RESEARCH POSTERS

PRICE RISK MANAGEMENT OF CANOLA IN WESTERN CANADA

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Farm price risk is related to variability in returns for enterprises. While increasing demand for canola has led to high prices, instability in returns is caused by variation in input and/or output prices. This study examines the use of futures markets and hedging as tools for reducing the price risk in Western Canada's canola production. Future contracts give traders (canola producers) two advantages: price-shifting and pricing. Hedging on futures markets is a method to shift risk (price-shifting). Canola producers can also lock-in a price (futures pricing) that covers costs of production and still provides positive returns – even while canola is still in the field. Hedging reduces price risk caused by price volatility. Different tests have been conducted to determine the strength of the relationship between canola cash prices and canola or soybean futures prices. Strong short-run and long-run relationships are required for hedging to be effective as a risk management tool. Weekly regional data from 1998 to 2007 (469 observations from the WCE and other sources) are used in time series Vector Regression models to test for Unit Roots and Co-integration - i.e., measures of price relationships. Preliminary results demonstrate a relationship between canola cash prices and canola future prices. Additionally, there is a relationship between Soybean cash prices and soybean future prices. These results indicate a co-integration between these commodities. U.S. soybean prices tend to lead canola prices. Estimation results indicate that futures prices lead cash prices. This is an important result for hedging. Next steps are to identify specific hedging models and to evaluate canola hedging strategies.

EFFECT OF CULTIVAR, SEED RATE, SEEDING METHOD ON YIELD AND FIBRE QUALITY OF FLAX

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Oilseed flax grown in Western Canada is often very short and the amount of flax straw that can be salvaged after combining is consequently low. The fibre industry requires high and uniform quality of raw material if flax is to become a successful bio-industrial crop. For oilseed flax producers, the ability to access the fibre industry as well as oil industry would increase the value of growing oilseed flax. The objectives of our study were to provide comparative information on oilseed flax (*Linum usitatissimum* L.) cultivars best adapted to central Alberta and determine optimal procedures for producing both oil and fibre. Field experiments were conducted under rain-fed conditions in 2005 and 2006 at CDC North and ALPAC Kraft mill site, about 200 km northeast of Edmonton, Alberta. A randomized complete block design was used with four replications. The treatments consisted of factorial combination of two cultivars (CDC Bethune and Flanders) three plant densities (800, 1600, 2400 plants m^{-2}) and three seedbed utilization (opener width/row spacing of 12.7%, 38.1%, and 63.7%). Fibre content was determined using NIR method. At higher seeding rate (1600, 2400 plants m^{-2}) flax seedling emergence was significantly increased by 9.0% with larger seedbed utilization (SBU). At harvest, there was significant differaence in total biomass yield between cultivars, 9596 kg ha^{-1} for CDC Bethune and 9055 kg ha^{-1} for Flanders. The average biomass yield for plant density of 800, 1600, 2400 plants m^{-2} were 8780, 9487, 9710 kg ha^{-1} respectively. Increasing the SBU from 12.7% to 63.7% significantly increased stem biomass yield by 9.1%. The salvaged straw yield of CDC Bethune was 4425 kg ha^{-1} compared with 4196 kg ha^{-1} of Flanders. There were no significant differences in fibre yield between Bethune (989 kg ha^{-1}) and Flanders (1017 kg ha^{-1}). Grain yield was not significantly influenced by cultivar, plant density and seed opener width. It is concluded that higher flax stem biomass could be achieved by increases in plant density and that there is no interaction between seedbed utilization and plant density.

DETERMINANTS OF SUPPLY AND YIELD FOR WESTERN CANADIAN BARLEY

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This project is funded by the Alberta Crop Industry Development Fund.

Crop production in the Prairie provinces have had substantial yield and production growth during the latter half of the twentieth century. Since 1960, barley average yield and total barley production have increased approximately 97% and 117% respectively. Recently, the growth in yield and production appears to be increasing at a much slower rate. Statistically, total barley production appears to be experiencing flatter growth when compared to average barley yield since 1980; total seeded and harvested barley acres also appear to be decreasing over time which may explain the decrease in total production. A large share of the growth in yield and production levels can be attributed to the research and development of new varietal technologies. This study attempts to establish a link between new varieties and barley productivity. The econometric analysis uses a natural structural break in the Canadian plant breeding system, the introduction of the *Canadian Plant Breeders' Rights Act*, to assess whether the release of new barley varieties has significantly influenced the average barley yield and total production in Western Canada. Since the *Canadian Plant Breeders' Rights Act* came into force on August 1, 1990, there have been 102 new barley varieties released in Canada. This number is substantially larger as compared to the period between 1960 and 1989, when only 46 new barley varieties were released. Econometrically, a barley supply equation and barley yield equation are estimated for the Prairie provinces. Variables in the yield equation reference the number of varieties released per year to determine whether the number of varieties released in a certain year is significant in the explanation of the changes in barley yield and production. Other variables that had significantly explained the supply of barley included the price of wheat (positive), the price of barley (negative), and a time trend to capture changes in technology (positive). Variables that significantly explained the yield of barley included weather (positive), and fertilizer (positive), whereas the price of barley was insignificant.

DETERMINANTS OF SUPPLY AND YIELDS IN THE ALBERTA CANOLA INDUSTRY: 1955-2006

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Through the past fifty years canola acreage in Alberta has increased over 6300%[1]. The decision to seed canola, as well as the resulting production has been influenced by a number of factors. The intent of this study is to determine the significance and effects of elements that have influenced the supply of canola. Using historical Alberta data including prices, yields, production, weather indices, the influence of substitutes in production and inputs (including advancements in breeding), supply equations will be estimated over the period of 1955 through 2006. This period has been witness to the first extraction of edible oil (1956), the first registered rapeseed variety (1963), the first double-low argentine "Canola" (1974), through to the first commercial GMO (1995); a period of considerable change and adoption.

Albertan total canola production and acreage supply response reveals the influence of; own price response (positive), substitutes such as barley (negative), prior behaviour (positive), the influence of weather (statistically insignificant), and a time trend (positive). Yields do not appear to respond to prices as much as to weather and a time trend, to reflect changes in technology and productivity. Canola breeding has contributed to increasing production, acres seeded and yields. Further refinements of the analysis will highlight the achievements of varietal development on supply response. September 2006 through September 2007 witnessed a 43% increase in canola price. Despite increased input costs one would expect for canola acreages to further increase in the near future.

[1]1957 – 2007, including rapeseed production.

AGRONOMIC IMPLICATIONS OF MORE INTENSIVE CANOLA ROTATIONS

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Rotation experiments were initiated in 1998 at Scott and Melfort to examine the implications of growing canola more frequently than the recommended 1 in 4 rotation. Rotations of continuous canola, canola-wheat, canola-wheat-pea, canola-wheat-pea-wheat and canola-wheat-flax-wheat were compared using an older blackleg susceptible cultivar [Westar] or a current herbicide tolerant hybrid with good blackleg resistance [Invigor]. Results to date suggest that:

- herbicide tolerance has largely overcome the need for long rotations for weed control.

