Wheat Growth Stages in Relation to Management Practices

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University of Arizona Cooperative Extension

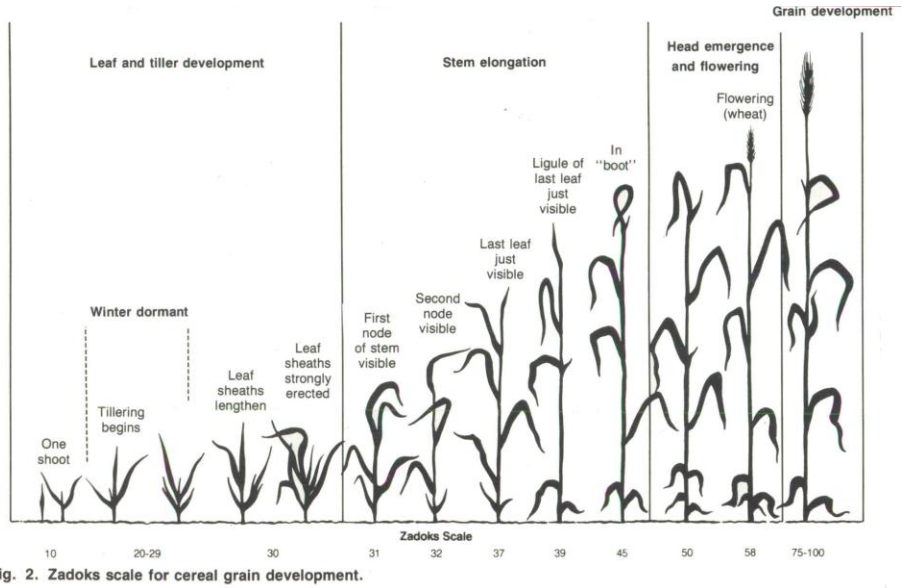
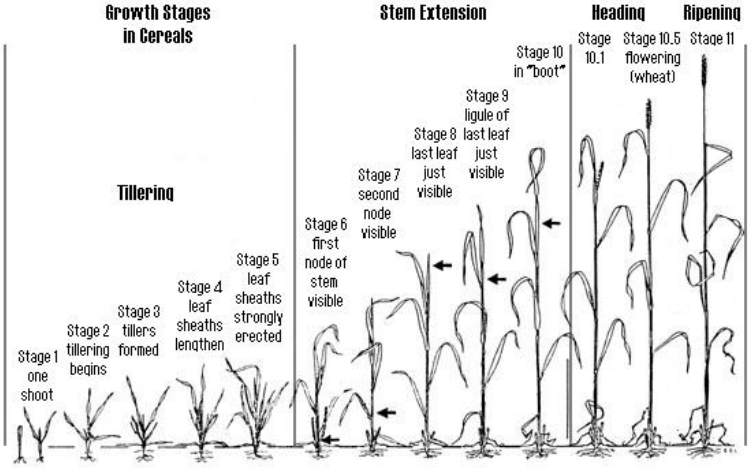


Fig. 2. Zadoks scale for cereal grain development.



According to Large (1954) cereals develop as follow Feekes Growth Stages

Growing Degree Days/Heat Units

- Daily Growing Degree Day
  - GDD= ((Daily Max Temp + Daily Min Temp)/2)-32
- AZMET

GDD and Development Stage

Development Stage	GDD Required	Accumulated GDD
Planting Date	0	0
Germination	180	180
Main Stem Leaf Production	215	395
Tiller Production	572	967
Stem Elongation	286	1253
Booting	286	1539
Heading	143	1682
Anthesis	86	1768
Grain Milk Stage	57	1825
Grain Dough Stage		

What affects growth stages?

- Planting date
- Cultivar – "intrinsic earliness"
- Temperature: warmer ➔*faster*
  - "heat units"
  - "growing degree days" (86/45°F)
- Water management
- "Daylength"

Germination

- Plants per sq m are being determined. Land preparation and soil pests are important. Flooding will kill young plants.

