



Drilling

Bolting & Establishment

Introduction

Sugar beet is a biennial crop which would normally complete its life cycle in two years. Year one is a vegetative stage where it produces a storage root and accumulates sugar followed by year two, the reproductive stage, where it uses stored energy to flower and produce thousands of seeds. Sugar beet yield is directly related to light interception, so maximising light interception is a key foundation of sugar beet agronomy.

Bolting

Despite being a biennial crop, sugar beet can flower in its first year in certain weather conditions, this is known as bolting. The switch to the reproductive phase requires exposure to low, vernalising temperatures (for bolting) and long days (for seed production). Temperatures between 3 and 12°C are the critical temperatures for vernalisation, with temperatures in the mid-range having greatest effect and those towards 12°C the least. As a rule-of-thumb around 40 days of vernalisation (where temperatures during the 24 hours are within this range) are required for beet to bolt.

Vernalisation can start before the beet emerge; therefore, depth of drilling can influence bolting. In some instances, high temperatures immediately after a cool vernalising day can neutralise this in a process called devernalisation.

Bolting can lead to yield losses of around 11% as sugar relocated to flowering stem, shades neighbouring plants and competes for water and nutrients as well as the risk of weed beet in future years if allowed to set seed.

Targeting maximum canopy cover mid-June

Sugar beet yield is directly proportional to light intercepted by the plant. The crop cannot be sown too early due to the risk of bolting, but this means there is a need to get the canopy cover maximised quickly to make the most of the peak summer radiation (represented in Figure 1). For this reason, a Leaf Area Index (LAI) of 3 by the third week in June should be targeted because at this point 95% of the incoming radiation will be intercepted by the canopy (LAI3 is 3m³ of leaf for every 1m² of ground). To achieve this a plant population of 100,000 plants/ha established is the target.

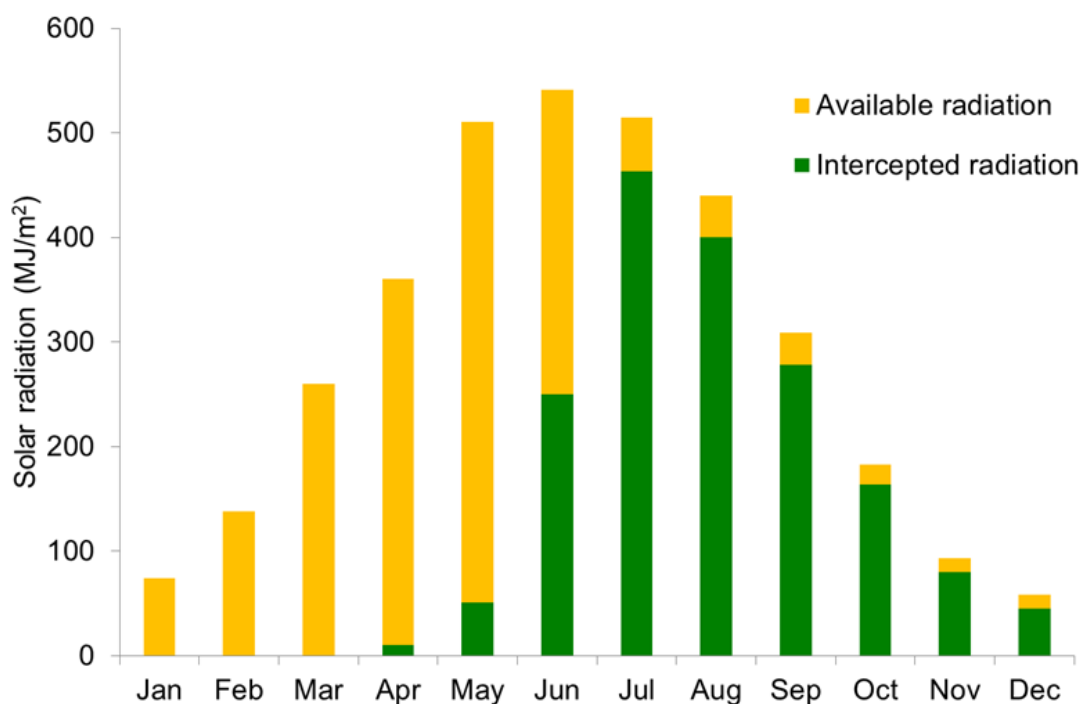


Figure 1. The available radiation compared to intercepted radiation by the sugar beet crop.

The importance of reaching the 12-leaf stage quickly

Changes associated with the development and maturity of leaves, result in fewer aphids being able to feed and reproduce successfully. These changes occur around the 12-leaf stage of development. On crops drilled in the middle of March this will usually be around the middle of June. The secondary spread of virus, and therefore the impact on yield has been shown to be much reduced on crops that have reached this crop growth stage.

Establishment and plant population

Plant population is a function of:

1. Number of seeds sown
2. The percentage germination
(UK seed germination typically 95%)
3. Losses during pre and post emergence

Sugar beet is said to be established at the 6-leaf stage with typical in field establishment being 80% of seeds sown. Multiple factors can affect establishment including:

- Temperature
- Lack of moisture in seedbed
- Frost
- Water logging
- Capping
- Compaction
- pH
- Poor seed quality/storage
- Sowing depth
- Pests and diseases

To assess establishment success you can calculate the plant population in the field when the beet has reached 6 leaf stage as follows:

For 50 cm rows

- Measure a 20m row of sugar beet and count the number of plants
- No. of plants x 1000 = plant population (000's plants ha)
- Repeat 10 times over the field

For 45cm rows measure a 22m row the follow the same process.



Plants 20m	50	60	70	80	90	100
Average plant population (Plants/ha x 1,000)						
50cm row	50	60	70	80	90	100
45cm row	56	67	78	89	100	111
Below optimum		Optimum			Above optimum	

Investigate the reason for poor establishment if the figure falls below 70%. Use this knowledge to help to make a better estimate of the seed rates required in future years.

The Drilling and seed rates Factfile gives guidance on seed rates to achieve this target