- current genetic blackleg tolerance is very beneficial for reducing incidence of this disease.

- yields are not greatly affected except where canola is grown continuously or every second year.

- where yield losses have occurred, fungicides have not been highly effective in restoring yield.

However, shortened rotations are not without increased risk, and during the most recent 4 year period there are indications that yield is declining in the canola-wheat rotation even where herbicide tolerant hybrids with good blackleg resistance are grown.

ROTATION, RESISTANCE AND FUNGICIDES TO MANAGE DISEASES OF CANOLA AND FIELD PEA

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The use of resistant varieties, crop rotations of various lengths and fungicides were examined for their effectiveness to manage diseases of canola and field pea. Variety resistance combined with 4 year rotations very effectively mitigate blackleg disease of canola. Use of either strategy was effective, but the best management practice is to combine them. These strategies are less effective against a disease such as mycosphaerella blight of field pea, where fungicide use may be beneficial.

ECONOMICS OF SHORT CANOLA ROTATIONS

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The high profitability of canola has producers wanting to reduce the rotation interval for producing canola. Long-term studies at Scott and Melfort, Saskatchewan have examined shorter canola rotations with an older blackleg susceptible cultivar [Westar] and a current herbicide tolerant hybrid with good blackleg resistance [Invigor]. Net returns for shorter interval canola were compared to rotations with canola once every four years. Continuous canola had the lowest returns, followed by the blackleg susceptible canola if grown every second year. Fungicide application had no economic benefit. Canola returns from a 3-year pea-canola-wheat rotation were comparable to the 4-year rotation for the blackleg resistant hybrid canola. Producers should not reduce canola rotations to two years, or less. Under the conditions of this study, a three year interval for canola rotated with pea and wheat might be considered for short durations.

EFFECT OF TEMPERATURE AND CONCENTRATION OF FUSARIUM ON ROOT ROT OF LUPIN

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Narrow-leaved lupin (*Lupinus angustifolius* L.) is a cool-season pulse crop that is well adapted in central Alberta. Severe root rot of lupin, primarily caused by *Fusarium* spp., has been observed at several sites in recent years. In a two-factorial trial, growth chambers were used to determine the effects of temperature (30/20, 25/15, 20/10, and 15/5 ºC) and *Fusarium* concentration on the development of root rot in the lupin cultivar 'Arabella'. Inoculation with isolates of *Fusarium avenaceum* significantly reduced seedling emergence, plant height, and root size (length, fresh weight, dry weight) at all temperature regimes. Plants were stunted at 30/20 ºC in both inoculated and non-inoculated conditions, indicating that lupin does not grow well at high temperatures. Optimum growth and minimum pathogen damage were observed in the 25/15 ºC regime. Root rot severity increased and emergence decreased with increasing concentrations of *Fusarium* inoculum. To successfully grow lupin crops, soils with low *Fusarium* concentrations must be chosen and the crop should be grown in areas where high temperatures are not common.

YIELD REDUCTION IN NARROW-LEAVED LUPINE CAUSED BY FUSARIUM ROOT ROT

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A total of 119 isolates of *Fusarium* spp. were isolated from diseased root samples collected from 12 fields of narrow-leaved lupine, *Lupinus angustifolius* L., in Alberta, Canada in August, 2005. Isolates of *F. avenaceum* L. predominated in this collection. Therefore, 15 isolates of *F. avenaceum* were assessed in a greenhouse study for their impact on lupine cv. Arabella and to identify an aggressive isolate for use in subsequent field studies. Nineteen narrow-leaved lupine cultivars and lines were inoculated with *F. avenaceum* in field trials in 2006 and 2007. Reductions in emergence, plant height, root length and weight were observed, associated with differences in root rot severity. Lines MLU-324 and MLU-320 had the lowest seedling blight and the highest yield under inoculated field conditions. Mean yield reduction ranged from 1-56 % among the lines tested. In another field study, lupine seeds were coated with a fusarium grain slurry, air dried and mixed proportionally with healthy seeds to form contamination ratios of 0, 5, 10, 25, 50, 75 and 100%. Emergence and yield declined with increasing rate of contamination.

HYBRID AND OPEN-POLLINATED CANOLA FERTILITY COMBINATIONS WITH SEEDING RATE AND WEED REMOVAL

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Adoption of zero tillage has increased to greater than 60% in western Canada resulting in less soil disturbance and tillage intensity. Fertilizer placement in a band or seed row application in one pass with the seeding operation has become common. Producers are switching to hybrid canola cultivars because of superior performance compared to open pollinated (OP) cultivars. Three studies were conducted at AAFC Lacombe to determine the effect of fertilizer rate and placement, seeding rate and time of weed removal on hybrid and OP cultivars on plant density, yield and quality. Treatment effects were more evident in some than in other years. For example, in 2001 the use of a nitrification inhibitor (Agritain) improved plant density and yield of canola compared to urea when fertilizer was placed in the seed row. Cultivar, fertilizer rate and seeding rate all influenced yield of canola but these factors did not interact to affect canola yield. However, the year influenced the effect of cultivar, fertilizer rate and seeding rate. For example, in 1998 a 2.5 lb per acre seeding rate resulted in canola yield that was similar to higher canola seeding rates, whereas 5 and 7.5 lbs per acre seeding rates were required for maximum yields in 2000 and 2001, and 1999, respectively.. In another study, a cultivar and time of weed removal interaction indicated that yield of the hybrid was higher than the OP and that in some years late weed removal resulted in a crop failure in the OP but not the hybrid. Cultivar and time of weed removal had a bigger impact on canola yield differences than did fertilizer rate. Combining optimal factors to achieve maximum yield is complex and difficult when managing one year at a time. Strategies that account for year variability to minimize the risk associated with decision-making will increase the bottom line.

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WEED MANAGEMENT IN LUPIN AND FABA BEAN

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Narrow-leaved lupin (Lupinus angustifolius) and white-flowered faba bean (Vicia faba major) grow well in Alberta and have large potential in domestic and foreign markets for fish food and hog food as a protein source. As relatively new crops to Alberta and not competitive with weeds, there is an immediate need for weed management information as well as minor use registrations. Three field experiments were conducted at three sites in central Alberta for two years. The three experiments included integrated weed management in lupin using herbicides and two lupin seeding rates, tolerance of lupin to herbicides and tolerance of faba bean to herbicides. Broadleaved weeds in faba bean can be addressed with the registered treatment pre-plant incorporated (ppi) Edge + Sencor. Edge + Sencor applied ppi can provide effective, season-long control of a wide weed spectrum without injury to lupin as well. Other options for lupin for different weed spectrums and soil conditions may include pre-emergent Sencor, Dual II Magnum, Lorox and Spartan. Post-emergent Sencor may be an option where mustard family weeds are small. Post-emergent Pursuit Ultra may be an option where hard-to-kill weeds such as cleavers and stork's-bill are a problem. Both Sencor and Pursuit Ultra tend to injure lupin and may cause a seed yield reduction. Higher water volumes should be used when applying Sencor post-emergently to lupin and faba bean to reduce the chances of injury. Using the data derived from these experiments, several minor use applications have been submitted to obtain registered tools needed to grow lupin and faba bean in Alberta.

