

Leaving Certificate
Agricultural Science

Sugar Beet

Learning Outcomes

- Family
- By Products
- Soils and Climate
- Place in rotation
- Varieties.
- Seed Bed Preparation
- Sowing
- Fertiliser
- Pest, Disease and Weed Control.
- Harvesting
- Yield.
- Wilting of Beet Tops

Sugar Beet



Sugar Beet

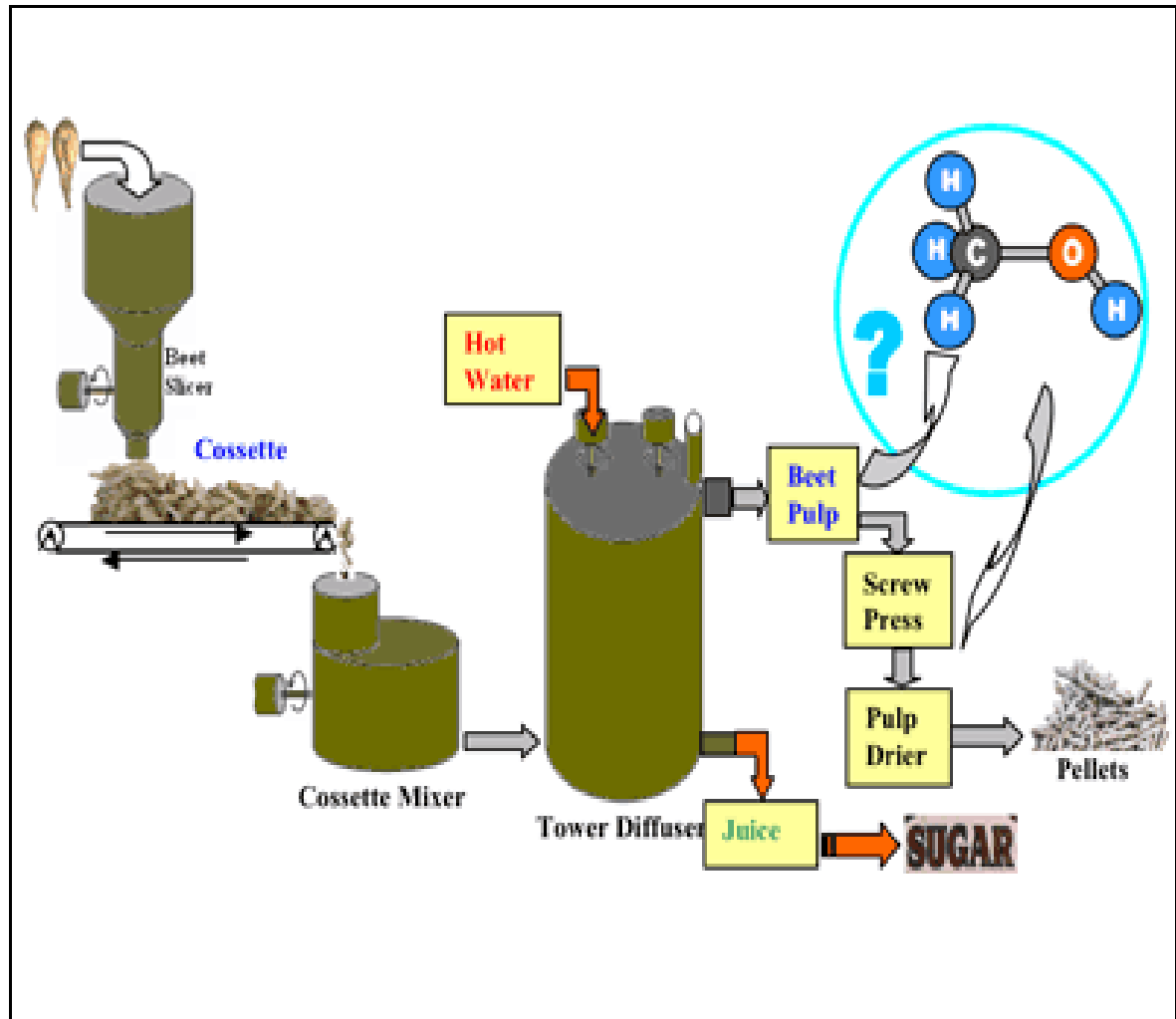
© Sugar beet (*Beta vulgaris*) is a member of the Order Chenopodeaceae: large root size and high sugar content.

