Crops and Food
Demonstrators notes

Q1. Which crops are included in the CEREALS, TOTAL + category? (Hint: Using the FAOSTAT Database Query page, click on ITEM then CEREALS, TOTAL+)

Wheat, rice, barley, maize, pop corn, rye, oats, millet, sorghum, buckwheat, quinoa, fonio, Triticale, canary seed, mixed grain, cereals.

Q2. What do the following agricultural terms mean? (Hint: Using the FAOSTAT Database Query page, click on ELEMENT)

Yield? **The data reported under this element represent the harvested production per unit of harvested area for crop products. In most cases yield data are not recorded but obtained by dividing the data stored under production element by those recorded under element: area harvested. Data are recorded in hectogramme (100 grammes) per hectare (Hg/Ha)**

Production? **Crop production data refer to the actual harvested production from the field or orchard and gardens, excluding harvesting and threshing losses and that part of the crop not harvested for any reason. Production therefore includes the quantities of the commodity sold in the market (marketed production) and the quantities consumed or used by the producers (auto-consumption).**

Q3. Are the yearly increases in cereal yield slowing? **YES**

What factors might cause the observed changes? It may be instructive to look at a plot of both the World yields and those from a high yielding system (the UK usually attains the highest yields).
The yield potential of the major cereal crops have been maximised. That is, their full genetic potential is nearly exhausted. Increases in production must now rely on increased efficiency (intensive farming).

Q4. Look at your graph. What do you notice about cereal production since 1961?
It is increasing.

And since 1996?
The increase is levelling off.

Q5. Why is the yearly increase in cereal production slowing? You may have to look at cereals yields to answer this question (See previous graph of *Yields*).
The increase in cereal production is slowing because yields are not increasing.

Q6. Compared with arable production, how efficient is meat production? For any **given** year, look at the YIELD for the major arable crops and for meat production, then calculate a percent efficiency. To calculate the YIELD for meat, using the FAOSTAT Data Collection page, select LAND USE. Then using the FAOSTAT Database Query page select:
WORLD+ LAND USE PERMANENT PASTURE
And submit to database. This will give you a value for the area of land under permanent pasture. Now identify your value for meat **production** in the same year from your CROPS LAB DATA.xls workbook. The meat YIELD is calculated by dividing the value for meat production by the area of land under permanent pasture. This value can be used to calculate a % efficiency compared with cereal yields. **Select only the most recent year**. **NOTE** Cereal yields are given in Hg/Ha. What do you need to do to make the meat yield and cereal yields directly comparable?

Meat production is very much less efficient than arable production. Note land use is given in (1000Ha). Values should be ~70 kg/Ha meat and >3000 kg/Ha for cereals, and efficiency for meat production of <3%.

Q7. What do you conclude about the contribution of these major crops to global food production?
Cereals>>tubers>meat/oil crops/pulses
Crops are the major contributor to global food production.

Q8. Approximately what will be the population of the Earth in 2050?
About 15 billion inhabitants
How much food does this model predict will be produced?
0.2 Tonnes/Year/Capita
What are the implications of these increases for citizens in 2050?
The world will not be able to meet the food demand unless a radical change in production is effected.

Q9. Use the CROPS DATA LAB.xls Excel workbook to estimate the current population growth rate (% per year, 1996 - 2002)? **~1.3%. There are several ways to do this. Calculate the average yearly change and take an average, or estimate the slope from a log plot.**

And the current growth rate in food supply (% per year, 1996 - 2002)? **0.45% (as above)**

Q10. Input these values into the FOOD SUPPLY workbook model and estimate the amount of food available per annum for each citizen in 2100? What does this suggest to you?

~140kg/capita/year (cf present ~230 kg/capita/year)
The population is getting close to its maximum

Q11. What happens to the amount of food available to each citizen in 2100 and how does this compare with 2003? (Note, the model assumes the changes will become effective immediately and this is unrealistic and a 'phase-in' period will be required; the model predicts are much better outcome than would be the case).

~500kg/capita/year in 2100 versus 690kg/capita/year in 2003

Current Best Yields are achieved by intensive farming methods; the best organic methods do not achieve half of this value. What would be the long term consequences of introducing intensive farming methods to all regions?

Sustainability not possible.
Environmental issues such as nutrient run-off, salination of arable soils, loss of farming land.

Q12. How does converting Pasture farming to Arable farming affect food supply in 2100?

With INPUT YIELD at 2.07, the outcome is about 165 kg/captia/year

Q13. What will happen to the food supply over the next 100 years if half of the Rain Forests are converted to Arable farming?

Not much change. By 2100, food supply is ~175kg/captia/year

Q14. What are your conclusions?

By converting about half the pasture land and half the Rainforest to Arable production and doubling yields, you can push food production to ~450kg/captia/year

It can be argued that Intensive Farming is used to maximise the growth of plants in regions where they don't grow particularly well. Are there other ways in which yield can be increased without resorting to Intensive Farming?

Genetic modification of crop plants
Development of new/minor crop plants