



BACKGROUND INFORMATION



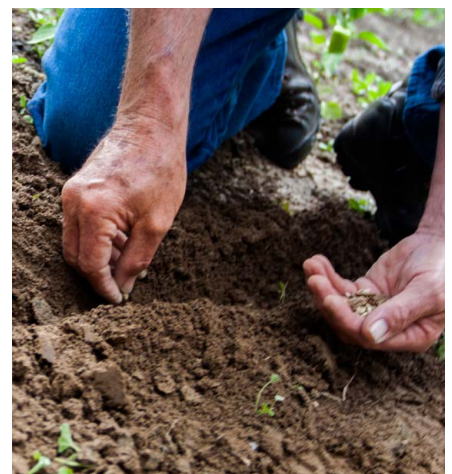
WORKSHEET 1

SEEDING DEPTH

Seeding depth refers to the depth at which seeds are planted in the soil. It plays an important role in both crop emergence (the development and growth of a germinated seed into a seedling) and crop yield (the amount of crop grown and harvested per unit area of land). Different crops have different optimal seeding depths.

Seeds that are sown significantly deeper than their optimal seeding depth often result in weaker plants with less leaf development. This is a result of the seedling using most of its stored energy for growth through the soil, leaving less energy for growth above the ground's surface as it photosynthesises.

Seeds that are sown too close to the surface are also at risk of ineffective growth rates. This can be a result of a lack of moisture in the top layer of the soil, which can affect the germination of the seeds into seedlings and produce stunted plants with poor root development.

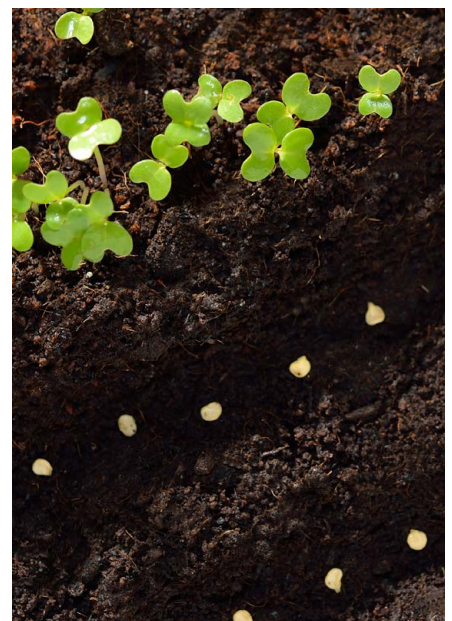


SEEDING DENSITY

Seeding density refers to the number of seeds planted in a given area. As with seeding depth, the density of seed placement can affect how crops grow and the yield they produce. Optimal density rates vary between different crops based on their unique growth rates and requirements.

If seeds are planted too closely, there is a potential for above-ground and below-ground competition between plants. Plants grown too closely can block one another's sunlight, reducing photosynthesis. Additionally, plants planted too close together would be competing for limited water and nutrients in the soil which impact growth rates.

If, however, seeds are spaced too far apart during planting, plant health can also be compromised. Weeds can spread more easily throughout a crop when plants are spaced too far apart, creating competition for the desired plants. Additionally, when plants are spaced further apart, the yield and the income produced by the crop are reduced.





PLANNING THE INVESTIGATION



WORKSHEET 2



INVESTIGATION QUESTION:

How does seeding depth affect the growth of plants?



GROUP MEMBERS:

TYPE OF GRAIN, OILSEED,
OR PULSE BEING EXAMINED:

RESEARCH – Include relevant background information about the plant you have chosen to examine.

CONDUCTING THE INVESTIGATION



WORKSHEET 3



Follow the instructions to set up your investigation.



MATERIALS AND EQUIPMENT



4 x large containers (e.g. 50 L plastic storage tubs) filled with soil OR 4 x 1 m x 1 m quadrats in garden/agriculture plot



Soil (if using containers)



10–40 seeds (students choose a grain, oilseed, or pulse from the **Super Seed Kit**)



Ruler (provided in the **Super Seed Kit**)



Gardening trowel



Watering can and water

CONDUCTING THE INVESTIGATION (cont.)