EVALUATION OF GPS YIELD MAPPING TECHNOLOGY AT RECLAIMED INDUSTRIAL SITES IN ALBERTA

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Precision agriculture includes the use of combines equipped with yield monitors and moisture sensors to provide geo-referenced crop yield information. The objective of this study was to evaluate GPS grain yield mapping technology at reclaimed industrial sites in Alberta. The Agricultural Research and Extension Council of Alberta (ARECA) and its member organizations contacted grain producers throughout Alberta with crop yield mapping capability. An interview protocol to acquire background information and crop yield data was completed by 47 farm operators. Six operators with appropriate crop yield data at reclaimed sites were selected for this study. Thirteen crop yield data sets were generated for reclaimed industrial sites after removing erroneous crop yield observations. Spatial analysis of the crop yield data sets was used to produce a spatial average with confidence intervals for each industrial site and representative off-site area. The study explored the effectiveness of GPS yield monitoring technology at reclaimed industrial crop-land to provide a statistical comparison of site and off-site crop yield; determine the number of site and off-site data points available and necessary for a statistical comparison; determine field and site crop yield variability; evaluate crop yield at various shaped sites including linear (pipeline) and square or rectangular shaped sites; evaluate crop yield for one or more years from the same area; and compare the value of adjacent or distant controls. The study demonstrated that GPS yield monitoring technology is applicable for statistical analyses of crop yield on linear and non-linear industrial disturbances for one or more years. The study also demonstrated that one or even several years of crop yield data may not be sufficient to provide assurance that site capability is acceptable under the influence of a full range of crop and environmental conditions typical for the area.

RESIDUAL LIMING EFFECT OF CATTLE MANURE APPLICATION ON CANOLA YIELD AND QUALITY IN NORTHERN ALBERTA ACID SOIL

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Acid soil productivity is restricted due to its low pH. This study investigates the effectiveness of using cattle feedlot manure to increase soil pH and improve canola yield from acid soil at Beaverlodge and Fort Vermilion. There were five treatments: Control, NPS fertilizer, NPS fertilizer+lime, and cattle feedlot manure (80 t ha^{-1} and 160 t ha^{-1}). The cattle manure and lime were applied only once in fall 2003 while NPS fertilizer was applied each spring according to soil test results. The pH was significantly higher in manured soil (by 0.3 unit for Beaverlodge and 0.8 for Fort Vermilion) than the control treatment in fall 2007 four years after the manure application. In addition, manured soil had higher available N (8.1 mg kg^{-1} at Beaverlodge and 17.9 at Fort Vermilion) and P content (10.4 and 21.6 mg kg^{-1}) than the Control (6.6 and 10.6 mg kg^{-1} for available N and 7.8 and 12.9 mg kg^{-1} for P at Beaverlodge and Fort Vermilion, respectively). Canola yield in 2007 was 31% (Beaverlodge) and 274% (Fort Vermilion) higher in manured treatments than the Control. The oil content (49.3% in Beaverlodge and 48.7 % for Fort Vermilion) and TN content (2.95% for Beaverlodge and 3.33% for Fort Vermilion) were similar to the Control but TP content was higher (by 17.9 and 5.7%) than the Control Applying cattle manure at rate of 160 t ha^{-1} once every four year had similar effect as the combination of liming once very four year and annual fertilizer applications with N at 95 to 100 kg N ha^{-1} yr^{-1} for Beaverlodge and 85 kg N ha^{-1} yr^{-1} for Fort Vermilion) and P2O5 at 26-36 kg ha^{-1} yr^{-1} for Beaverlodge and 45 kg ha^{-1} yr-$^{-1}$ for Fort Vermilion. Cattle manure application is an effective way to raise the soil pH, provide nutrients and increase crop productivity from acid soil.

RELATIVE CROP COMPETITION – A CONTEST!

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Canola production in Canada is dominated by hybrid, herbicide-resistant cultivars which control most major weeds and facilitate direct-seeding systems. Hybrid herbicide-resistant cultivars also substantially improve canola competition with weeds. The enhanced competitive ability of the new hybrids has been great enough to warrant comparisons with other crops that are considered to be highly competitive with weeds such as barley and rye. Experiments were conducted in 2006 and 2007 at four to five locations in western Canada each year to compare the relative competitive ability of several open pollinated- and hybrid-spring canola cultivars with spring barley, rye, triticale, and wheat. Cultivated oat was seeded across all experiments to simulate weed competition and oat biomass was used as the primary determinant of the relative competitive ability of each crop cultivar. Results varied considerably from site to site depending on the associated soil zone and environmental conditions. In some cases, hybrid canola cultivars were at least as competitive as barley and more competitive than triticale or wheat. More competitive canola hybrids were often observed at relatively cool, moist sites such as Beaverlodge and Lacombe as opposed to Lethbridge, Scott or even Saskatoon. At the latter sites, small-grain cereals were often more competitive than any of the canola cultivars. Most of the data indicate that cereal cultivars, and especially barley, are more competitive than canola, but some environments can lead to exceptions. Crop biomass was usually highly negatively correlated with oat (weed) biomass. At all locations, the hybrid canola cultivars were or tended to be more competitive than the open-pollinated cultivars. The relatively high competitive ability of new canola hybrids allows growers to more effectively implement integrated weed management practices with less dependence on herbicides.

INTROGRESSION OF CLUBROOT DISEASE RESISTANCE IN CANADIAN SPRING CANOLA AND DEVELOPMENT OF MOLECULAR MARKERS

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Introduction of clubroot disease resistance in Canadian spring canola has become an urgent demand for canola growers in Alberta. Around 25% of the canola acres in Alberta have been reported to be at the risk for clubroot infestation which would translate to a potential threat of about 50 million CAD annual losses to the canola industry in this province. So far five clubroot pathotypes (*Plasmodiophora brassicae*) have been identified in Alberta of which pathotype-3 has been reported to be the most prevalent. There is no report of resistance among Canadian spring canola cultivars against these pathotypes. However, clubroot resistance is available in few European winter canola (*B. napus*) cultivars as well as in the parental species of *B. rapa* and *B. oleracea*. A research project is undertaken at University of Alberta to identify *Brassica* germplasm resistant against the Albertan clubroot pathotypes and to transfer the resistant gene (s) in Canadian spring canola. More than two hundred cultivars/lines/land races of different *Brassica* species and sub-species have been collected from different National and International research institute, laboratories and Gene Bank from Asia, Europe and North America and some of them have been found resistant against the Albertan clubroot pathotypes. For example, non-canola quality rutabaga (cvs. PolyCross, BrookField) has been found to be more resistant to clubroot pathotype-3 and mixed culture of the five pathotypes then other germplasms (e.g., European Clubroot Differentials-ECD). To transfer this resistance as well as to develop new clubroot resistant Canadian spring canola variety different crossing approaches have been undertaken. These approaches will help us to understand the effect of the resistance of parental species in canola (*Brassica napus*), to identify the location of the resistant gene (s) on the chromosome and to develop molecular markers for marker assisted breeding and eventually to develop clubroot resistant spring canola cultivars for the Canadian prairies.

