The goal of this monthly newsletter is to serve the best interests of Idaho crop producers. Correspondence and inquiries should be addressed to: Olga Walsh, Cropping Systems Extension Specialist, Southwest Research and Extension Center, 29603 U of I Lane, Parma, ID 83660, Phone: (208)722-6701 (ext. 218), Fax: (208)722-6708, Email: owalsh@uidaho.edu

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University of Idaho Extension improves people’s lives by engaging the University and our communities through research-based education. Our areas of expertise are Agriculture, Community Development, Family and Consumer Sciences, Natural Resources, and Youth Development.

To enrich education through diversity the University of Idaho is an equal opportunity/affirmative action employer and educational institution.
WHAT’S NEW?
Southern Idaho Cropping School - update

Southern Idaho Cropping School took place in Caldwell, ID on February 9, 2016, at Caldwell Best Western Inn & Suites. This cropping school is aiming to provide up-to-date information and advice on cropping systems including weed control, nutrient management, irrigation, precision agriculture and pest control best management practices. The interactive, hands-on approach is fun and engaging and allows the attendees to fully participate in the discussion, exchange experiences and share their knowledge with others.

This year, the participants learned to identify and manage pests important for Idaho’s specialty crops such as mint and hops as well as cereal crops and sugarbeets. The pest management workshop was led by Dr. Jim Barbour (UI Parma R&E Center). Live and preserved insect pests were demonstrated and microscopic samples were provided for viewing.

Dr. Barbour’s interactive insect pest workshop.

Dr. Phill Wharton (UI Aberdeen R&E Center) has focused on scouting for and identifying common crop diseases. The participants learned about simple, cost-effective scouting tools that growers can use in the field. The evolution of laboratory analytical equipment and methodologies was discussed. The information on how to collect plant and soil samples for analysis was provided.
Dt. Don Morishita (UI Kimberly R&E Center) has led a workshop on challenges and management of resisting weeds in Idaho crops. The best management practices, such as regular scouting, changing herbicide chemistries, adjusting application timing and using a combination of newly developed chemicals, was addressed.

Drs. Wharton (left) and Morishita (right), deliver crop disease and weed-focused presentations.

Dr. Olga Walsh (UI Parma R&E Center) has focused on using precision crop sensors for scouting, yield potential determination and fertilizer application. She demonstrated various optical sensors and explained how these tools can be used to improve nutrient use efficiency by applying the fertilizer in the amounts required by the crop based on its' yield potential and nutrient status. She also provided up-to-date irrigation water use information and described practical ways growers can save irrigation water. Irrigation scheduling, soil moisture sensors and crop evapotraspiration were among several things discussed.
Craig Thompson (Take Flight UAS, LLC) has led a discussion of the use of Unmanned Aerial Vehicles in precision agriculture. He demonstrated a small multi-copter agricultural drone that has been used in a collaboration with UI Parma Cropping Systems team in a project funded by Idaho Wheat Commission. The drone is used to capture imagery at various altitudes for mapping and quantifying yield potential in wheat. The team is working on developing nitrogen fertilizer recommendations based on in-season estimated yield potential.

Craig Thompson discusses Unmanned Aerial Vehicle utilization for precision ag (Left). Plants with contrasting foliage colors (Right) were used for precision sensors demonstration by Olga Walsh.

Thank you to UI Parma R&E Center’s Farm Crew for attending this cropping school! For those who are interested, all the PowerPoint presentations delivered at the cropping school are posted on our Idaho Crops & Soils blog (http://idcrops.blogspot.com/).

Southern Idaho Cropping School will be an annual event and we will continue to deliver interactive educational workshops throughout the year as well.
Drones in Ag
Part 2 (of 3)

Flying utility drone spraying pesticide over a cornfield.
Photo credit: www.cnbc.com

With increased interest of growers, crop consultants and researchers in Unmanned Aerial Vehicles (UAVs) or drones, I am putting together a 3-part article on utilization of drones in agriculture.

Part 1 (January issue) focused on economic impact, legal and safety regulations to be aware of, when considering incorporating drones in ag operations. This Part 2 aims to describe most promising applications of drones for agriculture. Then, Part 3 (March issue), will list some fun facts and occurrences involving drones.

Recent review showed that corn producers stand to benefit the most from the incorporation of drones - the projected average savings of $11.58/ac. Wheat and soybean growers are projected to seeing savings of $2.57 and $2.28/ac, respectively. Furthermore, the potential grain yield increases are 3.3% for wheat and 2.5% for corn and soybeans. U.S. wheat, corn and soybean growers have a potential to save an estimated $1.3 billion per year by using ag drones due to improved yields and reduced input costs (Doering, 2015). Below is the list of various ag drone applications that growers can use right now for taking advantage of the available UAV technologies.

