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CEREAL LODGING

Understanding the Problem

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What is lodging?

Lodging is the state of permanent displacement of stems from their vertical position.

Generally speaking...

Favourable growing conditions that promote crop development and grain yield will evoke lodging and increase its severity.

Consequently...

Lodging should be regarded as an “abundance disease” which restricts the exploitation of otherwise yield promoting factors.

Pinthus, 1973

Two types of lodging

Root Lodging:

- Straight and intact culms (stems) leaning from the crown
- Most common form of lodging
- Occurs earlier in the season
- Involves some disturbance of the root system

Stem Lodging or Breakage:

- Bending or breakage of lower internodes
- Mainly induced by storms: wind with rain and/or hail
- May occur due to insects: wheat stem sawfly
- Generally occurs when the crop is drying down or ripe

Root Lodging

Stem Lodging & Breakage

Lodging Resistance vs Straw Strength

Often used synonymously, but technically different

Lodging Resistance: Ability to stay upright

→ required to combat root lodging

Straw Strength: Resistance of the straw to bending or breakage

→ required to combat stem lodging

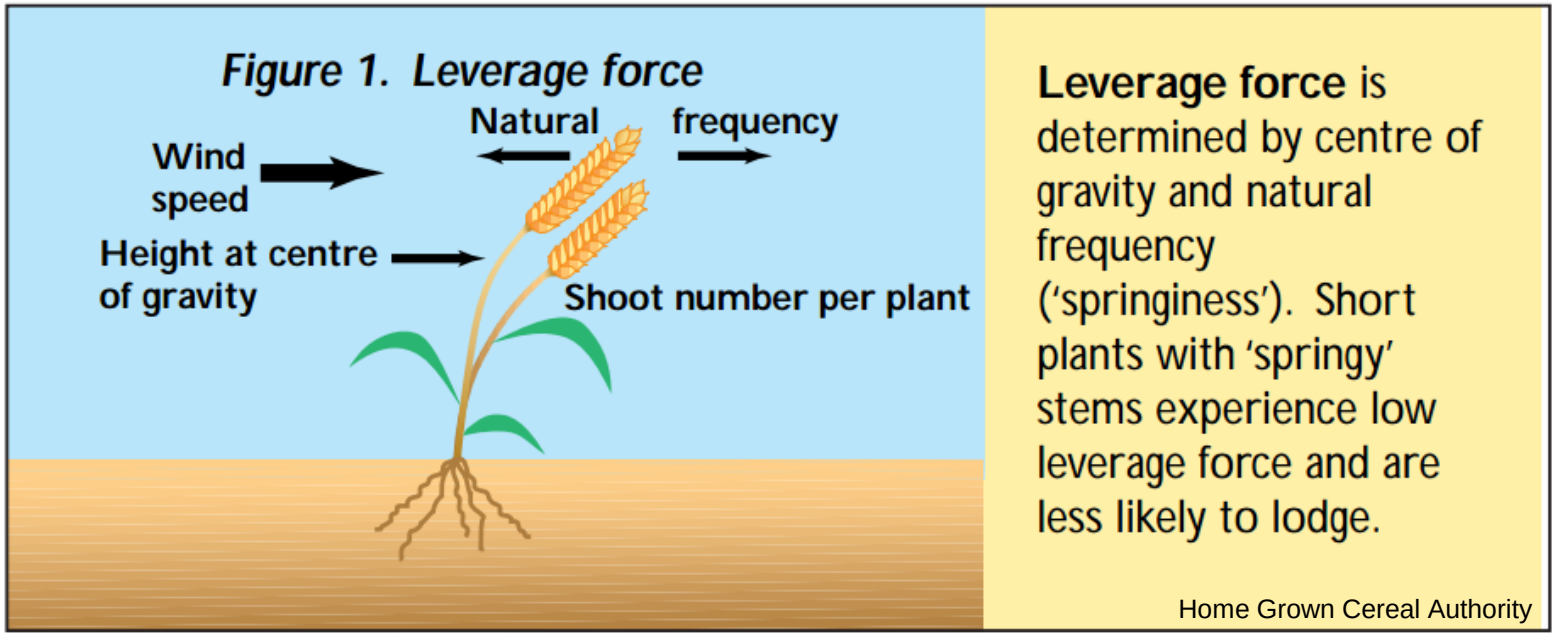
Effects of Lodging

Depends on when lodging occurs:

1. Yield reduction
   → loss in photosynthetic area
2. Uneven maturity
3. Lower kernel weight
   → Increase in protein content (?)
   → Variable effect on test weight
4. Lower falling number.... sprouting
5. Disease effects: mildew, other fungal pathogens
6. Lower profitability
   → In addition to above, greater time to harvest, more post-harvest weed control, crop drying, etc...

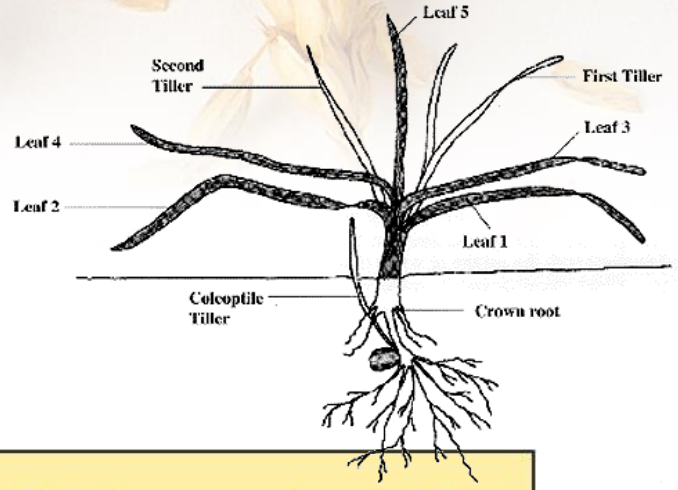
Characteristics that Influence Lodging

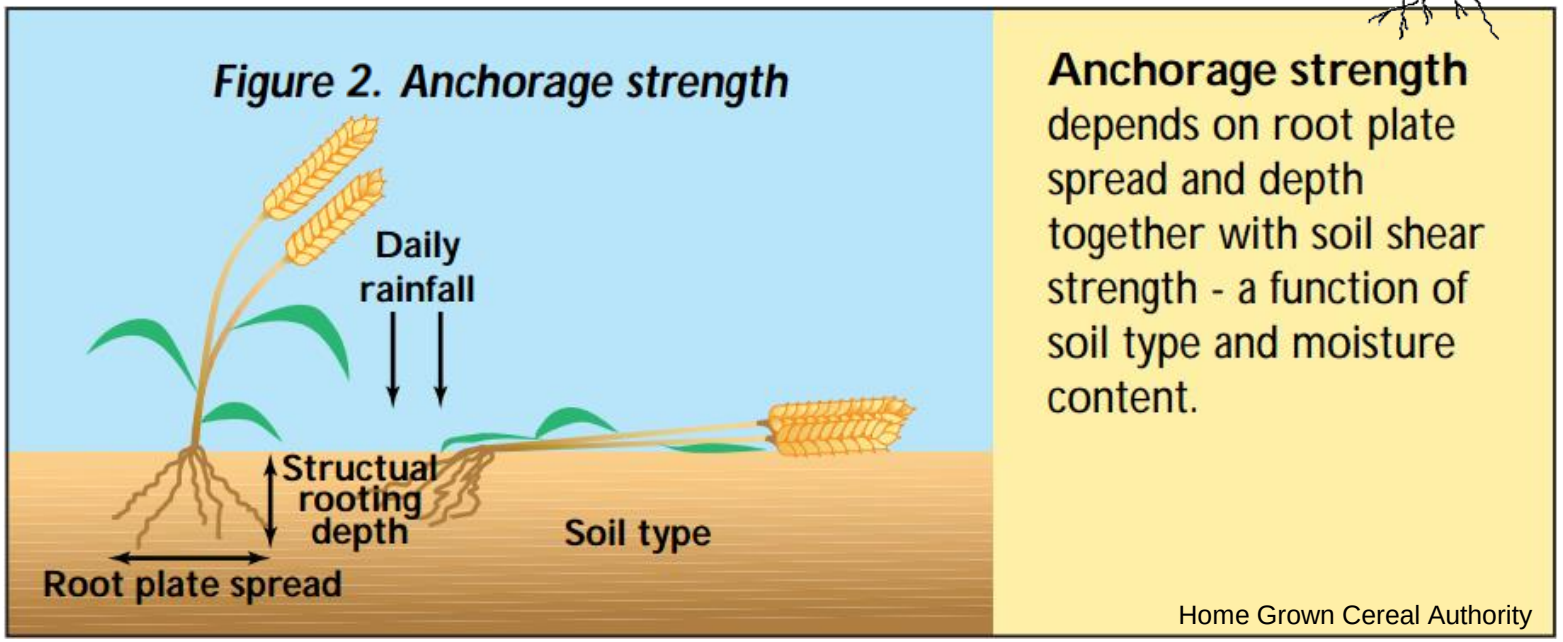
1. Crop height – centre of gravity
   → influenced by growth environment and genetics
      → cell division and elongation