EFFECTS OF DIVERSE CROPPING SYSTEMS ON ROOT MAGGOTS (*DELIA* SPP.) (DIPTERA: ANTHOMYIIDAE).

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Infestation of canola crops by root maggots can be reduced when non-host plants are grown with canola due to the disruption of the pre-oviposition behaviour of the flies by the presence of non-host plants. Intercrops of canola and wheat were established in 2005 and 2006 at Lacombe, Ellerslie, and Ft. Vermilion, Alberta to test if wheat, as a non-host to Delia spp., could reduce root maggot infestations to canola while also producing a second marketable product. Adult Delia spp. abundances and larval feeding damage to canola taproots in response to varying proportions of canola and wheat in the intercrops and monocultures will be discussed.

EFFECTS OF SOIL AMENDMENTS AND CHEMICAL TREATMENTS ON CLUBROOT OF CANOLA

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Clubroot, caused by Plasmodiophora brassicae, has been found in over 150 canola fields in Alberta over the past five years. The disease represents one of the most serious challenges to face canola producers in the province, because of the long persistence of clubroot in the soil, the lack of known control options, and the potential of clubroot to cause a devastating level of damage in affected crops. Two experiments were initiated in the Edmonton area to evaluate the effects of soil amendments and fungicidal chemical treatments on clubroot severity and on canola growth in clubroot-infested soils. Treatment with Terraclor (pentacloronitrobenzine) reduced clubroot severity, and increased plant height and yield in clubroot-infested soils. Amendment of soils with calcium carbonate or wood ash at 7.5 t/ha also reduced disease severity and increased plant height and yield. Although these amendments do not eradicate clubroot from the soil, they have the potential to reduce its effect on susceptible crops.

SEEDING DEPTH AND INOCULUM DENSITY AFFECT FUSARIUM SEEDLING BLIGHT AND ROOT ROT OF FIELD PEA

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Root rot limits plant vigour and yield of field pea crops by reducing the number of roots available for nutrient and water uptake and for symbiotic nodulation. A study was undertaken to assess the effects impact of seeding depth and inoculum density on infection by Fusarium, and to determine the impact of seedling blight and fusarium root rot on field pea seed yield. A highly aggressive strain of F. usarium avenaceum was incorporated into the soil at the time of seeding at 0, 20, 40, and 80 mL/6m rowthree concentrations (low, medium, high; 20, 40 and 80 mL per 6-m-long row) plus a non-inoculated control. In a separate experiment, field pea was sown into inoculated or non-inoculated plots at 2-, 4-, 6-, and 8-cm depths. EEmergence of pea seedlings declined with each increase in inoculum concentration. Nodulation was lower for the highest concentration compared to the control. Also, yYield was lower for the plots inoculated at the 40 and 80 mL/rowmedium and high rates compared to the control, and was lower for plots inoculatedat the high rate at 80 mL/row compared to those inoculated at 40 mL/rowthe medium rate. In a separate experiment, seed was sown into inoculated or non-inoculated soil at 2-, 4-, 6-, and 8-cm depths. Emergence and seed yield increased with increased seeding depth. Seeds planted at 2-cm depth had significantly lower emergence compared to deeper-seeded pplantingseas. Also, and plots seeded at 2-cm and 4-cm depths had significantly lower yield compared to those seeded at 6-cm and 8-cm depths. Increased inoculum concentration proportionately reduced seedling emergence and increased seeding depth improved seedling emergence and yield.

GROWING KURA CLOVER WITH BARLEY AND TRITICALE: EFFECTS ON SILAGE YIELD, QUALITY, WEED PRESSURE, AND CEREAL DISEASES.

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Producers are interested in sustainable crop production systems that reduce the application of chemical fertilizers and pesticides. Incorporating a living mulch in cereal silage production might help achieve this. Living mulches are a form of intercropping, which is the cultivation of two or more species in the same space and time. More specifically, a living mulch (LM) is a plant into which a row crop is seeded. Often, the LM is a perennial forage legume, e.g. a low-growing clover or vetch. Perennial legume living mulches may provide nitrogen, compete with weeds, and reduce disease incidence in an interseeded cereal. Kura clover (Trifolium ambiguum M. Bieb) is a low growing, rhizomatous legume. It is extremely long-lived and very winter-hardy, making it an ideal candidate for use as a LM in Alberta.

The objectives of this experiment were to investigate the potential of a kura clover living mulch to supply nitrogen to barley (Hordeum vulgare L.) and triticale (X Triticosecale Wittmack) silage crops, and to decrease cereal diseases and weed pressure. Field experiments were conducted in 2006 and 2007 at the Agri-Food Canada Research Station in Lacombe, Alberta. Kura clover plots were established in 2005. Treatments included two cereal rotations, three levels of nitrogen fertilization, and spring herbicide suppression of the clover. Initial results indicate that the presence of the living mulch significantly reduced weed numbers and early season leaf diseases in barley. Silage yields were decreased in the living mulch plots compared to the cereal monoculture yields. The spring herbicide suppression helped mitigate this effect. Relative feed values were greater for the living mulch plots than the cereal monoculture plots as the presence of the kura clover decreased % ADF and % NDF, while increasing % CP.