Development Stage	GDD Required	Accumulated GDD
Germination	180	180

Main Stem Leaf Production

Development Stage	Critical Management Factors
Seedling stage is the growth stage from wheat emergence until the plants begin to tiller	Early weed control

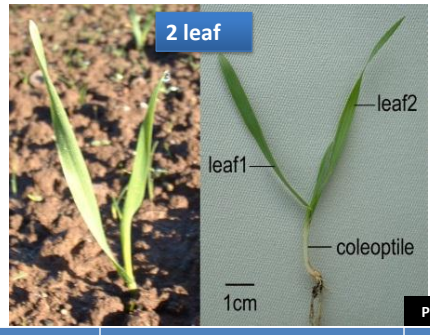


Photo: Mark Winfield, U. of Bristol, 2012

Development Stage	GDD Required	Accumulated GDD
Main Stem Leaf Production	215	395

Tiller Production

Development Stage	Critical Management Factors
Tillering usually starts when plant has 3-4 leaves. A (short growth cycle) wheat plant will typically produce 7-8 leaves on the main stem before stem elongation occurs	Early weed control and good nitrogen (nutrient) management

Development Stage	GDD Required	Accumulated GDD
Tiller Production	572	967

Stem Elongation

Development Stage	Critical Management Factors
Main stem node production. The maximum potential number of florets (and therefore max yield potential) is now set. The tillers produced last during stem elongation will often die. The final number of productive tillers depends on the conditions.	Good nutrient and water supply are determining yield potential.

Photo: Mark Winfield, U. of Bristol, 2012

Development Stage	GDD Required	Accumulated GDD
Stem Elongation	286	1253

Booting

Development Stage	Critical Management Factors
By booting each plant should have 2-3 productive tillers depending on growing conditions and crop density.	Water stress will significantly reduce yield. Ground cover should be 90% by booting. Radiation from now till anthesis will greatly affect grain number per unit area particularly in hot climates.

Photo: Mark Winfield, U. of Bristol, 2012

Development Stage	GDD Required	Accumulated GDD
Booting	286	1539

Heading

Development Stage	Critical Management Factors
The spike is emerging from within the flag leaf	Water stress will significantly reduce yields

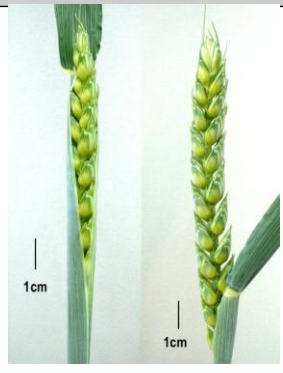


Photo: Mark Winfield, U. of Bristol, 2012

Development Stage	GDD Required	Accumulated GDD
Heading	143	1682

Anthesis

Development Stage	Critical Management Factors
Pollen is being released and individual grains are being fertilized	Water stress

Photo: Lackermann, U. of Wisconsin, 2009

Development Stage	GDD Required	Accumulated GDD
Anthesis	86	1768

Grain Milk Stage

Development Stage	Critical Management Factors
When the grain is squeezed, a milky solution is apparent	Water stress

Photo: Jack Kelly Clark, U. of California, 1990

Development Stage	GDD Required	Accumulated GDD
Grain Milk Stage	57	1825

Grain Dough Stage

Development Stage	Critical Management Factors
When squeezed, the grain will still deform slightly, but no liquid is apparent	Yield is almost set, but water stress will still reduce grain size and yield

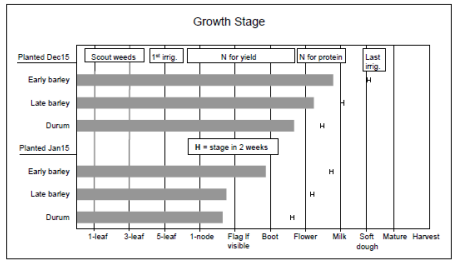
Photo: Jack Kelly Clark, U. of California, 1990

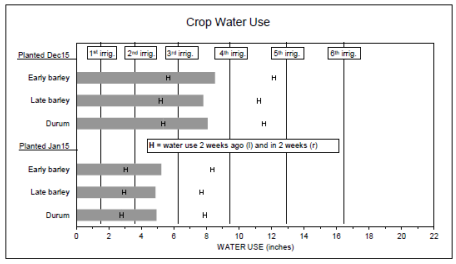
Ripening

Development Stage	Critical Management Factors
Grain is hard and firm and ready for harvest. Grain is best harvested at 14% moisture content.	Lodging can lead to grain spoilage. Birds and rats may attack grain.

