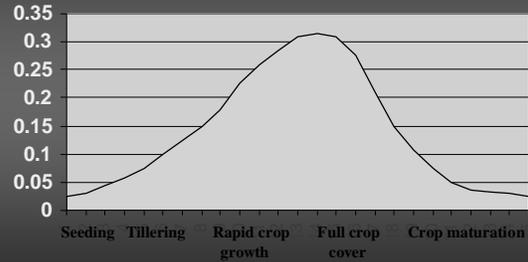


## Irrigation Management of Malting Barley to Improve Crop Yield and Quality

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### Estimated ET for small grains (inches per day)



### Effective Rooting Depth\* for Cereals

Growth stage	Effective root zone depth
2-4 leaves, start of tillering	.5-1.0 ft
5-8 leaves, early jointing	1.0-2.0 ft
Flag leaf-flowering	2.0-3.0 ft
Milk – soft dough	3.0-3.5 ft

\* Unrestricted root zone depth

Ashley et.al. 1996

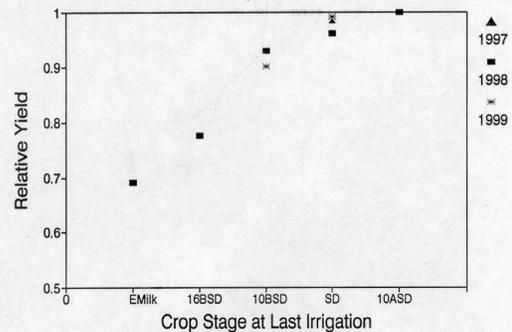
### Irrigation Scheduling

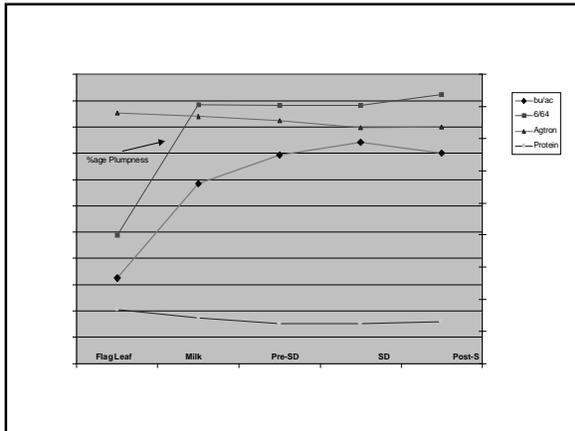
- Soil moisture level should not go below 50% ASM
- Tillering and flowering are most sensitive growth stages to drought stress

### Water Holding Capacity of Soil

Soil texture Class	Water holding capacity in/ft
Sand	0.4
Loamy Sand	0.9
Sandy Loam	1.7
Loam	2.1
Silt Loam	2.4
Silty Clay	2.0

### Last Irrigation of Wheat Drip Plots





### Typical irrigation system application efficiencies for surface systems

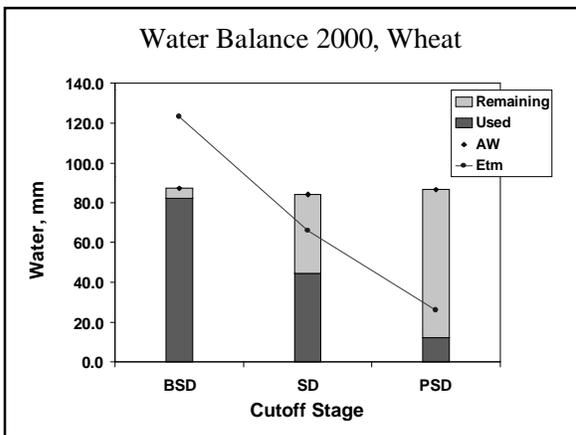
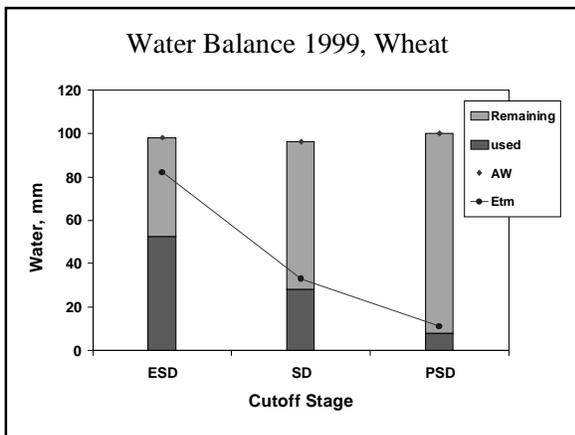
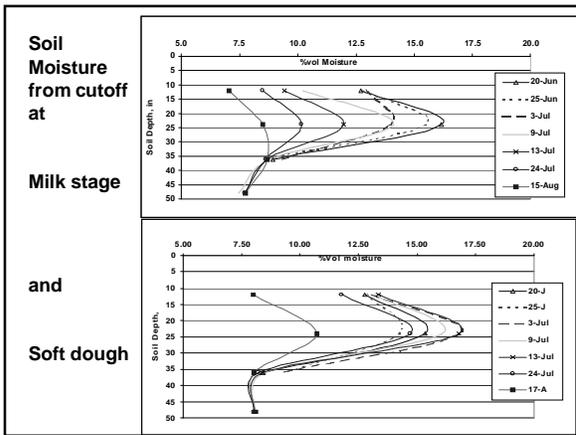
	Application Efficiency	Water required to put 1 inch in crop root zone
Corrugate	30-55	1.8-3.3
Border, graded	55-75	1.3-1.8
Flood, wild	15-35	2.8-6.7
Surge	50-55	1.8-2.0
Cablegation	50-55	1.8-2.0

