Drought and Heat Impacts on NW Dryland Wheat Production

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Agro-Ecological Classes, 2007

**Annual Cropping**
1.38 million ac
MAP=22 in

- W. Wheat: 49
- S. Wheat: 7
- S. Barley: 4
- S. Lentil: 5
- S. Pea: 13
- S. Garbanzo: 10
- Canola: 14
- Fallow: 4

**Annual Crop-Fallow Transition**
1.38 million ac
MAP=17.7 in

- Grain-Fallow: 46
- Transition: 47

**Grain-Fallow**
2.68 million ac
MAP= 11.8 in
Heat and Drought Stress in Wheat

- Heat stress during flowering and grain fill restricts reproductive development, decreases grain number and weight. Heat stress—Max/Min Temps above: 90/75 F
- Heat stress recovery requires cooling via evapotranspiration, which requires water, lower temps.
- Drought stress during flowering and grain fill also restricts reproduction, decreases grain-filling duration which decreases grain number and weight.
- Drought stress recovery requires decreased water loss (stomata) and, well, more water.
- Heat stress under drought conditions is the worst scenario—accentuates yield loss.
Heat and Drought Stress in Wheat

- Climate projections are for heat and drought stress to be more intense and common in near future (Rosenzweig et al., 2014).
- Heat and drought stress are common in semi-arid and arid regions world-wide (eg Mediterranean).
- Globally, wheat yield decreases of around 40% due to heat and drought stress have been reported (Zampieri et al., 2017).
Pullman WA, Cumulative Precipitation

Precipitation Since September 1, 2020

Inches

Normal

Total Since Sept 1 2020

Daily max/min optimums for wheat: 75/63 (F)
Daily max/min for heat stress in wheat: 90/75 (F)

Note below freezing temps in March
Daily max/min optimums for wheat: 75/63 (F)
Daily max/min for heat stress in wheat: 90/75 (F)
Heat and Drought Stress Impacts on Wheat Yield

- **Northwest**: overall wheat yield decrease of 40%
- **Washington**:
  - Winter wheat decreased 47%; 42 bu/ac (76 bu/ac in ‘20)
  - Spring wheat decreased 51%; 30 bu/ac (61 bu/ac in ‘20)
- **Idaho**:
  - Winter wheat decreased 32%; 71 bu/ac (101 bu/ac in ‘20)
  - Spring wheat decreased 32%; 63 bu/ac (91 bu/ac in ‘20)
- **Oregon**:
  - Winter wheat decreased 32%; 45 bu/ac (64 bu/ac in ‘20)

Source: USDA NASS
Wheat Prices ($/bu)
Heat and Drought Stress Impacts on Wheat Quality

• High grain protein percentages: 11.3% (9.7% 5-year average); wide range in grain protein with extremes >17%
• Low test weight: 59.3 lbs/bu (61.4 lbs/bu 5-year average)
• Overall the wheat crop graded #2 compared to usual #1


• Steep price discounts for soft white wheat
  – Example: decrease $/bu of 0.05 per 1/10th% grain protein above 10.5% up to $1.20/bu (12.9% protein)
• Premiums for grain protein
  – Example: increase $/bu of 0.08 per 1/10th % grain protein below 10.5% up to $1.25/bu
Heat and Drought Stress Impacts on the Next Years Wheat Crop

- Deficit of seed-zone water needed for early establishment of winter wheat
- Reduced stored soil water after annual fallow
- Favorable fall rains and temperatures have aided winter wheat establishment
- Need above average winter precipitation to promote soil water recharge

To be continued.....