

LODGING CONTROL FOR WHEAT AND BARLEY IN ARIZONA

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Introduction

Wheat and barley crops are susceptible to lodging, the bending over of the stems near the ground level. The incidence of lodging has been greatly reduced by the introduction of the short, stiff-straw cultivars of the Green Revolution in the 1960's and 1970's. Nevertheless, lodging is still a problem particularly with high inputs of nitrogen fertilizer and water. Lodging is not desirable due to uneven maturity of the crop, increased moisture content of the grain, decreased grain quality due to grain shriveling as measured by test weight, and increased harvesting costs. Plant growth regulators have been used to control lodging in wheat and barley, and herbicides, fungicides, and various cultural practices and environmental conditions also have an effect on lodging.

Plant Growth Regulators

Various compounds have been used as plant growth regulators in small grains worldwide. Ethephon (Cerone®), chlormequat chloride (Cycocel®), mepiquat chloride, and trinexapac-ethyl have all been used on wheat and barley to control lodging, especially in Europe. In the U.S., ethephon, marketed as Cerone® in wheat and barley, is the only plant growth regulator registered for wheat and barley. Ethephon is marketed as Prep® for use in cotton as a growth regulator. Chlormequat chloride (Cycocel®) and trinexapac-ethyl are only registered for turf and ornamentals in the US and are used to suppress growth. Mepiquat chloride is registered for use in the U.S. for cotton only as a growth regulator and harvest aid.

The use of plant growth regulators on small grains is uncommon in Arizona. Cerone® has been used on wheat and barley in the state, primarily in the Willcox area on up to a third of the small grain crop depending on the year. Lodging is a problem in the Yuma area, but Cerone® is generally not applied there because the temperature has to be between 35 and 90 °F for five days after application. High temperature often exceeds this range during the appropriate time for application.

Cerone® (Ethephon) is the only plant growth regulator registered for lodging control in wheat and barley in the U.S. (for label, go to <http://www.cdms.net/LDat/ld3NH005.pdf>). Cerone® decomposes in the plant to release ethylene, a naturally occurring plant growth regulator. Cerone® reduces lodging by decreasing plant height by 1 to 6 inches and increasing the strength of the straw. The last two to three internodes are shortened by this chemical, particularly the top internode referred to as the peduncle. Cerone® also reduces the tendency of barley heads to “neck” towards the ground and for the heads fall off the plant.

The timing of the application of Cerone® is important for the chemical to be effective and not cause crop injury. Cerone® should be applied from the emergence of the last leaf (flag leaf) to the late boot stage, but before the awns emerge (see product label for illustration). This window of application will last from 5 to 14 days depending on the weather. The heads should never be exposed to the spray solutions as might occur in cases where the head splits the boot open or the head has emerged. Rain or overhead irrigation received less than 6 hours after application will reduce or eliminate the efficacy of the chemical.

The rate to apply Cerone® depends on the expected severity of lodging and whether the crop is wheat or barley. Cerone® should not be applied in irrigation water, tank-mixed with herbicides or nitrogen solutions, or mixed with adjuvants, surfactants, or wetting agents.

Cerone® should only be applied to vigorously growing crops likely to experience significant yield loss due to lodging. In the absence of lodging, Cerone® can reduce yields relative to yields without application of this chemical. Cerone® should not be applied to a crop that is stressed due to water, insects, or disease. The plant growth regulator released by Cerone®, ethylene, increases the resistance of water flow through the leaf. Therefore, crop injury can occur if the temperatures are above 90 °F or under windy conditions where crop water demand is increased.

Cerone® requires 7 days to become activated in the plant and is not effective in reducing lodging during or before this time period. Cerone® will delay heading by 1 to 2 days and maturity by 1 to 4 days, but not any longer than the delay in maturity that might occur if the crop lodged.

Herbicides

Herbicides can affect lodging in small grains especially if applied outside the recommended crop growth stages. The herbicide 2,4D applied later than the boot stage may increase lodging particularly in barley. Lipid synthesis inhibitors such as Puma® applied after the first node appears can weaken the stem and make the crop more susceptible to lodging. An example of a herbicide reducing lodging is MCPA applied at the 2-leaf stage to wheat, which may also reduce yield. It is not a recommended practice to apply herbicides contrary to labeled rates and timing with the intent of causing slight crop injury leading to reduced tillering, height, and lodging.

Fungicides

A group of fungicides known as strobilurins (e.g. Headline®) have been shown to reduce lodging in small grains in production areas outside of Arizona where diseases are a problem. These fungicides may reduce lodging by inhibiting growth of fungal organisms in the lower stem. The lower stem in small grains tends to be solid rather than hollow, and this contributes to straw strength. The stem in small grains becomes progressively more hollow as the plant matures, and the extent of this characteristic varies with cultivar and growing

conditions. Nevertheless, application of fungicides to wheat and barley in Arizona is generally not economical or effective except in certain cases, and it is not recommended to apply of any type fungicides (even strobilurins) in Arizona with the intent of reducing lodging.

Cultural and Environmental Factors

The susceptibility of a small grain crop to lodging is greatly influenced by crop species, cultivar, and cultural practices. Barley is generally more susceptible to lodging than wheat because barley stems are weaker since they contain less straw-strengthening compounds such as lignin. Taller cultivars are generally more susceptible to lodging than shorter ones. Early planting, narrow row spacing, high seeding rates, excessive nitrogen rates, and excessive irrigation all contribute to increasing the susceptibility to lodging. Excess water and fertilizer during the stem elongation stage especially can increase the risk of lodging, but nitrogen and water deficiencies during this time period can also reduce yield potential.

Lodging often occurs near the end of the season during the last irrigation if windy conditions exist. Lodging is generally more common on heavy soils because of their relatively high water and nutrient holding capacity. If small grains are grown following vegetable crops, lodging can be a problem due to high levels of nitrogen fertilizer remaining in the soil after the vegetable crop. If a small grain crop is slightly leaning but not lodged, then a good balance has been obtained between high yields and minimal lodging.



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