THE IMPACT OF SEEDING RATE AND ROW SPACING ON PRODUCTIVITY OF CANOLA

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Canopy manipulation implemented by varying seeding rate and row spacing has been suggested as a potential method to reduce the severity of sclerotinia stem rot of canola. The impact of these measures on canola productivity was examined in the absence of disease in experiments at Melfort, SK and Lacombe, SB from 2002-2004. The effect of 4 row spacings (23, 31, 46 and 62 cm) and three seeding rates (0.5, 1.0 and 1.5 X the recommended rate of 6 kg ha-1) was examined for two glyphosate tolerant varieties (hybrid and open-pollinated (OP)) of canola in a direct seeding system. The effects of these factors were determined on days to first flower (DTSF), flowering period (FP), lodging, plant population, yield, % green seed (GS) and thousand seed weight (TSW). The DTSF and plant population were greater for the Hybrid than the OP, while FP, lodging score and GS varied inconsistently between cultivars. Yield was greater for the hybrid than the OP cultivar under dry conditions, but the OP was greater at 4 site-years under normal moisture conditions. The TSW of the OP was consistently greater than the hybrid. Seeding rate had few consistent effects on the factors measured except plant population, which increased with increased seeding rate. Yield of the 0.5 and 1.5 X rates were not different from the 1.0X rate, except at 1 site-year where yield of the 0.5X treatment was reduced compared to the 1.0X rate. Row spacing had the greatest impact on most measured factors. DTSF, FP and lodging score tended to increase and plant population decrease as width of row spacing increased. Yield at the 23 cm row spacing was always greater than or equal to yield at other row spacings. At 2 site-years, yield at the 61 cm row spacing was less than at other row spacings. The GS and TSW were not usually affected by row spacing. The results indicted that the use of wider row spacing may have a detrimental impact on crop productivity in the absence of disease and may not be a useful routine practice to reduce stem rot risk. Moreover, there was an indication of enhanced lodging with wider row spacing, which can increase disease risk.

TRITICALE STRAW BIOREFINING USING PUREVISION FRACTIONATION PROCESS FOR PRODUCTION OF ETHANOL AND COPRODUCTS

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Alberta Agriculture and Food contracted with PureVision Technology, Inc. (PureVision) beginning in January 2007 to investigate converting triticale straw into value-added products using PureVision's biomass fractionation technology as part of the Canadian Triticale Biorefinery Initiative (CTBI). During the 9-month project, completed in October 2007, triticale straw was processed into sugars, cellulose and lignin using PureVision's biomass fractionation equipment. Research was performed at the small pilot scale to optimize the process for Canadian triticale straw. The continuous process development unit, with a ~50 kg/day capacity (dry), consisted of a modified extruder and ancillary equipment. The overall project objective was to develop a two-stage fractionation process for converting triticale straw into a solid cellulose stream and two liquid streams containing mostly hemicellulosic sugars and lignin, respectively.

The project demonstrated that the fractionation technology segregates the lignin as a separate product stream. Removal of lignin from cellulosic feedstocks like straws and woody biomass benefits overall biorefining process economics by both providing a higher value lignin co-product and reducing enzyme costs with enhanced cellulose digestibility when fermentation sugars are desired for ethanol or biochemical production. An economic analysis of the fractionation process was conducted that compared PureVision's fractionation biorefining approach with a competitive biorefining process that utilizes dilute acid pretreatment. This comparative exercise showed a 13¢/gal ethanol advantage for the PureVision biorefinery when the cellulose is converted to ethanol, using a baseline lignin selling price of $330/metric ton as a feed binder. Alternative, non-biofuels markets for the purified cellulose include use as a pulp for different applications in the pulp and paper industry.

This work successfully demonstrated the fractionation process is capable of processing triticale straw to produce a solid stream of purified cellulose for ethanol production or pulp products and two liquid streams, with the first stage liquor containing most of the hemicellulosic sugars and the second stage liquor containing low molecular weight lignin. Based on the project outcome and previous work on other biomass feedstocks, similar results are anticipated for other Canadian agricultural residues.

FIELD PROOFING A DISEASE PREDICTION SYSTEM FOR ASCOCHYTA IN FIELD PEA IN ALBERTA (3 YEAR SUMMARY)

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In 2005, 2006, and 2007 field trials were conducted at 5 sites in north central Alberta to evaluate a disease prediction system and pea yield response, thousand kernel weight, and level of ascochyta infection of seeds when HeadlineR was applied to control ascochyta blight. Each plot had dimensions of approximately 200 ft by 80-100 ft, depending on the size of the sprayer used. Field selection was based on: high plant populations with a minimum of 75 plants/m2, good weed control, even crop emergence, and high rhizobium nodulation. Starting at the end of June, an ascochyta prediction system was used to predict the level of ascochyta risk. The prediction system assessed: canopy density, canopy humidity, presence of disease, and the short-term (5 day) weather forecast. At each location, the four criteria were assessed (non destructive plant evaluations) biweekly and the total scores influenced when the plots should receive Headline fungicide. In 2005 and 2006 all 5 locations reached the minimum 65 prediction score. In 2007, 4 of the five locations reached the minimum 65 prediction score. Also the 2007 site at Linaria was lost due to hail damage. In 2005, final yields revealed a significant yield increase from Headline application at all 5 locations with a range yield increase of 14-35%. In 2006, 3 out of 5 showed a significant yield increase with a range yield increase of 14-35%. In 2007, 3 out of 4 sites showed a significant yield increase of 5-19%. Over three years, a significant yield increase occurred at 11 out of 13 locations and the average yield increase was18%. Significant differences in thousand kernel weight occurred at 3 out of 5 sites in 2005, 4 out of 5 sites in 2006 and 2 out of 4 sites in 2007.

MANAGEMENT STRATEGIES AND PRACTICES FOR PREVENTING NUTRIENT DEFICIENCIES IN ORGANIC CROP PRODUCTION

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Abstract: Field experiments are underway in Canada to determine the influence of management practices (input level, crop diversity, green manure, fallow, legume) and amendments (Penicillium bilaiae, rock phosphate, elemental S, gypsum, manure, wood ash) on crop yield. In the cropping systems study established in 1995, crop yields for organic system without any chemical input were 30-40% lower than the conventional system with high inputs. But, lower input costs plus price premiums for organic produce normally more than offset lower yields, resulting in favourable economic performance and energy efficiency. Legume, green manure, fallow and manure helped to replace nutrients lacking in the soil and improved crop yields. In the organic system, amount of P removed in crop exceeded that of P replaced and this can be a major yield limiting factor. In amendments experiments, there was small effect of granular rock phosphate fertilizer and/or Penicillium bilaiae in increasing soil P level and crop yield in the application year. Other findings suggested the use of elemental S fertilizer, gypsum, manure or wood ash to improve nutrient availability, and yield and quality of produce. In conclusion, the findings suggest that integrated use of management practices and amendments has the potential to increase sustainability of crop production as well as improve soil quality plus minimize environmental damage.

POTENTIAL OF FENUGREEK (TRIGONELLA FOENUM-GRAECUM) AS A FORAGE FOR DAIRY CATTLE

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Fenugreek (*Trigonella foenum-graecum* L.) is a single-cut, annual legume, originating from the Indian subcontinent and eastern Mediterranean regions, where it is traditionally used as a spice or dye. Fenugreek also has potential neutraceutical qualities, some of which may be of benefit to dairy cows.

Forage-type fenugreek varieties have recently been developed at the Agriculture and Agri-Food Canada research station in Lethbridge, and at the University of Saskatchewan. Benefits of fenugreek for forage include high protein levels throughout the growing season, indeterminate growth, and nitrogen fixation.

Research in Lethbridge found that one cut of fenugreek was equivalent in dry matter to two cuts of alfalfa. Fenugreek silage has a similar nutrient composition to alfalfa silage, and superior digestibility, which could lower the need for protein supplementation in dairy rations and thus reduce feed costs.