WORKSHEET 3

METHOD

1. Transfer soil into four large containers, filled 2–3 cm from the top. The containers should be placed alongside each other, with similar access to shade and sunlight. Alternatively, prepare four 1 m x 1 m quadrats in a garden or agriculture plot. The quadrats should be located alongside each other.
2. Mark containers/plots with varying seed depth signs, for example: SEED DEPTH 10 mm; SEED DEPTH 25 mm; SEED DEPTH 50 mm; SEED DEPTH 75 mm.

Note: Choose seed depths most relevant to the investigation of your chosen grain, oilseed, or pulse.
3. In the first container/plot, use a ruler to measure 10 mm beneath the surface of the soil. Use a trowel to create a shallow trench spanning the length of the container/plot at a consistent depth of 10 mm.
4. Plant 10 seeds along the trench, spacing each seed 100 mm apart. Gently cover the seeds with soil.
5. Repeat steps 3 and 4 in the remaining containers/plots, measuring the trench depths at 25 mm, 50 mm and 75 mm respectively.
6. Water each container/plot using a watering can. Ensure the same quantity of water is provided to each.
7. Monitor, measure, and record plant growth over a period of 8–10 weeks. Water regularly, always ensuring the same amount of water is provided to each container/plot.
8. Record your data in a table, and once your investigation is complete, present your results in a graph.





ANALYSING THE INVESTIGATION



WORKSHEET 4



Respond to the following questions upon completion of your investigation.



a. Discuss the relationships you have identified between the variables in your investigation.

b. Do your results support your hypothesis? Explain.

ANALYSING THE INVESTIGATION (cont.)



WORKSHEET 4



- c. Reflect on your investigation and identify what worked well and what you could improve if the investigation were to be repeated.

- d. Write a conclusion for your investigation. The conclusion should answer the original investigation question: **How does seeding depth affect the growth of plants?** Refer specifically to the type of grain, oilseed, or pulse chosen for your investigation.

e. How could the data you have gathered throughout your investigation be used by growers or agronomists to improve crop yield and increase profitability?



TECHNOLOGY OVER TIME



WORKSHEET 5



Read the following descriptions of how agricultural technology has developed over time to ensure consistent depth and even distribution of seeds is achieved when sowing crops.



MANUAL BROADCASTING

In early years, a seeding method known as manual broadcasting was used to sow crops. After a field was plowed to create a series of furrows (shallow, linear trenches), farmers would throw seeds over the field by hand. This method was both labour intensive and posed several downsides in terms of the quality of the crop that was produced. Seeds that landed outside of the furrows were less protected from the elements than those that landed in the furrows. This meant the plants grew at different rates, and many of the exposed seeds were eaten by birds or swept away by wind.



Image: Chronicle / Alamy stock photo

SEED DRILLS

Broadcasting remained the most common sowing practice on Australian farms until the 1890s, when seed drills began to be adopted by farmers. Seed drills are machines that position seeds in the soil and bury them to a specific depth. Initially they were pulled by horses, and later, by tractors. This technology offered a range of advantages, including improved germination rates, consistency in seed depth and density placement, and reduced manual strain for the farmer.



TECHNOLOGY OVER TIME (cont.)



WORKSHEET 5

PRECISION AGRICULTURE TECHNOLOGY

Precision agriculture is a farming strategy that uses a range of observations and measurements in order to make informed data driven decisions. In recent years, many Australian farmers have introduced various forms of precision agriculture technologies into their practice in order to improve crop yields and assist in management decisions. GPS data can allow farmers to pinpoint their precise location within a field, and provide data that influences sowing depth and density decisions (such as terrain, organic content matter, moisture levels, nitrogen levels etc.)



Photo GRDC

