

DIRECT SEEDING



LEARNING OBJECTIVES

- 1) The learner will gain a solid understanding of direct sowing.
- 2) The learner will be taught which kind of crops should be direct sown.
- 3) The learner will gain an understanding of the environmental needs for seeds, in order to sprout and grow.
- 4) The learner will be taught how to create an adequate environment for seeding.
- 5) The learner will be taught how to care for the crop after planting.

DIRECT SEEDING

Direct seeding is a term that describes a seeding method. The direct seeding method involves sowing seeds directly into the soil that the plants will later mature in.^[1] Some of the advantages to direct seeding are that the grower will not need to transplant their crop at a later time. Plants that have been sown directly into the soil will develop faster than plants which have been transplanted.^[1] There is less risk for plants when they have been directly seeded into the soil, because transplanting can be stressful to plants in many ways.^[2]

Perhaps the greatest thing to consider in choosing whether or not to direct seed a crop is the type of root that the particular crop has. Some plants have roots that are intolerant to transplanting and these roots are called taproots. Plants with taproots should almost always be directly seeded into the soil that they will mature in.^[2]

TANSPLANTING TAPROOTS

If a grower does have the need to start a taproot crop from seed with the intention of transplanting, there are a couple things that the grower should keep in mind.

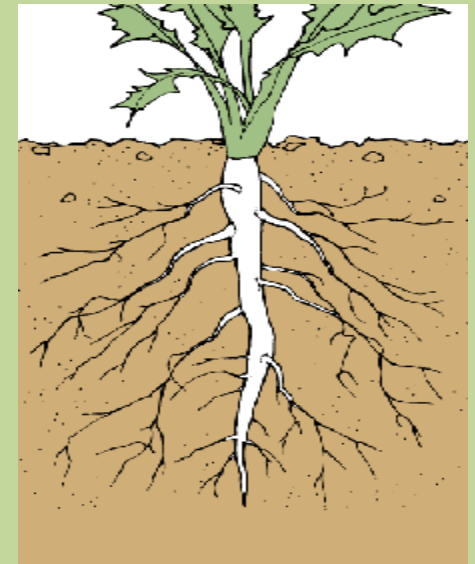
1) Taproot crops have roots that grow downward rapidly. They will quickly outgrow a shallow container. The young taproots are fragile and they should be transplanted as early as possible.^[2]



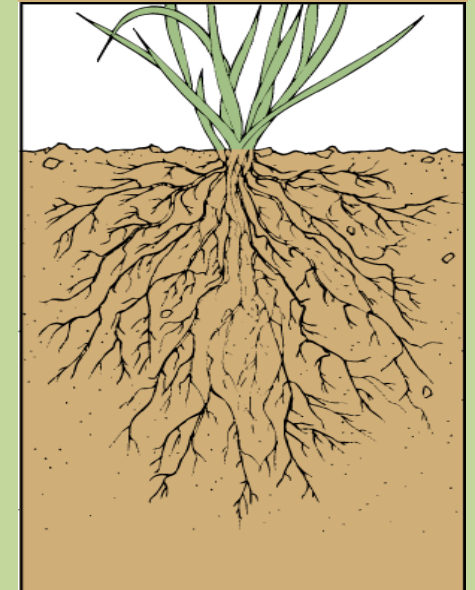
2) For the best success in transplanting taproot crops, plant several seeds together to create a cluster of seedlings. After the seedlings have grown their first set of leaves, transplant the entire cluster together, leaving the soil around the taproots.^[3] By transplanting the cluster of seedlings with their surrounding soil, the seedlings root's will be less likely to be damaged. The cluster of seedlings will need to be thinned after the second set of leaves have grown in order to provide proper spacing for the plants.^[4]

SELECTING CROPS TO DIRECT SOW

Taproots can be identified by their solid root structure. Some common examples of taproots are dandelions, carrots, beets, turnips and radishes. Taproots are fragile and taproot crops will always benefit from being directly seeded into the soil that the plant will mature in.^[4]



Fibrous roots can be identified by numerous, thin roots that grow downward and away from the plant. Generally, fibrous roots are more shallow than tap roots.^[5] Plants that have fibrous roots can be transplanted or they can be sown directly into the soil that they will mature in.