Characteristics that Influence Lodging

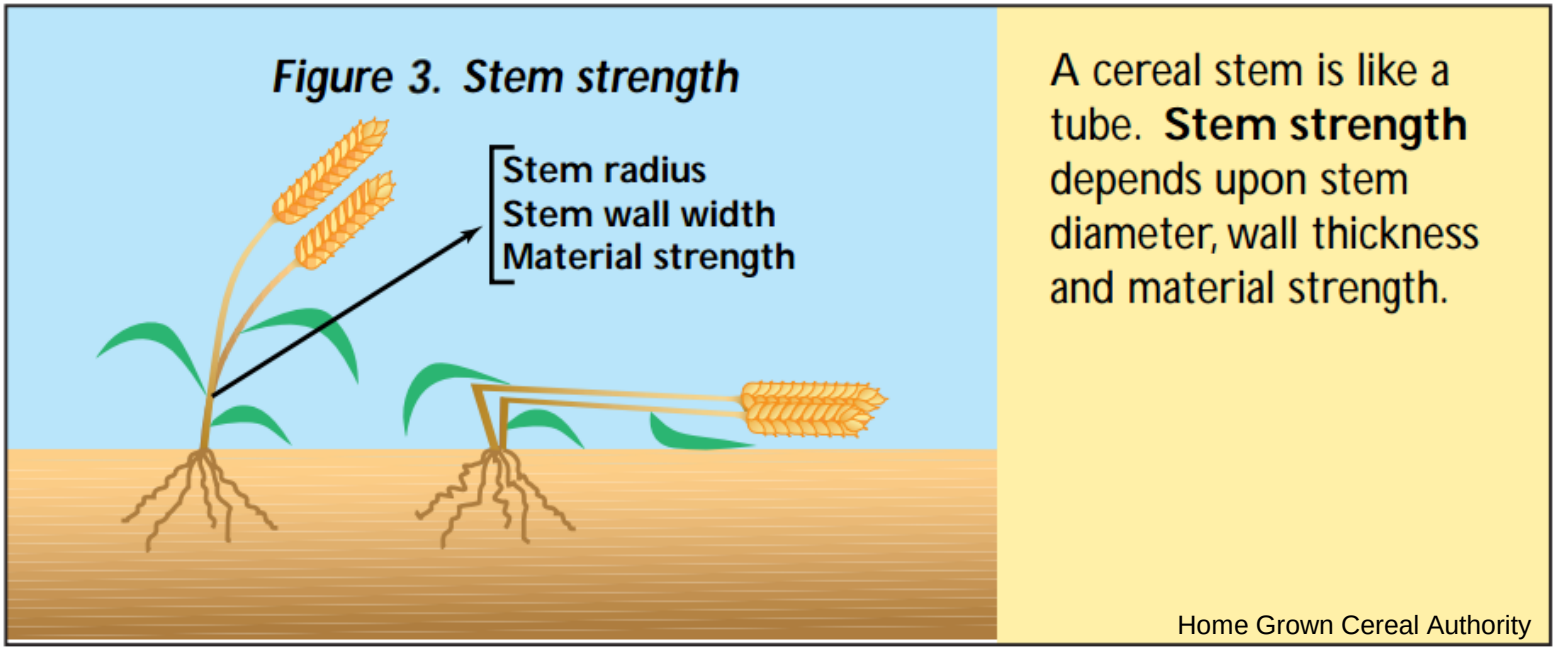
1. Crop height
2. Crown root system





Characteristics that Influence Lodging

1. Crop height
2. Crown root system
3. Strength of lower two internodes
   - → stem diameter, wall thickness, structure & composition
   - → solid (or partially solid) stem



Characteristics that Influence Lodging

1. Crop height
2. Crown root system
3. Strength of lower two internodes
4. Other characteristics
   - → tillering (anchorage)
   - → head size, awns (centre of gravity)

Environmental / Crop Management Effects

A. Light Intensity and Interception

→ High light intensity blocks action of natural gibberellins

→ Cell division and elongation ↓

→ Low light: internode elongation ↑ CHO accumulation ↓

→ Taller plants with weaker stem walls

Environmental / Crop Management Effects

A. Light Intensity and Interception

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<u>Influenced by:</u>

- Rainfall and cloudy days (shading)
- Plant density:

→ High Density: Canopy shading ↑ Height ↑ Strength ↓

→ Low density: Tillers ↑ Foliage ↑ Shading ↑

<u>BUT</u> better crown root development ↑

Environmental / Crop Management Effects

B. Temperature

→ Higher temperature increases metabolism

→ Cell division and elongation ↑ Plant height ↑

→ Higher temperature: Release of soil N

→ Low temperature: Tillers ↑ Foliage ↑ Shading ↑

BUT better crown root development = anchorage ↑

Environmental / Crop Management Effects

C. Nitrogen Supply

→ High nitrogen supply promotes plant growth

→ Essential part of chlorophyll (photosynthesis)

→ Major component of amino acids → proteins

→ Length of lower internodes ↑

