintaining a high crop yield. **1 point**

Accept one of the following:

- Use integrated pest management to control the insect crop pest.
- Use a method of pest control that employs a variety of biological, physical, and chemical methods to control the insect crop pest.
- Reduce stubble/crop residues in fallow fields that can harbor the insect crop pest.
- Apply the pesticide when the insect crop pest is most susceptible.
- Use intercropping rather than a monoculture to reduce the amount of habitat for the pests.
- Use pest-resistant genetically modified organisms.

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- (iii) **Justify** how the method proposed in (e)(ii) would provide a benefit to humans. **1 point**

Accept one of the following:

- Reduction in pesticide residue in food/reduction of pesticide ingested by humans.
- Economic benefits to humans including:
  - Less money spent on pesticides
  - Increased profit for farmers from crops
  - Less equipment required/less labor required to spray fields with pesticides
- Reduction in the number of workers exposed to pesticides/Improved health in agricultural workers from reduced pesticide exposure.

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**Total for part (e) 3 points**

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**Total for question 2 10 points**