COMMON DIRECT SOWN CROPS

Salad greens
Sunflowers
Cucumbers
Radishes
Turnips
Grasses
Melons
Carrots
Potato
Squash
Beans
Beets
Corn
Peas



SEED GERMINATION

Seed germination is a term that describes the process of a seed producing a sprout, or seedling. Generally speaking, there are three environmental requirements for a seed to germinate. Seeds need water, temperature and oxygen in order to produce and grow a sprout.^[6]

MOISTURE NEEDS FOR GERMINATION

Water moisture is needed for seeds and it is used in a process called imbibition. During imbibition, the seed uses the absorbed water to swell the embryo inside the seed, which breaks open the shell.^[7] The growing embryo continues to use water, along with oxygen, to convert the food that was stored in the seed into energy for the emerging sprout. Most seeds require enough water to wet them, though never too much water as to soak them. It is important not to soak the seeds after the seed shell has broken. The excess water will deprive the embryo of oxygen and prevent the embryo from creating energy from its stored food.^[6]

SEED GERMINATION

MOISTURE NEEDS FOR GERMINATION

ACCELERATING SEED GERMINATION

Seeds that have hard seed coating, like peas or beets, will take longer to germinate than seeds with a thin coating. A grower can reduce the amount of days needed for a seed to germinate by soaking the seeds in water. Seeds can be drown if they are soaked for too long. Most garden vegetable seeds can soak for 12 to 24 hours but never more than 48 hours, as they will drown.^[8] Some gardeners use a bowl of hot water that they immerse the seeds in, and then allow the water with the seeds in it to cool overnight. Another technique to speed up germination is to slightly acidify the hot water with lemon juice, tea or coffee. The acidic hot water will help the seed absorb water faster. ^[8]

SEED GERMINATION

TEMPERATURE NEEDS FOR GERMINATION

The soil temperature that is required for seeds to germinate can vary greatly between plant species. Generally, vegetable crops will germinate when the soil is between 75-90 F (24-32C).^[6] Many crops, like spinach or radishes, are called winter crops. Winter crops will germinate at soil temperatures as low as 40 F. If a grower sows seeds into the soil that is not warm enough, the time until germination will be extended until the soil warms to a temperature that is appropriate for that particular crop.^[7]

It is wise to wait until the soil temperature is warm enough for the crop, as the seed will wait until the temperature rises before germinating.^{[6][7]} During the waiting time; the seeds are vulnerable to disease, insects, fungi and animals.

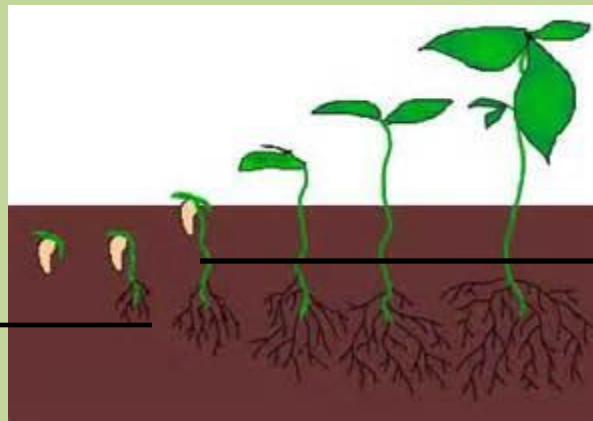


SEED GERMINATION

OXYGEN NEEDS FOR GERMINATION

During the inhibition process, the embryo in the seed uses oxygen, along with an enzyme to break down it's food storage into energy.^{[6][7]} A grower should allow oxygen to the emerging seed by keeping the soil wet but not waterlogged. It is also important to not plant the seed in compacted soil because the embryo's oxygen supply is in the tiny air pockets within the surrounding soil.^[6] The embryo will continue to use oxygen and water for energy until it emerges from the soil and receives sunlight. After the sprout receives sunlight, the sprout begins to use carbon dioxide and sunlight to create energy.^[6]

Oxygen is used for energy while the embryo is below the surface of the soil. _____



Once the sprout emerges from the soil, it will begin to use sunlight and carbon dioxide for energy.

