

Lodging: A Striking Threat to Cereal Crops

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SUMMARY

High-yield cereal crops must pass numerous tests as they go from seedlings to harvested products. One of the weirdest is lodging. Lodging is one of the most concerning problems faced by the farmers worldwide. This can reduce yield by up to 80% and causes several knock-on effects including reduced grain quality, greater drying costs, and slower harvest.

INTRODUCTION

Lodging is the state of permanent displacement of the stems from their upright position. Affects all cereal species and is a major limiting factor on grain production. In other words, lodging is the bending over of the stems near ground level of grain crops, which makes them very difficult to harvest, and can dramatically reduce yield. Lodging in cereals is often a result of the combined effects of inadequate standing power of the crop, and conditions such as rain, wind, hail, topography, soil, previous crop, and others. Lodging affects wheat, rice, and other cereals, and reducing it is a major goal of agricultural research. Dwarf varieties, which are shorter, are one way of reducing lodging. Lodging may occur at the root or the stem; the latter typically happens later, when the stem is dry and brittle. The timing of lodging can control its effect on yield, disease, grain moisture, quality, and evenness of ripening. Unfortunately, there's little you can do to control Mother Nature, so wind and rain will always be contributing factors to lodging. However, the new strains and some good agronomic practices should be beneficial in trimming the number of plants affected. Stem lodging occurs only after the ear or panicle has emerged and results in the shoots permanently leaning horizontally on the ground.

Forms of lodging

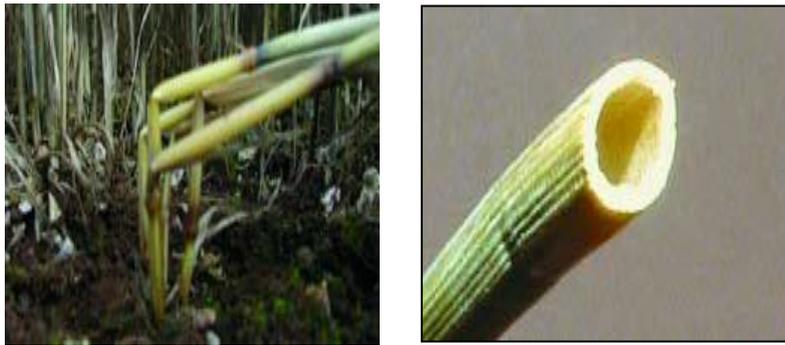
- 1. Stem lodging:** when the stem base is buckle
- 2. Root lodging:** when the root-soil systems fail



Bending moments

- The wind-induced force acting on the upper sections of a shoot or plant results in bending moment at the plant's base.
- If the bending moment of a shoot exceeds the strength of the stem base, then stem lodging is expected.
- If the bending moment of all the shoots belonging to a plant exceed the strength of the root/soil system then root lodging would be expected.

Stem Failure



Stem lodging occurs when the stem base has insufficient strength to hold the shoot up against leverage. Stem strength depends on stem diameter and the composition and width of the stem wall.

Root anchorage failure



Root lodging occurs when the root system has insufficient anchorage to hold the plant up against leverage. Anchorage depends on the spread and depth of the root plate and the strength of surrounding soil.

Causes of lodging

1. Climate



Heavy Rain



Heavy wind

2. Plant height



3. Nitrogen fertilizer



- Lodging in cereal crop is influenced by morphological plant traits as well as environmental conditions.
- Lodging in cereals is often a result of the combined effect of inadequate standing power of the crop and adverse weather conditions, such as rain, wind, or hail.
- Lodging is also variety dependent.
- For example, a tall, weak-stemmed wheat cultivar has a greater tendency to lodge than semi-dwarf cultivar with stiffer straw.
- High nitrogen fertilization causes plants to be more susceptible to lodging.
- This is due to lush growth which also provides an excellent environment for the spread of diseases such as leaf, stem, and stripe rust.
- In addition, increased plant densities, heavier seeding rates, shading, and high moisture content, especially under cloudy and humid conditions, have been found to increase the tendency of cereals to lodge.
- This condition can result in lodging problems with semi-dwarf cereal varieties.
- Balanced fertility helps to decrease lodging.
- Straw from potassium-deficient plants appears to be more brittle than those fully supplied with potassium.
- In addition, the tendency of a crop to lodge depends on the resistance, especially of the lower internodes. This is because the lower internodes have to resist the greatest movement of force.
- The tendency of a crop to lodge is dependent on its straw length.
- The ability of a crop to withstand lodging also depends on the length of the stems, particularly the length of the peduncle.
- Some of the factors that will increase the length of the stem include: genetic potential of the cultivar, high fertility level, especially nitrogen, and low solar radiation during the formative growth and stem diameter and stem wall thickness.
- Plant morphological characteristics such as plant height, wall thickness, and cell wall lignification can affect the ability of the plant to resist a lateral force.
- A small change in plant height can have a strong influence on lodging.

Effect of lodging

- Severe lodging is very costly due to its effects on grain formation and associated harvesting problems and losses.
- It takes about twice the time to harvest a lodged crop than a standing one. Secondary growth in combination with a flattened crop makes harvesting difficult and can subsequently lead to poor grain quality and high yield losses.
- Lodging alters plant growth and development, it affects flowering, reduced photosynthetic capabilities of the plant, hence affecting carbohydrate assimilation.

- Severe lodging interferes with the transport of nutrient and moisture from the soil and thus with food storage in the developing kernels.
- Can reduce yield up to 50%.
- Causes several knock-on effects including reduced grain quality, greater drying costs and slower harvest.
- Limits cereal productivity in both developed and developing countries.
- Influenced by many factors including: wind, rain, topography, soil type, previous crop and disease.
- It is frequently associated with conditions that promote plant growth such as an abundant supply of nutrients.

Management option for lodging

- Genotype: select a variety that has short and strong straw.
- Plant densities: plant densities should be reduced since these will promote strong straw and tillers.
- Nutrient management: Higher rate of nitrogen increase lodging by making plant taller.
- Irrigation: Restriction of excessive vegetative growth by delaying or with holding first irrigation reduces the lodging.
- Plant growth regulators: Plant growth regulators are synthetic compound, which are used to reduce the shoot length of plant. This is mainly achieved by reducing cell elongation, but also by decreasing the rate of cell division.

CONCLUSION

The grower has some control over all plant characters which affect lodging, by avoiding sites with high levels of residual soil nitrogen, delaying sowing date, reducing seed rate, delaying and reducing the amount of fertilizer nitrogen added and used of dwarf varieties with optimum time and depth of sowing.

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