© Yield: Roots = 40 Tonnes
 Tops = 25-30 Tonnes



By-products

- ◎ Sugar*
- ◎ Beet Tops
- ◎ Beet Pulp
- ◎ Molasses



By-products - 1

◎ Sugar is extracted from the sugar beet plant and sold to consumers or used as a food additive.



◎ Beet Tops are left behind in the field after sugar beet harvesting and they can be fed to cattle or sheep, having an equivalent food value to that of grass of moderate quality.



By-products - 2

- ◎ Beet Pulp is dried, shredded root material after all the sugar has been extracted. It can be fed to cattle or sheep and has a food value similar to barley.
- ◎ Molasses is a thick black liquid left after the crystallisation of sugar from water extract. It very sweet and improves the palatability of animal feeds. Its stickiness is used in pelleting animal feeds. It is used as an additive in silage production and has a food value similar to that of barley.



Sugar Beet Production in Ireland

- ◎ Ireland had two sugar factories; one in Mallow and one in Carlow that processed all the sugar beet.
- ◎ A number of varieties of sugar beet were available to grow and the Sugar Company advised farmers on which variety to sow depending on the soil type and location on their farm.
- ◎ Today, all commercial sugar beet production has ceased but there are some farmers growing beet for their own use.



Soil suitability & Climate

- ◎ Sugar beet grows well on deep, well drained soils with a soil pH of 6.5 – 7.
- ◎ Shallow soils or soils with compacted layers lead to root forking which in turn leads to a high level of **tare** (crop waste at the factory).
- ◎ Sugar beet is intolerant of acid pH and bad drainage; a lot of plants die at the seedling stage.



Soil suitability & Climate

- ◎ The sugar content of the plant is strongly influenced by the level/amount of sunshine it receives during the growing season.
- ◎ The sugar content should be at least 16% but this can be higher in areas with more sunshine e.g. South East of Ireland.
- ◎ Low rainfall makes seed bed preparation & crop harvesting easier.



