HGCA

Topic Sheet No. 27

Summer 1999

Managing crops to avoid lodging

Causes of lodging

Lodging **is controllable**. Over-lush crops subjected to wet, windy weather are most likely to lodge, due either to weak root anchorage or stem base failure. The physical forces and processes involved have been quantified and modelled for winter wheat.

Predicting lodging depends upon calculating these forces for particular crops.

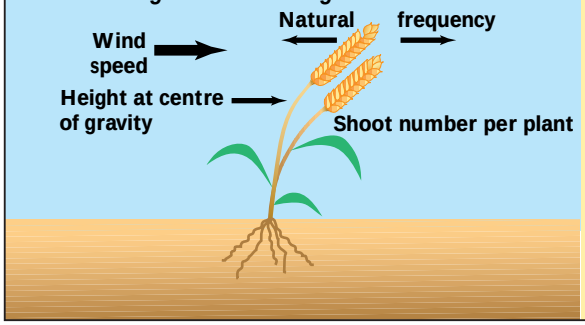
Stem lodging will occur when leverage force (Figure 1) exceeds stem strength (Figure 2).

Root lodging will occur when the leverage force of all shoots on any plant exceeds anchorage strength (Figure 3).

Action:

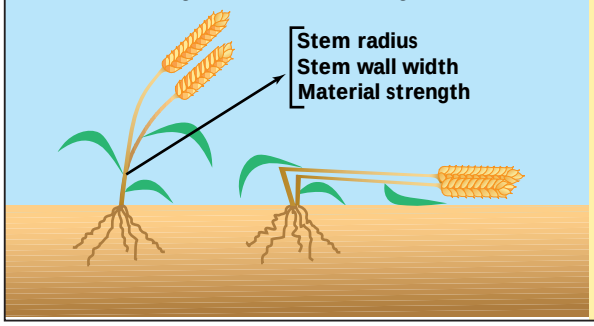
- **Choose varieties with good standing power scores of 8 or 9 for lodging-prone sites.**
- **Aim to establish a low plant population (less than 200 plants/m^2) if drilling early (before October).**
- **Assess lodging risk during spring taking account of plant density and canopy size.**
- **Roll poorly anchored crops in spring on suitable soil types.**
- **Limit and/or delay spring nitrogen applications, especially on lush crops likely to have weak stems.**
- **Control stem-base diseases.**
- **Apply a PGR at early stem extension to shorten lower internodes and reduce leverage.**
- **Apply a late season PGR if lodging risk is very high to shorten upper internodes and further reduce leverage.**

Figure 1. Leverage force



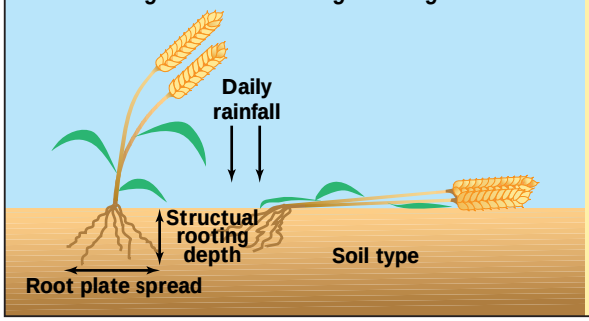
Leverage force is determined by centre of gravity and natural frequency ('springiness'). Short plants with 'springy' stems experience low leverage force and are less likely to lodge.

Figure 2. Stem strength



A cereal stem is like a tube. **Stem strength** depends upon stem diameter, wall thickness and material strength.

Figure 3. Anchorage strength



Anchorage strength depends on root plate spread and depth together with soil shear strength - a function of soil type and moisture content.

Managing crops to avoid lodging

Husbandry factors

- Early-sown crops are at greater lodging risk through increased leverage. They tend to have more internodes, so are taller, and have weaker stem bases.
- High seed rates result in greater root lodging because crowded plants have a narrower spread of crown roots.
- Excessive soil residual nitrogen or early nitrogen applications result in lush crops with larger canopies and weaker stems.
- Stem-base disease reduces material strength of the stem and increases stem lodging.

The right variety

Choosing a variety with a high **standing power** score on the Recommended List is important on lodging-prone sites, especially on weak, but fertile, soils like silts. Lodging may reduce yield. It can also impair quality by reducing Hagberg falling number and specific weight.

The RL standing power score combines scores on:

- **lodging** (percentage of trial plot standing between 45° and the horizontal)

- **leaning** (percentage of trial plot standing between vertical and 45°).

Varieties with standing power scores of 8 or 9 should be chosen for high risk situations.

Predicting losses

Lodging can occur at various stages. The largest yield losses (up to 50%) occur when crops lodge at flowering or just after grain filling starts. Flat-lodged crops also suffer most quality loss through ear diseases, reduced Hagberg falling number and lower specific weight. Yield losses are smaller for crops lodging shortly before harvest.

Two factors assessed in spring can help predict lodging risk:

- Canopy size – large canopies cause weak stem bases and high stem lodging risk
- Plant population – dense plant populations cause weak anchorage and high root lodging risk.

These assessments can help farmers plan management programmes and choose PGR treatments to minimise lodging.

Summary

Lodging causes significant losses every 3-4 years, both nationally and to individual farmers. Lodging can be expensive. It cuts yields, impairs quality, delays harvest and increases harvesting and drying costs. Information from an HGCA-funded project conducted by ADAS and Nottingham University should help farmers avoid lodging.

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