The winter rapeseed cultivar 'Bridger' had a yield increase from 2,601kg/ha to 3,070 kg/ha, a rate of 23 kg/ha per year (Fig. 1). The observed yield increase can be attributed to improvements in agronomic practices such as new pesticides and better fertility management. The yields of the best winter canola cultivars (top three each year) have increased from 3,400 kg/ha to over 4,400 kg/ha, an average increase of 52 kg/ha each year resulting from both agronomic and genetic improvements. Comparison of the genetic and non-genetic yield gains show that genetic improvements in winter canola were responsible for yield increases of 604 kg/ha (55% of the gain), while agronomics contributed 483 kg/ha (45% of the gain).

The yields of the best spring cultivars have also increased considerably, from 1,950 kg/ha to over 2,500 kg/ha (Fig. 2). The yield of 'Westar' spring canola increased from 1,665 kg/ha to 1,844 kg/ha due to improved agronomics. Comparing genetic with non-genetic yield gains, spring canola cultivars showed a yield improvement from genetics of 470 kg/ha (70% of the gain), while agronomic improvements accounted for an increase of 188 kg/ha (30% of the gain).

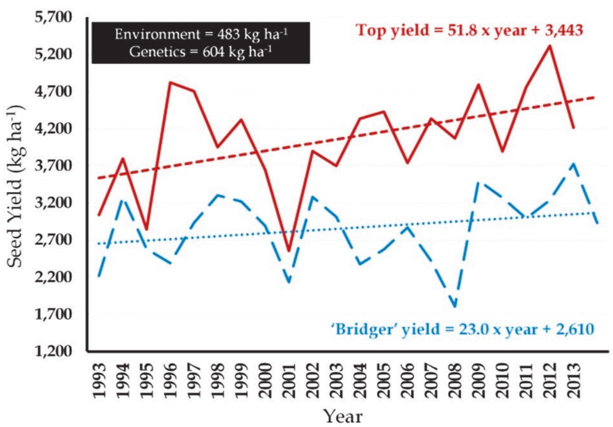

Figure 1. Yield increases in winter canola.

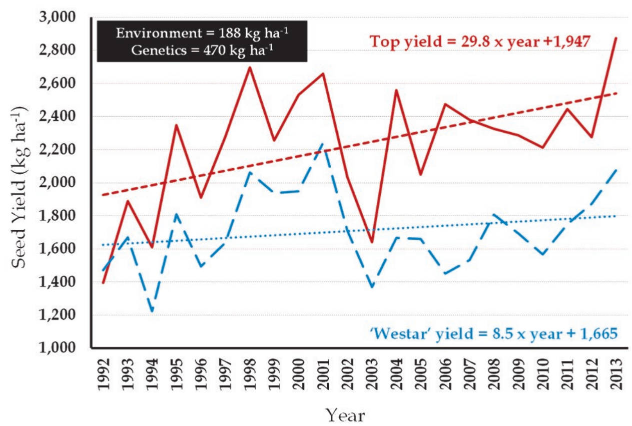

Figure 2. Yield increases in spring canola.

Two New Long-Term Winter Canola Cropping Systems Studies Established Near Ritzville, WA

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Two long-term winter canola cropping systems studies were recently initiated at the Ron Jirava farm five miles west of Ritzville, WA. Annual precipitation at the site averages 11.5 inches. The soil is a deep Ritzville silt loam with uniform texture throughout the profile.

Study 1 commenced in September 2014 and includes four winter crop species. These crops are winter canola (WC), winter pea (WP), winter triticale (WT), and winter wheat (WW). There are two 4-year crop rotations involving no-till summer fallow (NTF) that are compared to the "check" treatment of 2-year WW-undercut tillage fallow (UTF). The experimental design is a randomized complete block with four replicates. Individual plot size is 32 x 100 feet. Each phase of all rotation sequences is present each year for a total of 40 individual plots covering 2.94 acres. Crop rotation treatments are: (1) WC-NTF-WT-NTF, (2) WP-NTF-WT-NTF, and (3) WW-TF. Winter canola is planted from late July to mid-September depending on surface soil moisture conditions in the NTF and predicted air temperatures for the ensuing week. If adequate seed-zone moisture for planting WC is not present, spring canola is planted in late March. Winter pea is planted deep into moisture (no N fertilizer) with a deep-furrow drill into NTF during the first week of September. In the first author's experience, emergence of WP from deep planting depths has never been a problem. Winter triticale is planted deep into NTF during the first week of September if seed-zone moisture is adequate. If moisture is not adequate, WT seed is "dusted in" to NTF in mid-October. Winter triticale yields are much higher than those of WW with late planting. With the use of NTF, the two 4-year rotation sequences hold promise as stable, profitable, and ecologically-friendly crop rotations for the low-precipitation zone.

Study 2 was initiated in September 2015 following the completion of the 6-year safflower experiment (see article on page 28). The previous 3-year WW-safflower-UTF rotation was replaced by a 3-year WC-spring wheat-UTF system. Individual plot size in this study is 30 x 500 feet. The study site contains 56 plots covering 20 acres and has been the focus of cropping systems research for the past 20 years. As seed-zone moisture is generally greater in UTF (Study 2) compared to NTF (Study 1), WC will be planted in late August, if possible. If planting of WC is not possible, spring canola will be planted in late March. Excellent WC stands were achieved during this first year from an August 25, 2015 planting into UTF (Fig. 1). Due to widespread cold damage to *Brassica napus* WC varieties in recent years we, collectively, decided to use a *Brassica rapa* WC variety in this study due to improved cold tolerance and despite reduced seed yield potential compared to *Brassica napus* types. Long time Ritzville area WC grower Curtis Hennings suggested and provided the variety "Largo" for this study (Fig. 1).

Figure 1. Stand of 'Largo' *Brassica rapa* winter canola on the Ron Jirava farm near Ritzville, WA. This crop was planted with a deep-furrow drill on August 25, 2015. Photos were taken on April 5, 2016. Note the flowers are already well initiated on this date.

Based on experience of regional WC growers, only phosphorus is applied at time of planting WC in both Study 1 and Study 2. Nitrogen and sulfur is stream jetted in a Solution 32 formulation with a sprayer in a split application during the fall and again in early spring.

Rotational Effects of Winter Canola on Subsequent Spring Wheat as Related to the Soil Microbial Community

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Inclusion of canola as a rotational crop in the inland Pacific Northwest has expanded in recent years with the increased demand for canola-based products. Wheat grown after canola is generally reported to have greater grain yield compared to wheat grown after wheat. In a 7-year on-farm winter canola (WC) rotation study conducted near Reardan, WA, yields of spring wheat (SW) following WC were reduced compared to yields following winter wheat (WW). The objective of this research is to determine the differences and similarities in the soil microbial communities associated with WC and WW. If a shift in the microbial community between crops exists, we want to determine if the changes are connected to SW yield response. β-Glucosidase (BG) enzyme activity in WW was significantly greater compared to WC (Fig. 1A) in the first year (CS1), with the effect carrying over to the subsequent SW (CS2) in 3 of 5 crops years (CY). The BG enzymes are widely distributed among soil fungi and involved in the degradation of cellulose providing energy for soil microorganisms. Differences in BG activity could suggest alterations in the soil fungal community. Results of phospholipid fatty acid (PLFA)