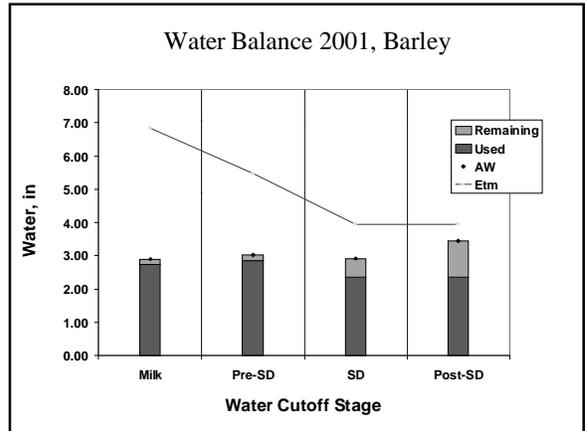
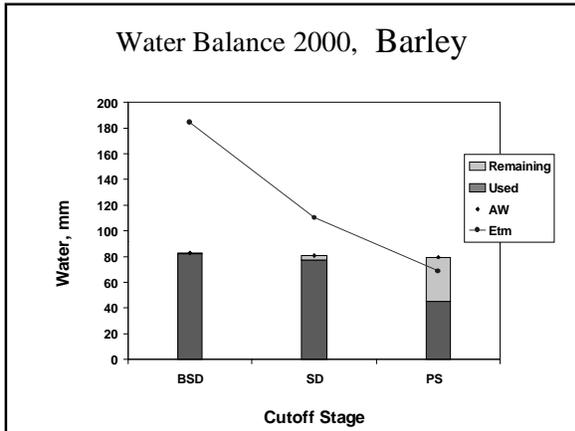
Sterling and Neibling 1994

### Typical irrigation system application efficiencies for sprinkler systems

	Application Efficiency	Water required to put 1 inch in crop root zone
Stationary lateral (wheel or hand move)	60-75	1.3-1.7
Solid set lateral	60-85	1.2-1.7
Center pivot	60-85	1.2-1.5
Linear	80-87	1.1-1.2
Subsurface drip	90-95	1.05-1.1

Sterling and Neibling 1994





### Early Season Irrigation - 2 to 4 leaves unfolded (tillering)

- Water stress limits tillering - do not exceed 50% soil water depletion
- Root zone is shallow - root depth = 6-12 inches, WHC is:
  - 0.5 to 0.75 in/ft usable water for sandy soils
  - 1.2 in/ft usable water for loams & clays
- check for adequate deep moisture and refill if needed

Neibling 2001

### Boot - Flowering

- Water stress limits number of seeds per head - do not exceed 40% water depletion
- Root depth extends to 36 inches if soil depth available
- Daily water use about 0.3 in/day max.
- Usable water between irrigations is about
  - 2.25 inches for sandy soils (about 7 days)
  - 3.6 inches for loams & clays (about 12 days)
- Expect to operate pivots full-time

Neibling 2001

### Milk Stage

- Water cutoff with full profile on loam or clay soils gives:
  - about 70% of max yield
  - possibly reduced test weight

Neibling 2001

### Early Soft Dough - Soft Dough

- Water cutoff on loams or clays at this stage with full profile gives:
  - Maximum yield
  - Blacktip is low if present
  - best test weight
  - cutoff at early soft dough gives best water use efficiency (bu/inch water)

Neibling 2001

## 5-10 Days After Soft Dough

- Irrigation required to this stage on shallow or sandy soils
- On loams or clays:
  - Yields are no higher than cutoff at soft dough
  - Blacktip is higher if present (esp. sprinklers)
  - test weight and protein can be lower under sprinklers (not furrow)
  - Water use efficiency is lower

Neibling 2001

## Conclusions

- Irrigation management depends on soil, crop, and irrigation system
- Speed of water use (ET) depends on environment and crop growth stage
- Tillering and heading through early seed development are most critical stages
- Final irrigation has large impact on crop yield, crop quality, and water-use efficiency