Two varieties of fenugreek, CDC Quatro and AAFC F70, were grown at the University of Alberta Edmonton Research Station in 2006. Plants were harvested bi-weekly, to determine growth characteristics such as biomass accumulation, canopy development, and leaf to stem ratio.

While F70 demonstrated higher emergence, and greater initial growth in terms of plant height, biomass, and leaf area, end of season measurements were similar between varieties. Both genotypes of fenugreek yielded as much dry matter as alfalfa hay in the same region.

F70 and Quatro did not exhibit any significant differences in leaf to stem ratio, fibre, or crude protein content. Throughout the growing season, fenugreek maintained a crude protein content greater than 15%, and at all points through the growing season maintained a higher Relative Feed Value compared to full-bloom alfalfa.

While the research on fenugreek in north central Alberta is at a preliminary stage, if fenugreek is found to be equal or superior to alfalfa as forage for lactating dairy cows, then producers will have another forage crop that they can feed to their cows and use in their cropping rotation.

EFFECT OF NITROGEN RATE AND PLACEMENT AND SEEDING RATE ON BARLEY PRODUCTIVITY AND WILD OAT FECUNDITY IN A ZERO TILLAGE SYSTEM

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Seed-placed nitrogen (N) in the form of urea can be a popular option for barley producers since it allows seeding and fertilizer application to be accomplished simultaneously with minimal soil disturbance. However, seedling damage can occur from excess seed-placed urea. The objective of this study was to compare the effects of seed-placed and side-banded N (urea) applied at different rates, and to investigate if increasing the barley seeding rate would improve the ability of barley to overcome urea induced injury and compete better with wild oat. A field experiment was conducted at Lacombe and Beaverlodge AB, and Brandon MB over three years. N was applied as urea at five rates (0, 30, 60, 90 and 120 kg ha^{-1} actual N) either directly with the seed or as a side-band, at three barley seeding rates (200, 300 and 400 seeds m^{-2}). When N was placed with the seed, barley plant density decreased, while time to maturity and wild oat fecundity increased as N rate increased. Barley yield also decreased but only at N rates above 60 kg ha^{-1}. Increasing the seeding rate partially overcame the negative effects of seed-row N placement. However, barley densities and yields were still lower, and wild oat fecundity greater compared to when N was applied as a side-band. Placing N as a side-band did not reduce barley density, resulting in shortened time to maturity, increased barley yield, and lower wild oat fecundity as compared to seed-placed N.

INVESTIGATION INTO THE ADAPTABILTIY OF MUNG BEAN (VIGNA RADIATA) ON THE CANADIAN PRAIRIES

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Summary

Mung bean (Vigna radiata) and black gram (Vigna mungo) are currently being investigated for commercial production on the brown and dark brown soil zones of southern Alberta. The primary food use of these crops is for Asian cuisine in the form of bean sprouts. Also, seed can be cooked whole, included in dhal, and the flour may be used as an ingredient in noodles and cakes (Bacon 2004).

In the winter of 2006, over 200 accessions from different areas of the world were acquired and multiplied out in the greenhouse. In 2006, field trials at Lethbridge and Bow Island, Alberta were conducted to assess adaptability to environmental conditions. Thirty three lines of mung bean were selected to have good adaptability; upright stature, resistance to insects and diseases, as well as, a physiological maturity that meets Alberta's short growing season. No black gram accessions were selected due to poor adaptability to the Alberta environment.

In summer 2007, thirty lines of Mung bean (Vigna radiata) were assessed for plant height, physiological maturity and yield at two locations, Brooks and Bow Island, using a Randomized Complete Block Design (RCBD).

Key words; Mung bean (Vigna radiata), adaptability, physiological maturity, yield

References

Bacon, G. 2004. Building global markets for pulse crops. FarmTech 2004 Proceedings, p. 30-33. www.farmtechconference.com/PDF/2004proceedings/bacon.pdf. Site visited April 2006.

Irmie, B. 1998. Mung Bean. www.rirdc.gov.au/pub/handbook/mungbean.pdf. Site visited April 2006.

Olson, M.A., Kaufmann, J., Henriquez, B, McKenzie, R., Bing, D.J., Lopetinsky, K.J., and Hoy, C., 2007. Developing Mung bean and Black gram; Phase II in the Commercialization of Two New Pulses for Alberta. Pp 1-59. Interim Report. Alberta Crop Industry Development Fund (ACIDF).

INFLUENCE OF INTEGRATED WEED MANAGEMENT PRACTICES ON WILD OATS (AVENA FATUA L.)

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Wild oat is a competitive annual weed that continues to be widespread on the Canadian prairies despite improvements and use of wild oat herbicides. Adoption of integrated weed management (IWM) practices provides an approach to reducing weed competition, enhancing crop performance and increasing farm income. The effects of crop rotation, seeding rate and herbicide rate on wild oat seasonal emergence, density and seed viability were evaluated in 2006 and 2007 at AAFC Lacombe, Beaverlodge and Fort Vermilion, Alberta. Crop rotations included continuous barley and barley-canola-barley-peas. Tall and short barley cultivars, AC Lacombe and Vivar, respectively, were seeded at recommended (150 plants m-2) and double rates (300 plants m-2) and canola, Invigor 5020, was seeded at a recommended rate of 120 plants m-2. Wild oat herbicides were applied at quarter, half and full recommended rates. Preliminary results from Lacombe show that moisture and warming soil temperatures in early spring corresponded to increased rates of wild oat emergence in late spring (June).The cumulative effects of a diverse crop rotation, high seeding rates and higher herbicide rates effectively decreased wild oat plant densities. Six years after initiating the trial, wild oat densities were lower in barley grown in a diverse crop rotation than when grown continuously. Herbicides effectively managed wild oat in both continuous and crop rotation treatments. Wild oat densities were significantly higher in quarter herbicide rate treatments even when combined with competitive crop cultivars, high seeding rates and a diverse crop rotation. Fewer wild oat seeds were retrieved in Lacombe from the spring and fall seed banks under a diverse crop rotation with competitive cultivars, high seeding rate and half or full herbicide rates. A greater proportion of viable seeds were recovered in the fall relative to the spring. Based on these result, adopting IWM practices will offer producers practical, economical and environmentally sustainable methods for wild oat control.