Photo: Bovidia.com, 2011

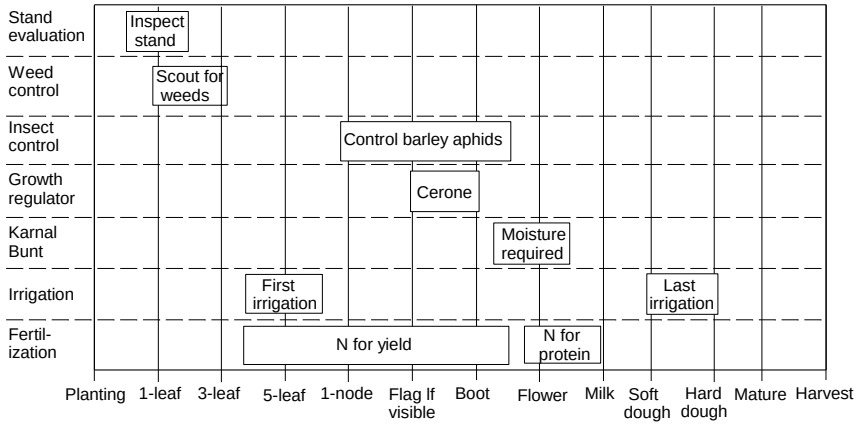
Buckeye
Small Grain Advisory
March 18, 2012





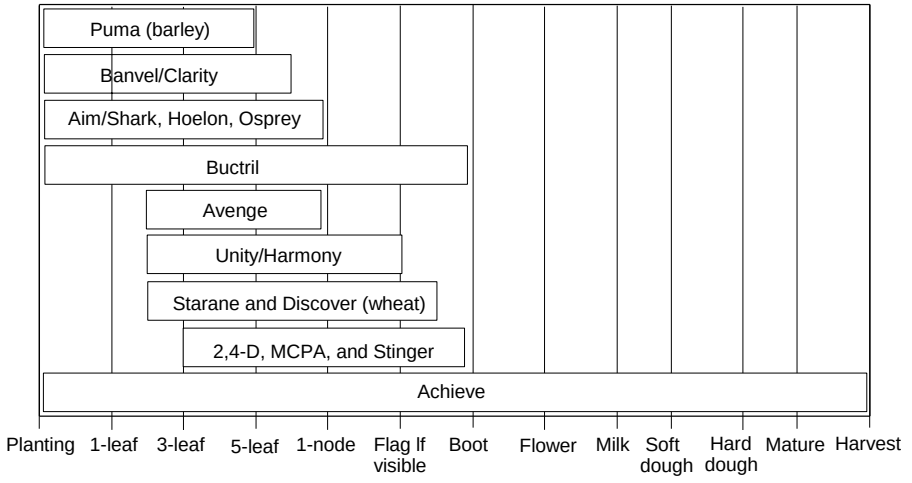
(Note: The irrigation timing is for flood irrigation on a sandy clay loam soil and does not consider rainfall. This advisory was developed by Mike Ottman, Extension Agronomist, University of Arizona using AZMET weather data. Funding for this project was received from the Arizona Grain Research and Promotion Council.)

Timing of management operations



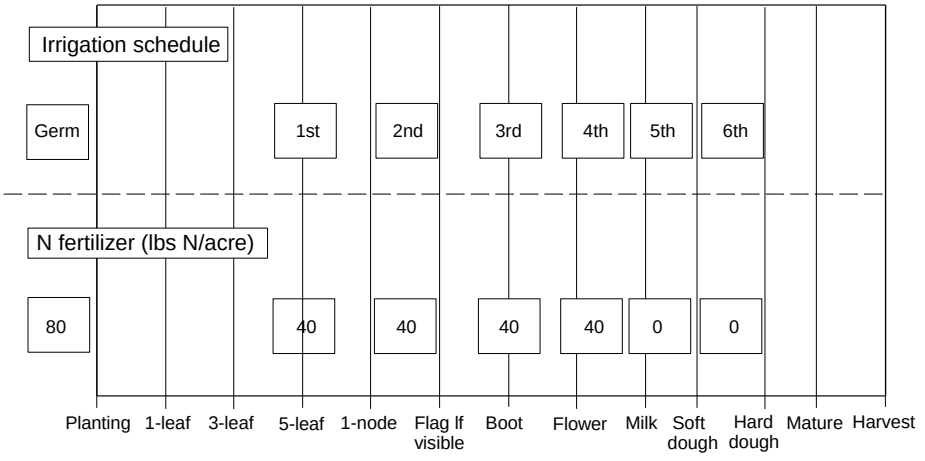
Credit: Mike Ottman

Herbicide timing



Credit: Mike Ottman

Fertilizer and irrigation schedule



Credit: Mike Ottman

Wheat Yield Components

Critical Yield Component	Determined by
Tiller and head number	Jointing (stem elongation)
Head Size	Mid to late tillering
Kernel number per head	Jointing (stem elongation)
Kernel size	Beginning at flag leaf (before boot stage) and continuing through grain fill

Questions