- **Measuring Crop Growth/Development**
  Small unmanned ag-drones are flown above the grapevines to gather information about the wine grape growth. The multispectral images captured by the drones are used to access the crops density. A combination of soil moisture sensors and specialized software enables growers to develop precise water and nutrient recommendations and adjust their practices to optimize the grape harvest. This approach delivers 10% yield increases while saving 30% less irrigation water (Wright, 2016).
• **Prescribing Variable-Rate Fertilization**
  An Normalized Difference Vegetative Index (NDVI) maps created using drone-acquired images show crop health status. Layering the NDVI maps with soil-level nitrogen to 24 inches depth helps to develop site-specific variable-rate sidedress application maps. (Otto, 2016).

• **Irrigation Equipment Monitoring**
  Drones allow for effective monitoring of multiple irrigation pivots. This is especially important for large growers with several spread out fields. Specifically for taller crops such as corn, when certain heights are reached, mid-season inspections of the nozzles and sprinklers is time and labor consuming.

• **Weed identification**
  Drones equipped with NDVI sensors and true color cameras capture images used to create weed maps showing areas of high-intensity weed infestation and the weed-free stands.

• **Spot spraying**
  Drones offer a great solution for small-scale spot spraying of chemicals such as herbicides. Drones do not require runways so they can be launched virtually anywhere in the field. The drones equipped with specialized pumps and spray heads flown at low altitudes allow for effective crop spraying. This approach delivers tremendous savings in fuel, labor, time and chemicals. (HSE, 2016).

• **Cattle Herd Monitoring**
  Drones are an excellent tool for monitoring cattle herds from overhead. The head numbers and activity level of animals can be easily tracked. This is especially useful for night-time monitoring and inclement weather. (Grassi, 2014).

![Drone cattle mustering, Queensland, Australia. Photo credit: www.qt.com.au](image-url)
GUEST CONTRIBUTION

Importance of crop stand establishment

-by Kelli Belmont

Kelli Belmont - Research Technician, UI Parma R&E Center

Fall-seeded field crops generally have higher average yields than spring varieties due to their early spring development. By planting in the fall, the crop can exploit spring soil moisture, compete with spring-germinating weeds, and mature earlier for harvest. Additionally, overwintering crops are similar to cover crops and can provide some advantages such as reduced soil erosion and leaching with no additional expenses associated with cover crops. However, frost damage can have very detrimental effects on the quality of many fall-seeded crops. The crop is exposed to extreme weather for a longer period compared with spring-seeded crops, that can reduce winter survival rates, crop vigor, and final yields (Vico et al., 2014). A plant’s ability to endure low temperatures, freeze-thaw cycles, and extended periods under snow is dependent on developmental stage, carbon resource accumulation, growing conditions and nutrient status (Tyler et al., 1981).
Figure 1. Winter wheat planted October 13, 2015 (left) compared with planted November 2, 2015 (right) in Parma, ID.

The temperature in which the crop is exposed to is determined by air temperature and snow cover. Snow has relatively low thermal conductivity (Sturm et al., 1997) that significantly reduces the temperature fluctuations that a plant is exposed to (Taras et al., 2002).

Frost damage to crops results not from cold temperature but mainly from extracellular (i.e. not inside the cells) ice formation inside plant tissue, which draws water out and dehydrates the cells and causes injury to the cells. Following cold periods, plants tend to harden against freeze injury, and they lose the hardening after a warm spell.

A combination of these and other factors determine the temperature at which ice forms inside the plant tissue and when damage occurs. The amount of frost injury increases as the temperature falls and the temperature corresponding to a specific level of damage (Frost Protection: Fundamentals, Practices, Economics).
Two types of freezes can impact crops. An advective freeze (wind freeze) is caused by the movement of a cold air mass into an area with subfreezing temperatures. Radiation freezes occur after a cold front passes, which precedes a mass of cool, dry air.

In a radiation freeze, cold air is located close to the ground with the warm layer above it, and is called an inversion.

**Table 1. Differences between advective and radiation freezes.**

<table>
<thead>
<tr>
<th>Advective Freeze</th>
<th>Radiation Freeze</th>
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</thead>
<tbody>
<tr>
<td>Winds &gt; 5 mph</td>
<td>Winds &lt; 5 mph</td>
</tr>
<tr>
<td>Can be cloudy</td>
<td>Clear sky</td>
</tr>
<tr>
<td>Cold air mass 450-3000’ thick</td>
<td>Cold air mass 30-200’ thick</td>
</tr>
<tr>
<td>No inversion</td>
<td>Inversion develops</td>
</tr>
<tr>
<td></td>
<td>Cold air in low spots</td>
</tr>
<tr>
<td>Difficult to protect</td>
<td>White or black frost damage</td>
</tr>
<tr>
<td></td>
<td>Easier to protect</td>
</tr>
</tbody>
</table>

During a radiation freeze event, the ground and ambient temperature drops and the wheat canopy experiences temperatures 4-7°F colder than what is measured at weather stations (Frederiks et al., 2008).

Damage to wheat from frost has been observed in all stages of growth from seedlings to maturity (Table 2).