PREPARING THE SOIL FOR SEEDING

TILLING

Tilling is a term that describes the process of breaking apart the soil for planting. The main benefits of tilling the soil are creating air pockets for root growth, while also supplying oxygen for the emerging spouts. Tilling can be useful for spreading compost, mixing in soil amendments and leveling growing spaces.^{[9][10]} Another benefit of tilling the soil is weed removal because tilling will uproot weeds and mix them into the soil.^[10]

Most growers will till the soil at the beginning of the growing season, before planting, in order to mix air into the soil.^[9] Some growers will till throughout the growing season, in between the crop rows, in order to kill unwanted weeds.^[10]



PREPARING THE SOIL FOR SEEDING

TILLING

There several methods for tilling the soil. The best method to use should be determined by the size of your growing space. In large growing spaces, like a field or pasture, a tractor or horse drawn tiller is highly recommended.^[10] Both, tractors and horses, are expensive to buy and maintain and they are not always practical for growers that have small growing areas.

Most growers that have a small growing area use a push tiller because they are cheaper to purchase or rent, and they are maneuverable in a smaller growing areas.^{[9][10]}

Here is a video that shows a [horse drawn tiller](#).

Here is a video that shows a [tractor drawn tiller](#).

Here is a video that shows a [push tiller](#).

PREPARING THE SOIL FOR SEEDING

TILLING NEW GARDEN BEDS

Tilling a new garden bed requires deeper tilling than a garden that has already been established.^[10] A new garden bed should be tilled to a depth of 8 to 10 inches. After tilling to that depth, 4 to 6 inches of compost should be added to the growing area by spreading it evenly.^[10] That compost should then be tilled into the soil to a depth of 3 inches.^[9]

TILLING EXISTING GARDEN BEDS

Existing garden beds should not be tilled more than 3 inches deep.^[9] There are many organisms in the soil that benefit the plants we grow. These organisms like bacteria, fungi and worms, are harmed with deep tilling as they are exposed to an environmental condition that they are intolerant to.^[10]

PREPARING THE SOIL FOR SEEDING

GREEN MANURE

Green manure is a term that describes a crop that is grown with the intention of tilling that crop into the soil.^[12] The green manure crop is often a legume variety of plant, like soybeans, which is naturally rich in nitrogen.^{[11][12]} When the green manure is tilled into the soil, the plants that have been tilled into the soil will decompose and provide additional nitrogen to the soil for the next crop grown afterwards.^{[11][12]}

Using green manure to increase soil fertility is a very old practice that has been used for hundreds of years.^[12]

Here is a video that describes [green manure](#).



PREPARING THE SOIL FOR SEEDING

AN ALTERNATIVE TO TILLING

Some growers prefer not to till their soil after their garden has been established. An alternative method to tilling the soil annually is to build the soil up by adding thick layers of compost onto the growing area.^[13] The alternative to tilling method is called the no-till method. This method requires a lot of resources, like composted manure, and it is not always practical for growers who do not have access to cheap or free compost.

Here is a video that shows a compost layering method as an [alternative to tilling](#).



PREPARING THE SOIL FOR SEEDING

AN ALTERNATIVE TO TILLING

In using the no-till method or any other tilling method, it is very important to only add compost that has been heated to a minimum of 140 F degrees. The heat will kill any unwanted seeds present in the compost, like grass seeds. The compost should not be heated above 160 F degrees though, because the beneficial bacteria that further decomposes the compost material will die.^[14] In order to determine the temperature of the compost, a grower will need to use a long soil thermometer.

Here is a video that shows how to use a [soil thermometer](#).



SOIL AMENDMENT

Soil amendment is a term that is used to describe the process of adding materials to a growing area, in order to optimize the soil's potential for growing plants.^[15] Some soil amendments increase soil fertility, change soil acidity or they can change the soil's composition.^{[13][15]} Some soil amendments are used to change the composition of the soil itself, in cases of sandy or clay ridden soil. Most of these amendments are organic material that is worked into the soil. By working the material into the soil, often by tilling, a grower can create an optimized soil that has small air pockets in it. Plants need the loose soil with air pockets in order to grow.^{[13][15]} Organic material, like peat moss or composted leaves, works well for creating air pockets in the soil. Generally, soil amendments are tilled or raked into the top 3 inches of soil. It is possible to over amend the soil when using fertilizers.^[15]

Here is a video that shows [amending soil by using compost.](#)

Here is a video that shows [using organic amendments.](#)