→ Canopy development ↑ Shading ↑

→ Crown root development ↓

→ Shoot to root ratio ↑ Shading ↑ Anchorage ↓

→ Great environment for diseases

→ Split applications / slow or extended release fertilizers

Environmental / Crop Management Effects

D. Seeding Rate

→ High plant density promotes more inter-plant competition

→ Impact on light interception

E. Seeding Date

→ Temperature effect: Tillers ↑ Anchorage ↑

E. Seeding Depth

→ Deeper seeding lowers crown root depth → Anchorage ↑

→ Good packing: Soil:seed contact → Anchorage ↑

F. Seeding Direction

→ Parallel to prevailing winds → Anchorage ↑

Environmental / Crop Management Effects

G. Late Irrigation (or late rainfall)

→ Moistens soil (anchorage ⬇) when centre of gravity is high

H. Plant Growth Regulators

→ Most consistent effect is to reduce plant height

→ Sometimes thicker stem walls (likely G x E effect)

I. Variety Choice

→ Shorter varieties USUALLY lodge less

→ Consult with Seed Guides (root lodging)

→ Local experience

→ Use solid stem varieties if sawfly is a problem

Breeding for Lodging Resistance

Courtesy of Dr. D. Spaner, University of Alberta

Breeding for Lodging Resistance

My Strategy

- Use parents with good lodging resistance
- Select a diversity of plant height: generally 75 to 95 cm
- First yield trials under irrigation
  - High fertility (~135 to 150 kg/ha actual N)
  - High seeding rate (35 to 40 plants m^2)
  - No PGRs
  - No fungicides
- Rating on 1-9 scale: 1 = completely erect 9 = completely flat
- Compare to well-known checks
  - Radiant = 3 to 3.5 Discard if > 1 to 1.5 higher

Success

Radiant

AAC Gateway

AAC Elevate

AAC Wildfire

THANK YOU!

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