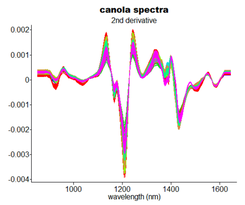
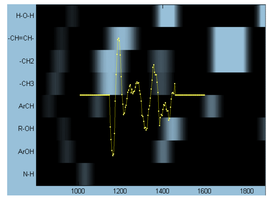
# Oil concentration measurement and application.

Dan Long and John McCallum

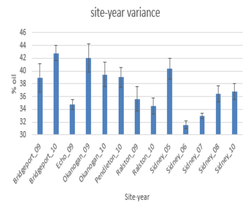
USDA United States Department of Agriculture
Agricultural Research Service

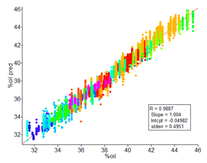
*Oil concentration can be detected with reasonable precision by NIR spectroscopy, if expanded to contain the 1100-1300nm region. [Long, et.al (2012)] This leads to the ability to measure oil content quickly (c. 3 s) in the field or during processing. Band assignments (blue background highlights) shown are from Westad, et. al. (2008).*




*Samples for this calibration were gathered from other studies across the northwest (WA, OR, and MT) to provide a wide range of oil content. It was striking how the fields and years (combined as "site·year") showed location and time dependent oil content.*

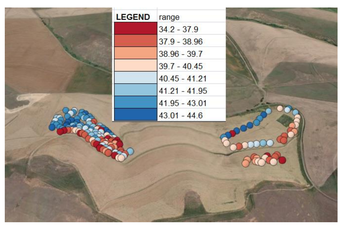


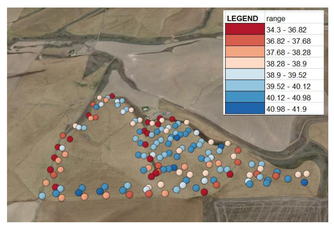




# Field variance study

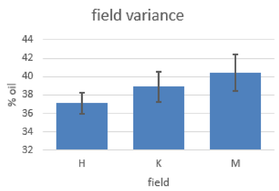

**Objectives**

- sample seed harvested from different farms in different regions of the country,
- measure the oil content of those seeds,
- geo-reference those samples and map the results,
- ultimately, compare variances within plant, within a field, field to field, and region to region.

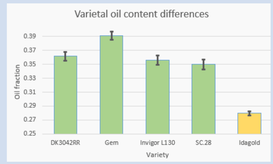
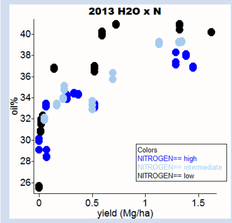
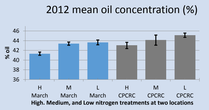
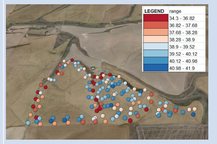




While the mean oil content in these fields is different, there is also much variance. The sample standard deviation is shown by the error bars. It is of interest that the variance appears to follow geographical features, especially features that may indicate water availability in these dryland crops.
NMR oil measurements from Jim Davis, U of Idaho




# Observations

| | Genetic | Nutritional | Spatial | Temporal |
|---|---|---|---|---|
| Data |   |     |   |  |
| | Obviously, there are genetic differences in a plant's ability to produce oil. Mustard (in yellow), for example, tends to produce much lower oil concentration. The four varieties of *B. napus* shown have smaller variance in their mean [95% confidence interval of mean shown] | At left shows an irrigated study designed to produce variance in plants for remote sensing experiments. Under sufficient water (yield > 1Mg/ha), N rich plots show lower % oil, than low N plots. The increased nitrogen above a threshold value may not increase yield.<br><br>Below are mean values for seed harvested from dryland studies with varying nitrogen treatments | In a single harvest, there is variance in oil content as shown on the map. We have found that this variance follows geographic features. Low oil is often found in low areas and draws in a field where there might be more plant available water. These are also reported as high-yielding areas of the fields. | Lower oil seed (left) has visibly more red seed than higher oil seed (right).<br>Separating red and black seed from the same sample showed a 4% difference in oil content when tested with td-nmr. The redder seed (which tends to be smaller) is believed to be less mature seed. This has not yet been verified with a harvest time study |
| Approx. range | 3% | 2% | 4% | 4% |

# Conclusions & Questions

- There is significant variance in oil concentration in canola.
- That variance arises from different sources.
- Canola is indeterminate in development.
- Oil concentration may depend on crop maturity.
- Canola oil content is not strictly a genetic trait. {Should we be using it as a phenotypic selector?}

- While we can measure oil content quickly and easily spectroscopically, this data may not precisely represent what we need to know