IRRIGATION

Irrigation is a term that describes a method for giving seeds and plants adequate water artificially, not relying on rainfall.^{[16][17]} Irrigation can be in the form of flood irrigation, which uses deep trenches to channel flood water. Irrigation can also be localized, which we are more familiar with. Localized irrigation is when we apply water to the soil around and on top of the seeds or plants.^{[16][17]}

CHOOSING THE RIGHT IRRIGATION

The greatest factor in choosing a system of irrigation is the size of your growing area.^{[16] [17]} Large growing areas, like fields, require a large irrigation system that can pump ground water or transport water from a distance. Growers that have smaller areas, often less than an acre, find water sprinklers or drip irrigation to be more practical.^[17] Greenhouses and small gardens are often watered with a garden hose and nozzle or drip irrigation.^[16]

IRRIGATION

CHOOSING THE RIGHT IRRIGATION

Large growing areas, like several acre fields, require large irrigation systems during very dry or hot periods throughout the growing season. ^[17] They are quite expensive and they are only practical for large growing operations.

Center pivot irrigation systems irrigate large areas in circular pattern. Here is video that shows a [circle pivot irrigation system](#).

Lateral move irrigation systems work well for large, square or rectangular fields. Here is a video that shows a [lateral move irrigation system](#).



IRRIGATION

CHOOSING THE RIGHT IRRIGATION

Most growers that have a growing area of a few acres or less will use moveable sprinklers or a drip irrigation system. [16]

Moveable sprinkler systems are not very expensive to purchase. They are also not very efficient because they waste water when compared to drip irrigation. [16]



IRRIGATION

CHOOSING THE RIGHT IRRIGATION

Drip irrigation systems are very efficient in water conservation. They work through a network of pressurized waterlines, valves and sometimes nozzles. Drip irrigation systems will drip water, through a perforated water line or nozzle, directly where it is needed for the plant; the root zone.^{[18][19]} The root zone of a plant lies directly underneath the plant and it is the area that needs water. In a fibrous root system, the root zone is usually the diameter of the plant itself.^[19] By watering the root zone only, a grower can avoid washing away nutrients from their soil, while saving money from not overwatering.^[18]

Here is a video that shows [drip irrigation](#).



DIRECT SEEDING METHODS

Direct seeding by hand

There are different methods for direct seeding.^[1] Some methods for direct seeding use commercial equipment like automated seed planters for very large fields. Other methods use hand tools, including our hands, for direct seeding. In choosing best method for direct seeding, the grower should consider the size of their crop production area and their available resources.^[1]

Direct seeding by hand involves using hand tools like a shovel or hoe to create a trench or hole to place the seeds into.^[20] This method of hand sowing is time consuming and it not always practical for the commercial grower. Growers who have small growing areas will often choose to direct seed many of their crops by hand because it is more practical for their small growing space.^[1]

DIRECT SEEDING METHODS

Direct seeding by hand

Here is a four step method for direct seeding by hand

1. Open a trench with your fingers or a hand tool to a depth of approximately two times the diameter of the seed.
2. Sow two or three seeds for each desired plant. A few of the seeds will not sprout. Of the seeds that do sprout; they can be thinned and the extra plants can be moved to a location where many of the seeds within a particular area did not sprout.
3. Cover the seeds and level the trench.
4. Gently tamp down the soil with your hand or the head of a rake to assure soil-to-seed contact.

[Here is a direct sowing by hand video.](#)



DIRECT SEEDING METHODS

Direct seeding by using a push seeder

Many small farmers choose to use a push seeder.^[20] The push seeder allows for small farmers to seed a large area in a small amount of time. Another advantage to using a push seeder is that crops do not need a lot of thinning.^[21] Most push seeders are equipped with changeable seed plates. These plates are inside of the push seeder and they allow for a predetermined depth and spacing for different seed varieties. Generally, push seeders will drop the seeds into a trench that the seeder makes.^[21] The push seeder will then cover the seeds with soil that it then presses down.