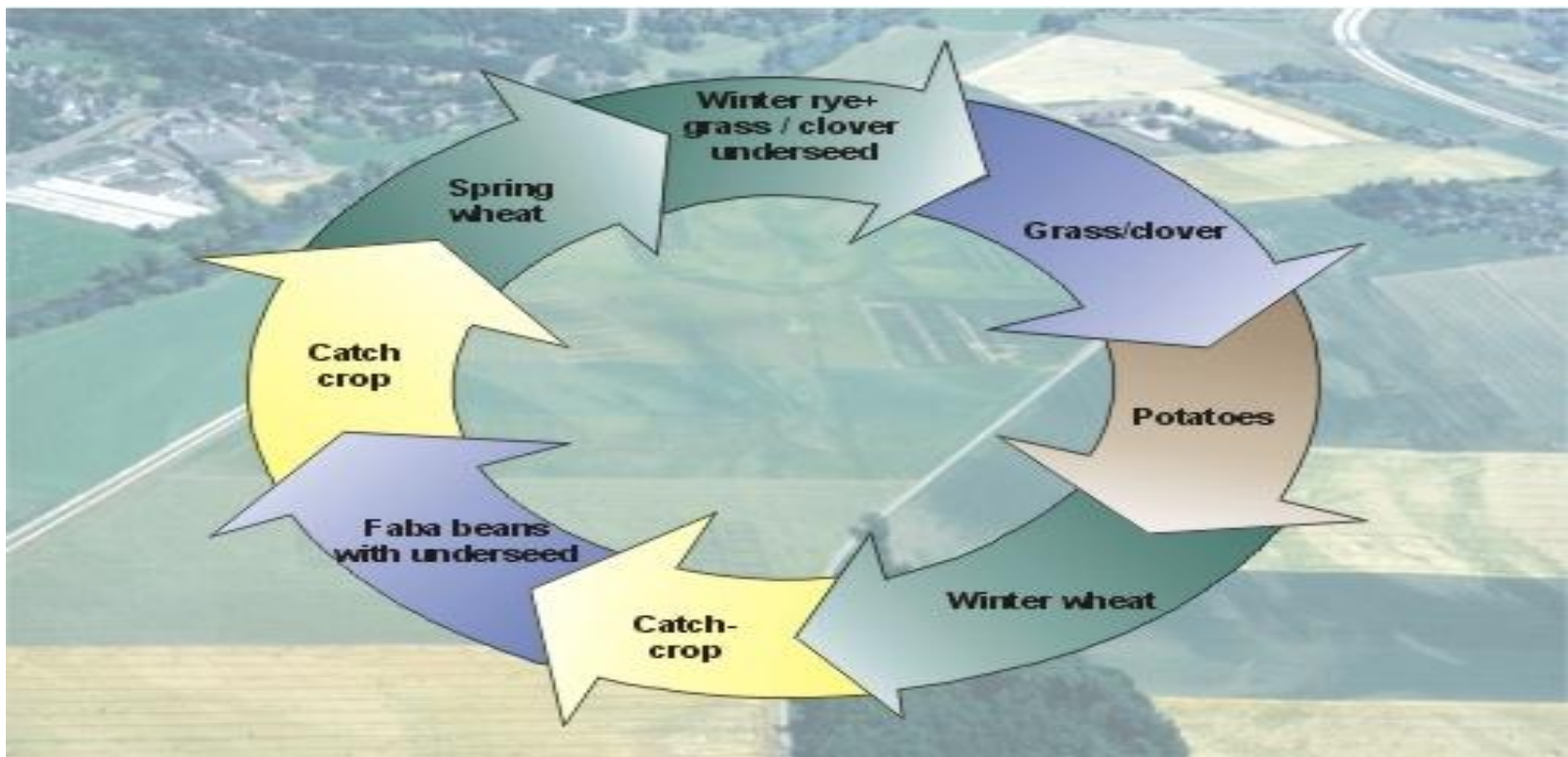
Place in Rotation

- Crop rotation must be practiced in order to avoid serious build up of soil borne diseases and pests e.g. the beet cyst nematode.
- Sugar beet and other host crops (Fodder beet, mangels, beet roots, spinach beet, turnips, Swedes, rape and kale) must not be grown on the same soil (in same field) more frequently than 1 in 3 years.
- E.g. Grass- beet- Barley- potatoes

Crop Rotation

Crop Rotation helps to:

- Control certain soil – crop residue – borne pests & diseases.
- Maintain soil structure & organic matter.



Varieties

- A limited number of varieties are available.
- Farmers are advised as to what variety would be the best to sow. **Afton** is one of the best.
- Previously the sugar company advised farmers what to sow when taking into account the soil type & location of their farm.



Preparation of seedbed

- Sugar beet requires a fine seedbed for uniform seed germination and plant establishment.
- Autumn plough the land if possible.
- In spring cultivate the land to a depth of 20 cm with a spike rotavator.



Sowing

Time, rate & method of seed sowing

- Sugar beet is sown early in spring to obtain a long growing season and high yields.
- Sown using a precision seeder: as sugar beet seed is irregular in shape it is pelleted to make it more usable, seeds are coated with inert clay materials moulded into a spherical shape before the precision seeder can use it. The inert clay dissolves in the soil.

Sowing

- Normal seed spacing = 18 cm in drills 56 cm apart = 100,000 seedlings per ha.
- Germination & establishment = approximately 75,000 - 80,000 seedlings per ha.



Nutrition & Fertilisers

- ◎ Soil should be tested before applying fertilizer to determine what is requirement and how much (Johnstown Castle, Co Wexford).
- ◎ In addition to balanced amounts of N, P, K, sodium and boron are also found in these fertilizers.
- ◎ Sodium is essential for the salt loving sugar beet.
- ◎ Boron is added to prevent the occurrence of heart rot.
- ◎ Spread on ploughed ground & cultivated into the seed bed



Establishment – Disease Control

The most important disease of sugar beet is **Virus Yellow**.

- The peach potato aphid or green aphid transmits virus yellows.
- The foliage of infected plants becomes chlorotic and yield losses result.
- Sites where aphids over-winter should be dealt with to keep down numbers in the aphid populations.
- Crop residues should be ploughed in quickly and headlands and loading areas should be cleaned off quickly after use.
- Crops should be sprayed with a systemic aphicide if populations reach 2 per plant.

Establishment – Pest Control

The main pest is the **beet cyst nematode**, which is controlled by crop rotation.

