roots to grow laterally instead of through the soil profile (Fig. 1). The surveying of multiple sites throughout Washington has led to the conclusion that there are two soil pans within a typical profile (Fig. 2). The first pan can be found anywhere from 2-8" below the surface. This pan has been termed the rodweeding layer and is the result of long term tillage. The second pan can be found anywhere from 9-15" below the surface. This pan has been termed the glacial pan and was formed during the Missoula floods. Soil pH affects the availability of Silicon (Si) within the soil. More acidic pH allows the Si to become available in the soil solution while higher pH levels cause Si to be adsorbed to soil particles. High amounts of Si have been linked to soil pan formation. Silicon amounts can be influenced by many factors including crop type. Grass crops such as wheat can accumulate up to 10 times as much Si as broadleaf crops. Figure 3 shows penetrometer data collected from two sites and the effects of these relationships.

Future research will continue to look at subsoil quality and possible management tools to decrease soil compaction.

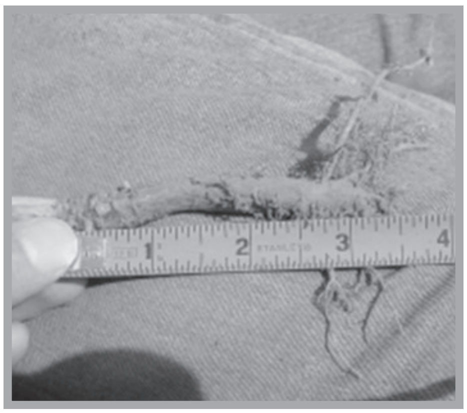

Figure 1. J-hooked canola root. J-hooking begins approximately 2.5" below the surface.

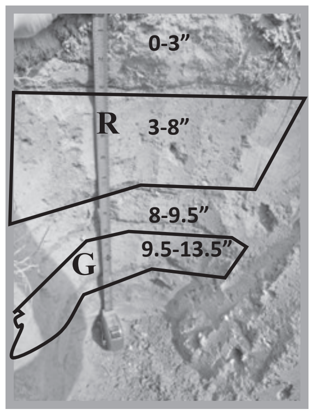


Figure 2. Soil pit displaying the impacts of management and soil formation processes. Total depth of pit was approx. 17". R= rodweeding layer, G=glacier layer.

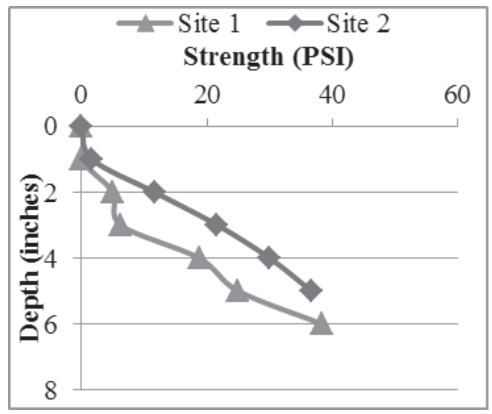


Figure 3. Penetrometer data for two sites.

## Winter Canola Water Use in Low Rainfall Areas of Eastern Washington

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An on-farm winter canola seeding date trial was initiated in the summer of 2013 in Ritzville. Clear differences in fall water use due to planting date were observed. Unfortunately, this study was terminated due to excessive winter-kill. More fall water use and increased crown height correlated to higher winter mortality (Fig. 1).