[Here is a video that shows direct sowing by using a push seeder.](#)



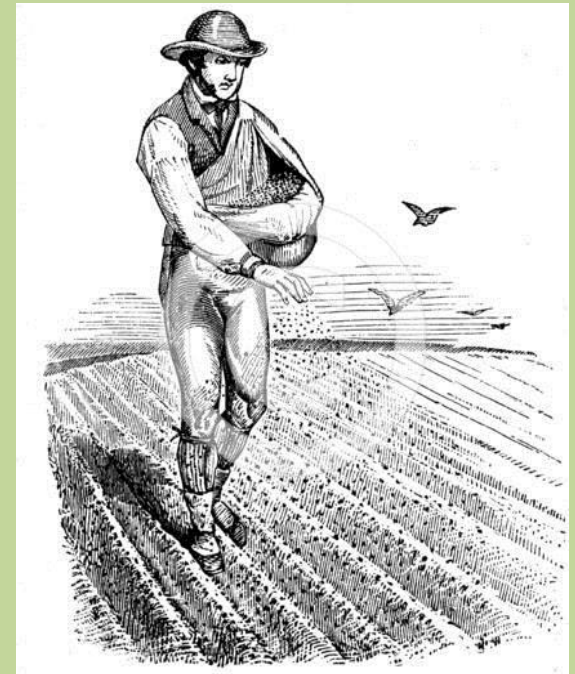
DIRECT SEEDING METHODS

Direct seeding through the broadcast method

The broadcast method of planting seeds involves tossing the seeds evenly over a large area.^[1] The broadcast method works well for planting grasses or cover crops in large areas like fields and pastures.

- 1) Determine the application rate using references such as crop-spacing charts or the seed packages.
- 2) Broadcast evenly over surface of soil by hand, with a push spreader or with a mechanical spreader.
- 3) Cover lightly with a mixture of 50% garden soil and 50% compost.

[Here is a video that shows broadcast seeding by hand.](#)



DIRECT SEEDING METHODS

Direct seeding with a broadcast seed spreader

Broadcast seeding with the use of a walk behind seed spreader has many advantages to broadcast seeding by hand.^[22] One of the advantages is that a walk behind seed spreader will give the grower an even spread of seed on the surface of the ground. Most walk behind seed spreaders have an adjustable gate that lets the seed pass through it.^[22] The operator of the walk behind seed spreader can adjust the gate to compensate for the varying walk speed of the operator, allowing for a constant application of seeds.

Here is a video that shows broadcast seeding by use of a [walk behind broadcast seed spreader](#).



THINNING A DIRECT SOWN CROP

Seeds that have been sown directly into the soil often require sowing more seeds into the soil than the soil in a particular place can support. Extra seeds are sown into the soil because some of the seeds are expected to not sprout.^[23] Many of the seeds that do sprout can be eaten by insects, birds or animals. The sprouts are also susceptible to a heavy rain that can wash them away, and they are susceptible to diseases like harmful fungus or mold.

Thinning is a term that is used to describe a method for removing a portion of an unwanted crop.

Thinning is used to give an adequate space between plants. ^[4]^[23] By having an adequate space between plants, a grower can have an optimal crop yield.^[4]

[Here is a video that shows thinning.](#)



RECORD KEEPING

Record keeping for a grower is important. The information to record will depend on the growing operation, because they are not all the same.^[25] Some growers have hired help and they must record labor hours as well as information about the crop. Many growers are farming for a profit and they should record expenses, like equipment, along with labor hours.^[24] All growers should record what amendments were added to the soil and when, including concentrations.^{[24][25]} Some growers record crop yields to compare with past harvests.

They can then predict how that crop produce in the future.^[25] Many growers will use field notes that are hand written. These are often taken when working with the crops, checking for insect damage or monitoring weed encroachment.



ASSESSMENT QUESTIONS

- 1) What is direct seeding? How is it different than transplanting?
- 2) What kind of plant root system benefits from being direct seeded?
Taproots or fibrous roots?
- 3) How should taproots plants be transplanted, if the need arises?
- 4) What environmental factors do seeds need in order to sprout?
- 5) What should be done to loosen the soil before planting?
- 6) How far down should the soil be loosened for a new growing area?
- 7) How far down should the soil be loosened for an existing growing area?
- 8) What is green manure? How does it increase soil fertility?
- 9) What is an alternative method to tilling the soil?
- 10) How hot should compost be in order to kill unwanted seeds?
- 11) What are soil amendments? How are they used and for what purposes?
- 12) What factors should you consider in choosing the right irrigation for your growing area?

ASSESSMENT QUESTIONS

- 13) How is direct seeding by hand different than direct seeding using machines?
- 14) What is broadcast seeding? What are the benefits of broadcast seeding?
- 15) How do you thin a crop? What does thinning the crop do?
- 16) What records should growers keep?

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