CANOLA PRICES AND BIODIESEL PRODUCTION IN CANADA

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This research estimates the required increase in canola acreage required to produce biodiesel in Canada. The federal government has introduced a policy that requires all diesel fuel to contain 2 percent biodiesel by 2012. This federal requirement will increase the demand for biodiesel to 800 million litres/year. In Canada, biodiesel is produced from canola oil, which is grown almost entirely in Manitoba, Saskatchewan and Alberta. From 1997 to 2007, average annual Canadian canola production was approximately 7.3 million tonnes. Each 1000 liters of biodiesel requires approximately 2.2 tonnes of canola seed, so the biodiesel industry would generate an additional requirement for 1.8 million tonnes of canola per year, which represents a 24 percent increase from the 10 year average. Canola prices are expected to increase dramatically, having a major positive impact on farm profitability in western Canada. To estimate expected price changes, canola acreage response is estimated for Alberta, Saskatchewan and Manitoba using regression models with 30 years of crop-year price data for major crops grown in western Canada. The regression coefficients represent output elasticities, which represent the percentage change in canola acreage for a 1 percent change in canola prices. Combining this information with average canola yields over ten years and average acreage levels in each of the three prairie provinces allows an estimate of the price changes that would stimulate the required level of canola production. Preliminary results indicate that canola prices would increase by $75 to $91 per tonne under the market conditions required to meet the 2% biodiesel production targets as well as meet other current uses for canola seed.

SOIL CARBON IN PERENNIAL AND ANNUAL CROPPING SYSTEMS AT BRETON

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Stores of soil organic carbon (SOC) are shaped by cropping systems and management. Few longterm studies of agricultural cropping systems have compared continuous annual and continuous perennial systems. We studied the C dynamics in the Hendrigan Plots at Breton, over 1980 to 2005, in three cropping systems: continuous perennial fescue-white clover forage (CF), continuous annual grain/barley (CG), and an 8-yr agroecological rotation (AER). Data included estimates of net primary productivity (NPP) and inputs of C to soil, and changes in SOC mass. The AER system had the greatest NPP and input of C to soil. The CG and CF systems had similar inputs of C to soil, but soil C increases were much less in CG than in CF. Inputs of C to soil were mostly from above-ground productivity in CG and mostly from below-ground productivity in CF. The diverse AER system (with 4 years of annuals and 4 years of perennials, and additions of manure and legumes) and the continuous perennial forage CF system had equally large SOC increases of 75-84 g C m-2 yr-1. Continuous or partial use of perennial forage crops may greatly increase SOC in soils with low inherent organic matter, such as those at Breton.

NEURAL NETWORK TREES AND SPOT SATELLITE IMAGERY TO ESTIMATING AGRICULTURAL LAND COVER IN SOUTHERN ALBERTA

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The ability to accurately identify agricultural land cover is essential to (1) provide inputs into agricultural production models, (2) model environmental change, (3) evaluate carbon sequestration. Remote sensing provides a means for acquiring data over large areas but improved methods for land cover information are required. As a nonparametric approach, neural network (NN) modelling may offer significant performance advantages compared with standard statistical classification techniques. In this study, the use of a series of NNs linked into a tree structure and involving August SPOT satellite reflectance values, was compared with traditional Maximum Likelihood Supervised Classification (MLSC). The Lethbridge study site included fallow and native rangeland, and a variety of crops grown under dryland and irrigation. Field level cropping data were provided by Alberta Financial Services Corporation and Alberta Agriculture and Food. Both NN and MLSC had excellent classification accuracies for native rangeland, fallow and cropped land. Within crops, the classification accuracy of oilseeds, cereals and broadleaf cereals (corn) were similar with the two techniques. The NN tree classification outperformed the MLSC on forages and pulse crops but was less accurate for root crops. The use of linked NNs with alternate single dates as well as multi-temporal imagery is being investigated.

DEVELOPING DIAGNOSTIC TOOLS FOR NITROGEN MANAGEMENT IN POTATOES

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Optimization of N application in potatoes offers economic and environmental advantages. Traditionally, in-season N requirements for potatoes are monitored using petiole nitrate analyses. In this pilot study the use of a chlorophyll (SPAD), Greenseeker and Dualex meter as potential "real-time" non-destructive tools for estimating N levels in potatoes was evaluated. The study was superimposed on an existing experiment designed to examine petiole nutrient recommendations for Russet Burbank potatoes. A subset of treatments involving four rates of N (24, 150, 200 and 250 lb/ac) were selected. There were four replicated plots per treatment. Seven times throughout the season, and coincident to petiole sampling, SPAD meter, Dualex meter and Greenseeker measurements were taken. The Dualex showed the most promise as a replacement for petiole sampling. With the exception of June 27th and August 8th, when there was no significant differences between the four N treatments, the Dualex values for the lowest N rate of 24 lb/ac were significantly higher than the other three N rates. A good relationship was found between the petiole N-NO3 and Dualex values confirming the similarity in the results trend observed for the two types of measurement. Further studies are required to evaluate the potential of the Dualex.

GROWTH ANALYSIS OF FABA BEAN AND LUPIN UNDER GRASSY WEED COMPETITION IN A NORTHERN ENVIRONMENT

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Grassy weed pressure can significantly decrease the productivity of faba bean (Vicia faba L.) and narrow leafed lupin (Lupinus angustifolius L.). Field experiments were conducted in north central Alberta, between 2004 and 2006. Faba bean and lupin were grown with barley (Hordeum vulgare L.), as a model weed, at 3 densities (0, 25, and 50 plants m-2). Leaf area index (LAI), light interception, canopy height, and dry matter (DM) accumulation were measured at 21-d intervals between 37 and 120 d after planting (DAP). At 79 DAP, 25 barley plants m-2 reduced faba bean LAI by 41% and lupin LAI by 64% compared to weed free treatments. Grassy weeds tended to be shorter than the faba bean canopy but taller than the lupin canopy. As a result, weed presence did not affect the amount of light available at the top of the faba canopy. Due to the height advantage of grassy weeds over lupin, the amount of light available at the top of the lupin canopy was reduced by 51%, 100 DAP. A grassy weed density of 25 plants m-2 reduced lupin DM by 72% and faba bean DM by 45%. The poor competitive ability of lupin may be attributed to slow early season LA development, short stature, and poor light interception which indicate the need for early and effective grassy weed control in lupin crops.

MIXING CABBAGE SEEDPOD WEEVIL RESISTANT AND SUSCEPTIBLE CANOLA FOR IMPROVED CROP PROTECTION

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The Cabbage Seedpod Weevil, CSPW (Ceutorhynchus obstrictus) is a serious, alien invasive insect pest of canola in North America. Insecticides are currently the only control strategy available to producers, so development of weevil-resistant canola was undertaken as a means of promoting economic and environmental sustainability. White mustard, Sinapis alba, has long been known to harbor genetic resistance to the weevil and to other insect pests like root maggots and flea beetles, and was therefore selected as the resistant parental line for developing resistant canola. Introgression of resistance traits was achieved by crossing S. alba with Brassica napus, and performing embryo rescue. Several of these genotypes were found to be CSPW-resistant based on field and laboratory screening. Maintaining refuges of susceptibility can minimize selective pressures and maintain resistance in transgenic crops. Mixing resistant and susceptible lines may have added benefits. Insects may spend more time choosing and less time feeding and ovipositing. In a field plot trapping study, we found that intercrops of resistant and susceptible genotypes significantly reduced numbers of CSPW relative to susceptible monocultures early season. Surprisingly, CSPW numbers were also reduced relative to resistant monocultures at one date. Analysis of CSPW dispersion at this date indicated repellence of CSPW from conspecifics on these plots.