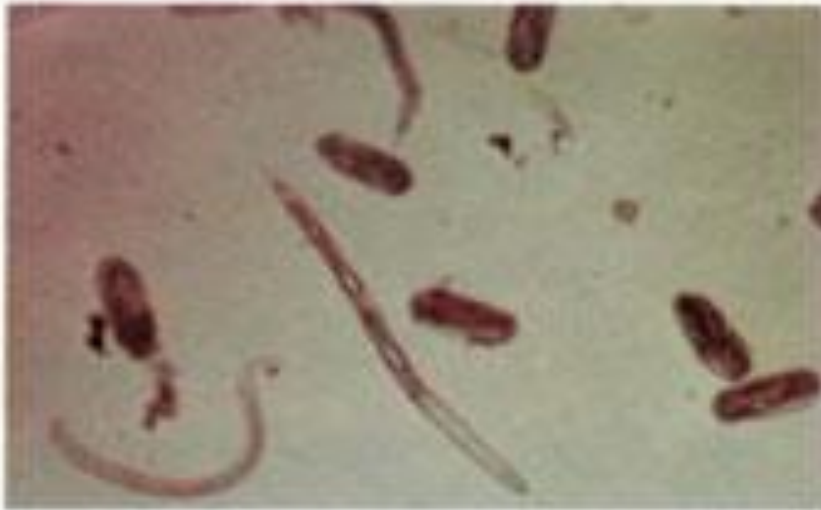


Figure 7. Eggs and larvae



Figure 8. White female larvae on roots



Weed control

- Spraying with a mix of a total contact herbicide & residual herbicide twice between sowing & full leaf cover.
- Contact herbicide – kill only plant tissue they come in contact with.



Weed control

- Residual herbicide- applied to soil & remains active for some time, killing all germinating seeds. Taken up by the roots & move to actively growing parts, slowly killing them. They are not absorbed to the leaf so can be used after crop emergence.
- Spraying with contact and residual herbicides; twice between sowing and full leaf cover controls weeds.



Chemical control

- **Total Herbicide:** kills all vegetation
- **Selective Herbicide:** kills weeds without killing plant
- **Translocated Herbicide:** absorbed by plants & is translocated to all parts of the plant



Chemical control

- **Eradicant Fungicides:** kill fungal infections at site of application
- **Protective Fungicides:** protect against attack- applied during dry weather so it is not washed away.
- **Systemic Fungicides:** kill all existing infections and protect the plant from attack



Harvesting

- Sugar beet is harvested from mid September onwards, using a sugar beet harvester.
- It lifts the plants from the ground, removes the tops, cleans and conveys the roots to a storage hopper or directly to a trailer being driven alongside.



Harvesting

- Harvest while soil conditions are dry and store until they are collected.
- If crop is harvested in wet soil conditions, leaving a lot of soil adhering to the roots, further cleaning is necessary.
- Farmers are paid on weight of cleaned beet & sugar content. (16%)



Yield

- Sugar beet roots: 40 tonnes per ha
- Sugar beet tops: 25/30 tonnes per ha



Storage

- If the sugar beet is not required until October-January, the roots should be stored on concrete yards or on very dry firm ground in clamps.
- Road sidings and lay-bys are often used.



Storage

- Clamps should be long and narrow and not higher than 2.5m to minimise heating.
- Sugar beet should be protected with straw during frosty weather as frost reduces sugar content (%) and makes the roots unsuitable for processing.



Beet Tops

- Sugar beet tops are normally left in the field after the harvesting operation.
- They can be fed to cattle or sheep in situ: using electric fence to strip graze.
- They can also be transported to yards and shed for feeding animals.
- They must be wilted for a few days to allow oxalic acid to break down: as the fresh sugar beet contains oxalic acid which causes diarrhoea/scouring in animals.
- Beet tops may be ensiled and fed later in winter.



Scientific investigation

Aim:

- To measure the sugar content of sugar beet.

Apparatus Needed:

- Sugar Beet Roots,
- Pocket Refractometer,
- Sharp Knife,
- Chopping Board,
- Mortar and Pestle
- Pippette



Method:

1. On a chopping board, use a sharp knife to remove the outside skin of sugar beet root and place in bin.
2. Dice the remaining piece of the root into smaller pieces.
3. Place one of the pieces into a mortar and pestle and grind to obtain a drop of sap.
4. Transfer the sap using a pipette into the refractometer.
5. Read off the sugar concentration