



## Chapter 10: Agriculture, Biotechnology, & the Future of Food

### Terms to know:

Genetically engineered crops	Genetically modified organisms (GMOs)
Transgenic plants	Undernourishment
Overnutrition	Malnutrition
Green Revolution	Arable land
Biocontrol	Bt
Integrated pest management (IPM)	Pesticides
Selective breeding	Genetic engineering
Recombinant DNA	Biotechnology
Precautionary Principal	Seed banks
Feedlots	Aquaculture
By-catch	Sustainable agriculture
Community-supported agriculture	Organic farming
Food labeling	

### Possible Transgenic maize in Oaxaca, Mexico

1. What are genetically engineered crops?
2. How do scientists accomplish this?
3. What is the concern about these transgenic plants?

### The Race to Feed the World

4. What are the causes for the poor distribution of food to people who need it?
5. What is food security?
6. What factors have allowed us to increase food production?
7. What is undernourishment?
8. What is overnutrition?
9. What is malnutrition?
10. What was the green revolution's contribution to agriculture and food supply?

11. When did this begin?
12. What crop was produced and what was it bred to do?
13. What did it do for wheat production?
14. What was the positive side of the green revolution?
15. What was the negative side?
16. What is the benefit of monoculture?
17. What happens to biodiversity in monoculture? Why?
18. How many different crop species are in our diets? What percentage of the total food we eat does this represent?

### **Pests and Pollinators**

19. How many pounds of active ingredient pesticides are applied every year in the US?
20. How do insects and microbes develop resistance to pesticides?
21. What is the "evolutionary arms race" that chemists are facing? (Figure 10.7)
22. What is biocontrol?
23. What do parasitoid wasps do when they breed?
24. What is Bt and how is it used?
25. What are the problems associated with biocontrol?
26. What is the concern with the cactus moth?
27. What is IPM and how does it work?

28. Why are insects so important to our food crops?

29. What is the trend scientist are seeing in our pollinators?

**Genetically Modified Food**

30. What is genetic engineering?

31. What are *GMO's*?

32. What is recombinant DNA?

33. Check out Figure 10.13. Briefly describe the development of each of the *GM* foods in the table and what happened to it.

Golden rice -

Flavr Savr Tomato -

Ice-minus strawberries -

Bt crops -

Starlink corn -

Sunflowers and superweeds -

Roundup Ready crops

Terminator seeds -

34. In what 3 ways is selective breeding in traditional agriculture different from *GM* crops?

35. In what ways are most plants engineered today?

36. What crop accounts for most *GM* food?

37. What were and are some of the concerns of GM foods?
38. What are some of the arguments in favor of GM foods?
39. How do supporters claim GM crops reduce carbon emissions?
40. What is the precautionary principal?
41. What are some of the ethical issues involved in GM food production?
42. What happened in the Monsanto-Schmeiser case?
43. What did the European Union do concerning GM foods during 1998 to 2003?
44. What resulted from this?
45. What did Zambia do about GM foods?

#### **Preserving Crop Diversity**

46. What is the danger of monoculture when it comes to the preservation of our food crops?
47. What has happened to the diversity of wheat crops in China?
48. Maize in Mexico?
49. What is the primary cause for this decline in diversity?
50. What do seed banks do?
51. What is the "doomsday vault" and where is it located?

#### **Feedlot Agriculture**

52. What are feedlots also referred to as?

53. What are the advantages of feedlots?
54. What problems are associated with feedlots?
55. How much waste does one dairy cow produce per year!
56. What do they inject into these cattle and for what reason?
57. How much manure in a day will a steer generate?
58. What happens to all the waste?
59. What happens to chemicals such as antibiotics that animals are given when crowded like this?
60. How can the manure be used for agricultural purposes?
61. What do you eat every day to ensure you get enough energy and the nutrients you need to grow properly?
62. Why is eating meat far less energy efficient than eating vegetables?
63. How much land area is needed to produce 2.2 lbs. of pork?
64. Eggs? Chicken? Milk?
65. How much water for each?

### Aquaculture

66. What is aquaculture?
67. What can uneaten fish scraps be used for?
68. What is by-catch?
69. How much more efficient is fish farming than ocean harvesting?

70. What happens when dense populations are farmed?
71. What problems does waste create?
72. What problems does the fish diet create?
73. What happens when non-native and native species meet?
74. What is the scenario with GM salmon if they are released into wild life habitats?

**Sustainable Agriculture**

75. What is low-input agriculture?
76. What was the Organic Food Production Act of 1990?
77. Look at Table 10.3. List 5 of the criteria for crops to be considered organic and 4 for livestock.
78. What benefits do farmers have from organic farming?
79. Read "Organic Farming" on p. 288---How does organic farming help the soil?
80. What are some of the obstacles to organic farming?
81. Why do you think you pay more for organic labeled foods?
82. What is community-supported agriculture?