DIVERSIFICATION STRATEGIES FOR BARLEY DISEASE MANAGEMENT IN ALBERTA

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Barley is an important feed grain crop in Alberta that accounts for 40-50% of Canadian production. To ensure a constant supply of feed many farmers often grow barley continuously for several years; however, continuous barley production leads to a build-up of plant diseases and a general reduction in yield potential over the long-term. A three-year experiment was established at Lacombe in 1998 to determine if barley cultivar rotation could be used to reduce the impact of leaf diseases, while maintaining crop productivity (Turkington et al. 2005). Treatments consisted of various sequences of two cultivars with varying degrees of scald and net blotch resistance, Kasota, and AC Lacombe; a previously scald-resistant cultivar CDC Earl; a susceptible check, Harrington; and a non-host, triticale cultivar Wapiti. Rotations were established in 1998 with comparisons being made in 1999 and 2000. Results indicated that barley cultivar rotation can be a potential short-term strategy to help reduce leaf disease levels and maintain crop productivity for Alberta barley producers where crop rotation options are limited due to feed requirements or market factors. However, continuous production of barley, even utilizing cultivar rotation, will not provide long-term sustainable leaf disease management, especially for scald. The summer of 2004 was the third year of a separate trial that was established to look the interactive effects of agronomic factors such as rotational diversity, seeding rate, and time of silage removal on crop health, competitiveness, disease levels, productivity and quality in a cereal silage production system. In 2004, all plots except for the continuous triticale were seeded to the barley cultivar Seebe. The rotation treatments of CDC Helgason barley/Pronghorn triticale/Seebe and Pronghorn/AC Mustang oats/Seebe had significantly greater emergence compared to the continuous Seebe treatment, which had the lowest emergence. The remaining rotation treatments had intermediate emergence and were not significantly different from the continuous Seebe rotation. Overall, silage yield on a dry weight basis was highest for the Pronghorn/AC Mustang/Seebe rotation (8060 kg/ha), intermediate for the CDC Helgason/AC Mustang/Seebe rotation (7822 kg/ha) and lowest for the remaining rotations (7005-7279 kg/ha, LSD = 400 kg/ha). The spot-form of net blotch was the main leaf disease present and it was highest for the continuous Seebe rotation (13.8% leaf area diseased on the flag-2 leaf) and lowest for the Pronghorn/AC Mustang/Seebe rotation (5.9%) with the other rotations having intermediate disease levels (8.2-11.7%, LSD = 2.1). Rotation had a significant influence on root mass assessed in the fall. Root mass was highest for the Pronghorn/AC Mustang/Seebe rotation (42.4 g/2 m length of row), lowest for the continuous Seebe rotation (29.1 g), and intermediate for the remaining rotation treatments (34.4-37.0 g, LSD = 8.2 g). Rotation treatments had an impact on silage yield and this appeared to be related to crop health as indicated by leaf disease levels and root mass measurements. Results are currently being analyzed from a second 3-year cycle of this trial starting in 2005.

SCALD OF BARLEY IN ALBERTA: SCREENING, RESISTANCE BREAKDOWN AND MANAGEMENT

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In Alberta, scald caused by the fungus, Rhynchosporium secalis, is one of the main leaf diseases of barley. Average yield losses due to scald may be as high as 5-10%, with monetary loss estimates of over $30 million depending on the year. Ongoing evaluation of breeding material for resistance to this disease is required due to changing virulence patterns in the scald pathogen, lack of resistance in malting barley, public desire for sustainable/environment friendly crop production and more intensive barley production coupled with increased demand. The objective of the current project at the Lacombe Research Centre, Agriculture and Agri-Food Canada, is

the coordination of scald screening for barley breeding programs in western Canada. Each year 6,000-8,000 hill plots of barley are typically evaluated for scald reaction at the Lacombe Research Centre and the University of Alberta, Edmonton. Most candidate cultivars with scald resistance currently going through the cooperative variety testing system were first identified as part of this scald screening project as well as part of collaborative screening efforts between Alberta Agriculture, Food and Rural Development (AAFRD) and ICARDA/CIMMYT in Mexico (J.H. Helm and F. Capettini, personal communication). Hill plots are typically comprised of germplasm, breeding lines, checks, material from the Alberta Regional Variety Trial, all currently registered barley cultivars for western Canada that possess some level of scald resistance, and candidate barley cultivars going through the Prairie Grain Development Committee (PGDC, formerly the Prairie Registration Recommending Committee for Grain) Western Cooperative Tests. Overall, regional trial results and evaluation of all registered cultivars possessing scald resistance has indicated the development and increased influence of more virulent races of the scald pathogen, especially at Lacombe. These results are of major concern with regard to the appearance and increased prevalence of these more virulent scald races. As a result of these races the resistance genes in cultivars like CDC Earl, CDC Dawn, and Falcon may no longer be effective at certain locations in Alberta, which has been confirmed by Xi et al. (2002, 2003). Moreover, these cultivars likely no longer represent effective sources of resistance that can be incorporated into adapted cultivars by western Canada barley breeders. More recently, scald pathotypes capable of attacking some of the more resistant cultivars, such as Kasota and Seebe have been observed (Turkington et al. 2005; K. Xi, personal communication). For long-term scald management it is critical that potential sources of scald resistance continue to be identified and incorporated into commercially acceptable breeding material. Research is also needed to look at ways of managing sources of resistance that are already present in our western Canadian cultivars. One potential option investigated at Lacombe, is for producers to rotate barley cultivars with different sources of resistance, which would be analogous to rotating herbicides with different modes of action; a practice being used to prevent the development of herbicide resistant weeds (Turkington et al. 2005).

PRAIRIE CARNATION®: AN OPPORTUNITY FOR CROP DIVERSIFICATION

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Prairie Carnation (*Saponaria vaccaria* L.) is a member of the family Caryophyllaceae. Several members of this plant family are grown as ornamentals, but none are used as food or feed products in Canada. This crop has commenced contract production on the prairies. Prairie Carnation® will be used as a renewable bio-product crop to produce fine starches for cosmetics and other industries. Saponins extracted from the seed will be used for veterinary and medical applications and are being tested as a vaccine adjuvant and also as an active compound for some clinical treatments. Peptides from Saponaria seeds show antibiotic effects and are tested as cosmetic active compounds. Research has been conducted to advance crop development in from 2005-2007 at several locations. Trials included seeding date, seeding rate x spatial arrangement, fertility, timing of fungicide application and crop tolerance to herbicides. Our results, and farmer adoption, demonstrate that Prairie Carnation® has considerable potential to be a commercially and agronomically successful crop.