# Agriculture in Education:

# an educational resource for the Year 9 Mathematics

**Statistics and Probability – Data representation and interpretation**

# Resource: Investigating a Kale crop

Content Descriptor:

Construct back-to-back stem-and-leaf plots and histograms and describe data, using terms including ‘skewed’, ‘symmetric’ and ‘bi modal’ [(ACMSP282)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACMSP282)

Source:

Australian Curriculum, Assessment and Reporting Authority (ACARA), downloaded from the Australian Curriculum website on 18 December 2014



**Learning Outcome/s**

* Students calculate relative frequencies to estimate probabilities, list outcomes for two-step experiments and assign probabilities for those outcomes.
* They construct histograms and back-to-back stem-and-leaf plots.

**Description**

This resource aims to give students a context in which they can apply and demonstrate an understanding of statistical theory in a real life agricultural scenario. The scenario involves estimating probability and calculating frequencies of crop success rate and evaluating data from an experiment that tests this. Students will be required to comment upon results in mathematical terms such as ‘skewed’, ‘symmetric’ and ‘bi modal’ and provide advice to the fictional farmer in the scenario.

**Setting the scene**

A worksheet is provided with this resource which is self-explanatory and sets the scene for students to engage with the topic. However it does not include explanations of the skills and understandings required to complete the work. It assumes that the teacher will use other resources to introduce concepts and skills as necessary. The worksheet included with this resource will also serve as very good evidence for assessment of the learning outcomes.

A related resource available in Scootle that can be used to familiarize or teach students some of the basic terms and concepts for these learning outcomes can be found at this hyperlink:

[Stem and Leaf Displays: A collection of 11 digital curriculum resources](https://www.scootle.edu.au/ec/resolve/view/R12072?accContentId=ACMSP282)



**Work Task: Part A – Evaluating data in a two-step experiment**

A farmer is planning to plant out a new crop of kale. He has two varieties that he wants to try to see which is the most profitable. He has 10 kilograms of seed for Variety A and 15 kilograms of Variety B. He plans to mix the seeds together and then sew them over two paddocks. One paddock is twice the area of the other. The plants which grow from seed are different colours so that the farmer can easily distinguish between them.

The farmer also wants to know if he can increase the crop yield by applying fertilizer, but because of the cost of fertilizer he wants to test how successful it is before committing to it. He decides to just use fertilizer on the small paddock. After three weeks the plants have sprouted and the farmer does a survey of the two paddocks to discover if there is any difference in the success rate of the two seed types that have managed to progress to successful plants.

1. Use a tree diagram to list all probable results of the crop yield producing successful plants of the two varieties both fertilized and not fertilized.
2. If there are 300 plants in the smaller paddock how many would you expect there to be in the larger paddock?
3. What percentage of the crop do you expect to be fertilized Variety B?
4. What percentage of the crop do you expect to be unfertilized Variety A?
5. If after harvest the yield from the small paddock was 250 kilograms and 350 kilograms from the large one, what can you say about the effectiveness of the addition of fertilizer?

A further breakdown of the crop yield into varieties provided the results in the table below.

| Crop Yield | Fertilized | Fertilized | Unfertilized | Unfertilized |
| --- | --- | --- | --- | --- |
|  | Plants | Mass kilogram | Plants | Mass kilogram |
| Variety A | 140 | 125 | 200 | 150 |
| Variety B | 160 | 125 | 340 | 250 |

1. Use this data to evaluate the success of the crop. How do these results compare with the predictions you made from the statistics?
2. What would you advise the farmer to do in future with regards to planting a particular variety of kale and using fertilizer?



**Work Task: Part B – Histograms and Stem and Leaf Plots**

The farmer decided to consult the local market retailers about what customers preferred to buy before he committed to the variety you have suggested. At the market the farmer was told that customers seemed to prefer the tall leafy kale and would consider mass as a secondary factor.

The farmer decides that more data is needed. Below is a random sample of the harvested crop displaying height and mass of the plants taken from the unfertilized paddock.

Variety A

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Height – cms | 26 | 29 | 27 | 28 | 26 | 28 | 29 | 30 | 27 | 28 | 25 | 27 | 29 | 31 | 29 | 30 | 27 | 28 | 28 | 26 |
| Mass – gms | 750 | 790 | 680 | 740 | 720 | 750 | 680 | 810 | 730 | 760 | 690 | 750 | 630 | 740 | 770 | 780 | 710 | 800 | 700 | 670 |

Variety B

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Height – cms | 35 | 39 | 38 | 40 | 38 | 40 | 39 | 38 | 39 | 41 | 39 | 37 | 38 | 40 | 37 | 36 | 34 | 37 | 41 | 42 |
| Mass – gms | 670 | 710 | 700 | 730 | 710 | 740 | 730 | 700 | 720 | 750 | 700 | 670 | 690 | 740 | 680 | 700 | 690 | 700 | 760 | 770 |

1. Construct a histogram to visualize the frequency of the height data of both varieties.  
   How would you describe the resulting graph? What implications are there for the farmer?
2. Construct a back to back stem and leaf diagram to represent the mass of each plant variety. What does this data representation indicate about the two varieties? How is this data skewed?
3. What further information do you think the farmer would need to make a fully informed decision about which variety to go with in future?

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