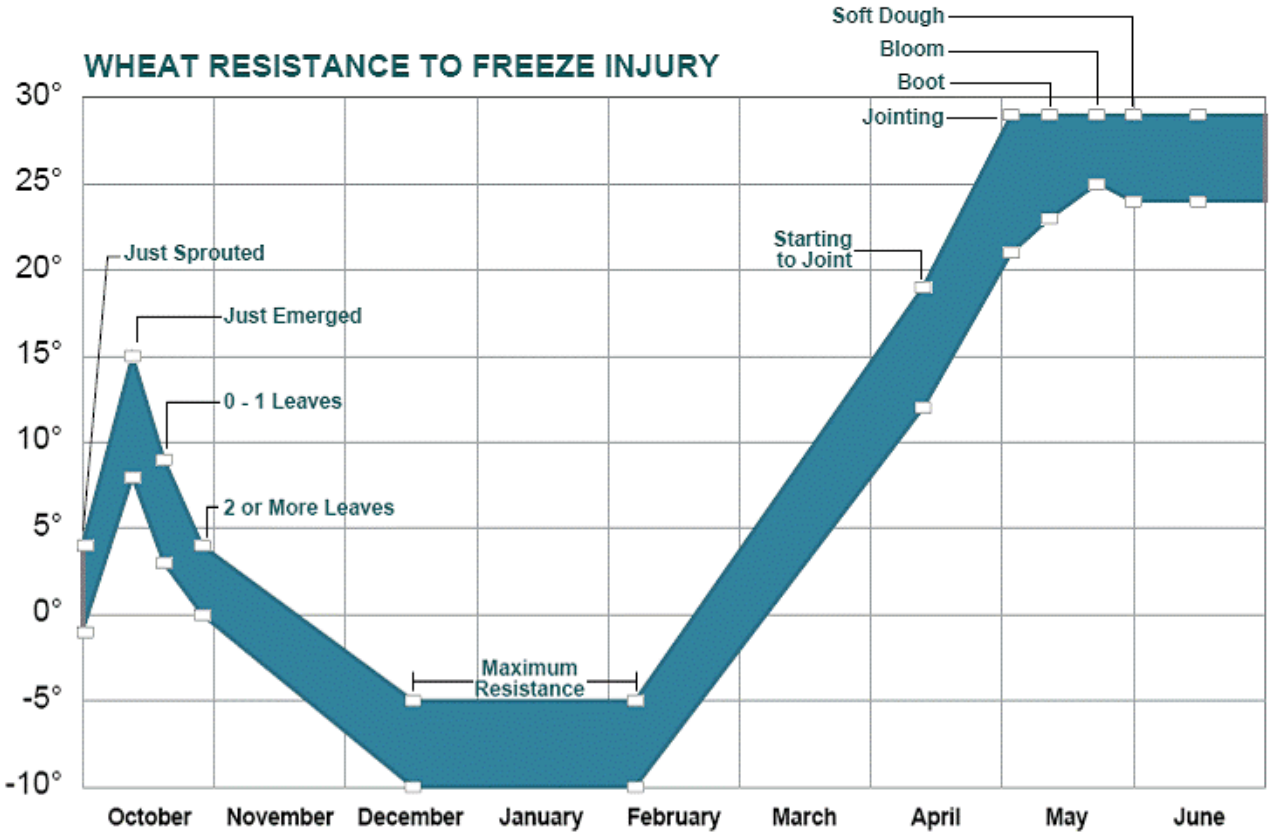

Figure 1. Temperatures that cause freeze injury to winter wheat at different growth stages. Winter wheat rapidly loses hardiness during spring growth and is easily injured by late freezes (graph adapted from A.W. Pauli).

Table 1. Temperatures that cause freeze injury to wheat at spring growth stages and symptoms and yield effect of spring freeze injury.

Growth stage	Approximate injurious temperature (two hours)	Primary symptoms	Yield effect
Tillering	12 F (-11 C)	Leaf chlorosis; burning of leaf tips; silage odor; blue cast to fields	Slight to moderate
Jointing	24 F (-4 C)	Death of growing point; leaf yellowing or burning; lesions, splitting, or bending of lower stem; odor	Moderate to severe
Boot	28 F (-2 C)	Floret sterility; spike trapped in boot; damage to lower stem; leaf discoloration; odor	Moderate to severe
Heading	30 F (-1 C)	Floret sterility; white awns or white spikes; damage to lower stem; leaf discoloration	Severe
Flowering	30 F (-1 C)	Floret sterility; white awns or white spikes; damage to lower stem; leaf discoloration	Severe
Milk	28 F (-2 C)	White awns or white spikes; damage to lower stems; leaf discoloration; shrunken, roughened, or discolored kernels	Moderate to severe
Dough	28 F (-2 C)	Shriveled, discolored kernels; poor germination	Slight to moderate