# Is our food safe?

**I'm a SCIENTIST Get me out of here**

You are a scientist from the Pesticides Safety Directorate (PSD) and your job is to check whether food is safe to eat. You have received an anonymous email claiming that two farms have got dangerous levels of chemicals in their apples. You go to the farms to investigate.

You take ten samples of apples from each farm and test them for how much CAPTAN residue they contain. The figures you get are below.

| Pesticide residues (units, mg per kg of apples) | |
|---|---|
| **Holly Farm** | **Ivy Farm** |
| 1.4 | 0.1 |
| 1.5 | 0.3 |
| 1.8 | 7.1 |
| 1.6 | 0.2 |
| 1.5 | 2.2 |
| 1.5 | 0.8 |
| 1.6 | 0.5 |
| 1.4 | 3.7 |
| 1.7 | 0.4 |
| 1.3 | 0.5 |

## Pesticides

Pesticides are chemicals that are used on crops to **kill pests**. Pests can be anything damaging, including mould and other fungi, insects, slugs and snails and rats and mice. Fungicides are pesticides that kill moulds and fungi. One such fungicide is **CAPTAN** which is used to kill or stop mould on a range of fruits and vegetables, including apples.

When a pesticide is used, a small amount may remain on or in the food. This is called the **pesticide residue**. Government scientists set a level that the pesticide residue must be below in food. This value is known as the **Maximum Residue Level (MRL)** and for captan in apples is 3 mg per kg of apples.

**Variables** are the things that change in an experiment. There are 2 main types

**Independent variables**
These are ones **deliberately changed** by the experimenter. If you are testing the effects of more than one independent variable in an experiment you only **change one independent variable at a time.**

**Dependent variables**
These are the ones that are **affected by the independent variables**, and the **ones you measure** in an experiment.

**A Fair Test**
This is one where the **only** difference between the tests is your independent variable, so any change in the results **must be** due to that. If other things are changing too, then they might be causing the results to be different. Make sure that for every test you do the conditions are the same, and that only **one variable changes at a time.**

## Safety

The Maximum Residue Levels are not a safety limit. They are based on the maximum amounts of residue that might be found in food if pesticides were used correctly to achieve effective protection of crops.

How much pesticide people consume would depend on how much of the food they ate. MRLs are usually very far below the level where ingesting the pesticide might cause health risks. To check this scientists work out how much of the pesticide affected food it would be safe to eat (this is called the Acute Reference Dose, ARfD) and check whether this is below the amount people might conceivably eat.
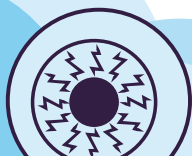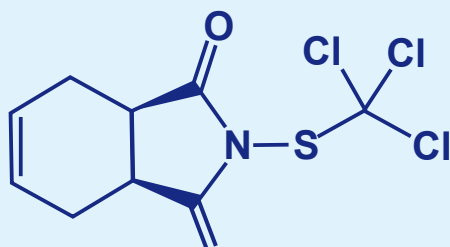
**Captan**
**Formula:** $C_9H_8Cl_3NO_2S$
**IUPAC name:** 3a,4,7,7a-tetrahydro-2
[(trichloromethyl)thio]-1H-isoindole-1,3(2H)-dione

## Things to think about

Which makes the results look safer – the average or looking at the raw data?

In which set of data are the numbers more spread out? Which set of data is more reliable?

**! Important info!**
Holly Farm also uses two **other** pesticides on their fields which you have NOT tested for

**Valid** - results are valid when they are repeatable **and** they answer the question. Think of this in terms of this the question "what is my mass?"

To find out you go on the scales five times and they always read 50kg. That is **reliable** and **valid** because the results are always the same AND it answers the question.

Now imagine you put on a backpack containing 10kg of bricks. Now go on the scales again. They will read 60kg, every time you measure, so the results are **repeatable** so they are **reliable**, but they are **not valid** because it does not answer the question of what your mass is.

**Reliable** – an experiment that gives repeatable results. This doesn't always mean the results are **accurate.** They need to be **valid** too

You have to write a report for your boss on your investigation. Include answers to the following questions.

1. What is the average captan residue on apples at **each of** the two farms?
2. Are the averages of either set of data higher than the Maximum Residue Level (MRL) of 3mg/kg?
3. What is the standard deviation for each set of data?
4. Given this standard deviation, how many samples would you need to test to be confident you had a reliable result?
5. Do you think that all the apples from each farm are below the MRL? (Think about the values within each data set.)
6. What percentage of samples exceed the MRL?
7. Do your results give a valid answer to the question, 'is this food safe to eat?'
8. Can you say that apples from either farm are definitely safe?
9. If captan levels were above the MRL in both wheat and in parsley, which do you think scientists would worry most about? (Hint: Which is a diet staple?).
10. What fraction (by mass) does an MRL of 3mg/kg represent?

**Further info**
**Reliability vs Validity**
www.imascientist.org.uk/rvv

**Info on pesticides: from the PSD**
www.pesticides.gov.uk/

**Info on pesticides: from the Soil Association**
www.soilassociation.org/web/sa/saweb.nsf/manuf/secondary.html