For the 2014 season, winter canola water use patterns were monitored in variety trial plots seeded around August 20 in Okanogan, Pomeroy, and Asotin. At all sites, water use was highly correlated to biomass production, Nitrogen (N) uptake, and growing degree days in a linear fashion. In terms of an extraction pattern, winter canola at Pomeroy did not utilize water stored at 4 feet until about 2 months after planting, first using water in the top 3 feet of soil. By early November, winter canola was extracting water down to 5 feet, while fall precipitation began to recharge the top foot. Fall growth and water extraction then ceased, allowing winter precipitation to fill the entire profile. This pattern was also observed in the 2013 Ritzville study. Okanogan, however, had very little extraction and it was confined to the top 3 feet of the soil profile. Okanogan canola used 3.26 inches of available water over the fall growing season. Pomeroy had a much higher initial water content than Okanogan, along with more soil nitrogen, which contributed to increased biomass accumulation and therefore more water use. At the Asotin site, soil depth was highly variable, and this factor largely determined total profile water content. A rough planting date comparison was observed at Asotin, as the cooperating farmer planted the field surrounding the plots one month earlier (Fig. 2). Within the first 2 feet, the canola in the grower's field used 5.3 inches of water and terminated growth for winter a month earlier than the plots (which used 3.5 inches of water).

Moisture measurements will be continued in spring at all locations, and yield characteristics will be determined at harvest. This water use study will be continued next year, along with a repeated season of the planting date study in Ritzville.

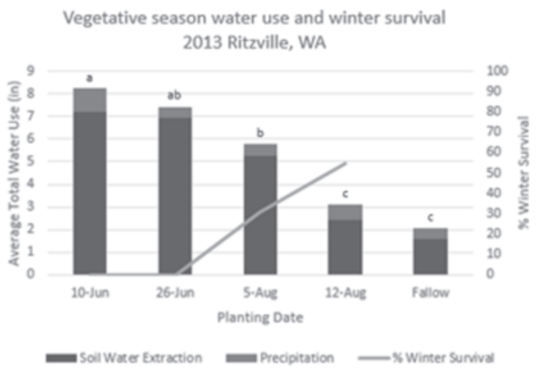


Figure 1. Average fall total water use for each planting date in Ritzville. Values marked by the same letter indicate no significant difference. Average percent of plants surviving winter is depicted as well and corresponds to the right axis.


Figure 2. Winter canola plots and surrounding field at Asotin, WA. Photo taken 10/30/14.

## Utilization of Winter Canola for Seed and Silage

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We have developed an integrated two-year study which investigates agronomic production as well as animal end use of canola to determine if it is possible to make high quality silage from canola and to determine if harvesting a forage crop in the fall affects the seed/meal yield and quality at the subsequent harvest for seed. The objectives of the study are: 1) to determine canola forage and seed yield, quality, and silage quality when grown at various N:S fertility levels; 2) determine ensiling characteristics of winter canola by field treatments; 3) reduce silage effluent with absorbents (alfalfa cubes). Roundup Ready® canola was planted in research plots on August 13, 2014 at WSU IAREC, Prosser, WA (8 lbs. PLS/acre). Eight soil N:S treatments were applied to the soil following baseline soil sampling. The N:S treatments included 100 and 200 lbs Nitrogen (N) and 0, 20, and 40 lbs Sulfur (S) for each N treatment. In addition 100-20+Agrotain® and 200-40+Agrotain® were included. All plots received 52 lbs $P_2O_5$ in the fall with no additional K. One-third of the N:S was applied before planting and two-thirds was applied in April 2015. Stand counts were determined on 9/29/2014 and forage harvest commenced on October 13, 2014. Half of each plot was harvested. At harvest, DM yields were determined and experimental tube silos were filled (n = 48; 4 replications). Tube silos were emptied on 11/24-26/2014 and the pre- and post-ensiled samples were prepared for analysis. Fermentation profiles of the ensiled materials were conducted to determine the ensiling characteristics of the material. All samples will be scanned by NIRS for forage quality determination and prediction equation development and sulfur content were determined by ICP. The regrowth and the undisturbed plots will be harvested for seed in summer 2015 to determine the effect of harvesting a forage crop on seed yield and seed/meal/quality and oil content. Field results indicate no differences in initial stand count for forage vs. seed (15.8 and 16.7 plants/0.5 $m^2$, respectively). Forage plot DM yields were similar across treatments (Table 1). Sulfur content