There are many factors that influence freeze injury to wheat, such as, plant growth stage, plant and soil moisture, and duration of freezing temperatures. Moist soils cools and warms six times slower than dry soil, and reduces the temperature lows for winter wheat (Klein 2013).

Furthermore, differences in elevation and topography between fields within a field complicate freeze injury. After a freezing event, it takes a week or more of warm days to see the condition of the winter wheat crop (Klein 2013).

As stated in the NebGuide G1429 (*Estimating Winter Wheat Grain Yields*), the main tillers may be killed or severely injured, but other tillers may survive and compensate for some of the potential yield loss.
### Table 2. Temperatures that cause injury to wheat at spring growth stages and symptoms and yield effect of spring freeze injury.

<table>
<thead>
<tr>
<th>Growth Stage</th>
<th>Approximate Injurious Temperature (2 hr)</th>
<th>Primary Symptom</th>
<th>Yield Effect</th>
</tr>
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<tbody>
<tr>
<td>Tillering</td>
<td>12°F</td>
<td>Leaf chlorosis; burning of leaf tips; silage odor; blue cast to fields</td>
<td>Slight to moderate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Death of growing point; leaf yellowing or burning; lesions, splitting or bending of lower stem; odor</td>
<td>Moderate to severe</td>
</tr>
<tr>
<td>Jointing</td>
<td>24°F</td>
<td>Floret sterility; head trapped in boot; damage to lower stem; leaf discoloration; odor</td>
<td>Moderate to severe</td>
</tr>
<tr>
<td>Boot</td>
<td>28°F</td>
<td>Floret sterility; white awns or white heads; damage to lower stem; leaf discoloration</td>
<td>Severe</td>
</tr>
<tr>
<td>Heading</td>
<td>30°F</td>
<td>Floret sterility; white awns or white heads; damage to lower stem; leaf discoloration</td>
<td>Severe</td>
</tr>
<tr>
<td>Flowering</td>
<td>30°F</td>
<td>Floret sterility; white awns or white heads; damage to lower stem; leaf discoloration</td>
<td>Severe</td>
</tr>
<tr>
<td>Milk</td>
<td>28°F</td>
<td>White awns or white heads; damage to lower stems; leaf discoloration; shrunken, roughened or discolored kernels</td>
<td>Moderate to severe</td>
</tr>
<tr>
<td>Dough</td>
<td>28°F</td>
<td>Shriveled, discolored kernels; poor germination</td>
<td>Slight to moderate</td>
</tr>
</tbody>
</table>

References


**GETTING TO KNOW IDAHO AG**

*Idaho Nutrient Management Conference, March 10, 2016, Jerome, ID*

What a great event to participate in! We had a great turnout at the 8th semi-annual Idaho Nutrient Management Conference this year. Over 55 participants have shared their research successes, took advantage of the networking opportunities, and discussed long-term and future projects and their impacts to stakeholders.

Updates on nutrient management from state and federal agencies, and educational institutions (UI, EPA, ISDA, IDEQ, and NRCS). The talks were grouped into three major groups: Crops & Nutrient Management, Manure Management, and Water & Nutrients.

The clicker-facilitated surveys enabled us to efficiently evaluate each presentation as well as seek feedback on how to go forward with the conference. Some of the ideas for the 2018 include encouraging student participation by waiving or reducing the meting registration for those students presenting a poster or a talk.

The planning committee for this year consistent of: Mario E. de Haro-Martí (Chair), Extension Educator, Dairy and Livestock Environmental Education, UI Extension - Gooding County; Olga Walsh (Co-Chair), Cropping Systems Agronomist & Extension Specialist, UI Parma R&E Center, Amber Moore, Soil Science Extension Specialist, UI Kimberly R&E Center; Mireille Chahine, Extension Dairy Specialist, UI Kimberly R&E Center; Lide Chen, Extension Waste Management Engineer, UI Twin Falls R&E Center; Richard Norell, Dairy Extension Specialist, UI Idaho Falls R&E Center; Howard Neibling, Water Management Engineer, UI Kimberly R&E Center; Carlo Moreno, Extension Educator, UI Extension - Minidoka County; Lauren Hunter, Agriculture Extension
Educator, UI Extension - Blaine County; and Jami Whited, Administrative Assistant, UI Twin Falls & Kimberly R&E Centers.

We would like to thank the speakers: Mario de Haro, Travis Youngberg, Olga Walsh, Amber Moore, Marv Patten, Lide Chen, Rick Norell, Ralph Fisher, Chris Rogers, Mary Anne Nelson, David Tarkalson, Anita Koehn, Howard Neibling for sharing their expertise.

We also would like to thank our sponsors who provided support for the meeting, as well as demonstrated various products and services related to nutrient management via booths, posters, and educational materials: Helena Chemical Company, Soiltest Farm Consultants Inc, Western Laboratories, Western Ag Research, Necternal, and the University of Idaho Extension.

We hope to see you in 2018!