RESEARCH POSTERS

FIBRE QUALITY AND SUITABILITY FOR PAPER MAKING OF BARLEY, WHEAT, TRITICALE AND OAT STRAW

Kwesi Ampong-Nyarko[1], Qi Luo[2], Shijie Liu[3], Jill DeMulder[1], Trevor Kloeck[1], Henry Najda[1], Nabi Chaudhary[1] and Zhixiong Zhang[1]

[1]Alberta Agriculture and Food, Crop Diversification Centre North, 17507 Fort Rd, Edmonton, Alberta T5Y 6H3
[2]Alberta Research Council, 250 Karl Clark Rd, Edmonton, Alberta T6N 1E4
[3]Faculty of Paper Science and Engineering, SUNY College of Environmental Science and Forestry, Syracuse, NY 13210-2778

Field trials were conducted at Edmonton, Stony Plain and Westlock in 2004 and 2005 to determine the effect of environment and variety on yield, chemical composition, morphology and pulping suitability of barley (AC Lacombe, AC Metcalfe), wheat (AC Barrie, CDC Imagine), triticale (AC Ultima, Pronghorn) and oat (Cascade, CDC Orrin), straw. Pulp yield, permanganate number, residual peroxide, fibre length, other chemical and morphological properties of the straw were measured. Triticale gave the highest total straw biomass yield at Westlock and Stony Plain locations. Barley gave the highest total straw yield at Edmonton location. The average stem proportion of total straw biomass yield was triticale 2636 kg/ha, wheat 2221 kg/ha, barley 2182 kg/ha and oat 1940 kg/ha. The mean ratio of stem to total straw biomass was 49% for all species. Location and variety had insignificant impact on cellulose, lignin, pentosans content, and other morphological properties. There was no statistical difference in holocellulose, cellulose, pentosans, ash silicates and silica, ethanol-benzene extractives, hot water extractives, fibre width and fibre coarseness between oats, barley, wheat, and triticale. Statistical difference was found in acid insoluble lignin content, where triticale straw had the lowest of all cereals. This finding suggests that triticale will require less rigorous cooking (time, temperature, chemical dosage) than the other cereal straws to achieve the same kappa number level. It is also likely that pulp from oats, barley, and wheat straw may be exchangeable in the pulping process.

DOES SOIL NITROGEN LEVEL AFFECT HERBICIDE EFFICACY?

Blackshaw, R.E. and Brandt, R.N.

Agriculture and Agri-Food Canada, Lethbridge, AB Canada.
E-Mail: blackshaw@agr.gc.ca; brandtrn@agr.gc.ca

Field experiments were conducted at the Lethbridge Research Centre in 2004 and 2005 to determine if soil fertility affects herbicide activity on weeds. The factorial set of treatments in experiment 1 consisted of a) soil N level (30 or 110 kg ha-1) and b) flucarbazone (Everest) dose (0, 3.75, 7.5, 15, or 30 g ai ha-1). Experiment 2 treatments consisted of a) soil N level (30 or 110 kg ha-1) and b) sulfosulfuron (Sundance) dose (0, 2.5, 5, 10 or 20 g ai ha-1). Herbicides were applied at a spray volume of 100 L ha-1 to wild oat at the 3 to 4 leaf stage growing in AC Barrie spring wheat. Herbicide efficacy was determined three weeks after herbicide application by taking aboveground wild oat dry weight biomass. Flucarbazone at lower than recommended doses was often more efficacious (17 to 28% greater) on wild oat at high compared with low soil N levels. However, flucarbazone efficacy at the recommended dose of 30 g ha-1 was not affected by soil N fertility. Wild oat control was greater with high than with low soil N at all sulfosulfuron doses in 2004 and with the three lower than recommended doses in 2005. Wild oat control with sulfosulfuron ranged from 7 to 38% higher with high compared with low soil N levels. The question remains as to how transferable are these results to other herbicides or other weed species. Additional research is clearly warranted.

EFFECT OF SEEDING DEPTH AND SEEDING RATE ON FUSARIUM SEEDLING BLIGHT OF NARROW-LEAVED LUPINE UNDER FIELD CONDITIONS

Chang, K.F. Hwang, S.F., Gossen, B.D., Lopetinsky, K., Olson, M., Bing, D.J., Bowness, R.T., Turnbull, G.D., Strelkov S.E. and Howard, R.J.

Alberta Agriculture and Food, Lacombe, AB, Canada Email: kan.fa.chang@gov.ab.ca

Narrow-leaved lupine (Lupinus angustifolius L.) has proven to be a successful pulse crop in Alberta. However, it is vulnerable to root rot infection caused by Fusarium spp. Field trials were established at Lacombe, Alberta, in early May, 2006 to assess the effect of seeding depth and rate on seedling blight and root rot. Seed of the lupine cultivars 'Arabella' and 'Rose' were sown at 2.5-, 5.0-, 7.5- and 10.0-cm depths into soil inoculated with an aggressive isolate of Fusarium avenaceum (Fr.) Sacc. (collected from lupine) and compared to a non-inoculated control. Inoculation reduced emergence only at the 10 cm depth. However, yield significantly declined with increased seeding depth for both cultivars, down to the 7.5 cm depth. In a separate trial, each cultivar was sown at a depth of 2.5 cm at rates of 150, 225, and 300 seeds/m2. Emergence and yield were lower for both cultivars when seeded at 150 versus 225 or 300 seeds/m2. These trials will be repeated in 2007 to confirm the results before recommendations are made to producers.

HOST RANGE OF FUSARIUM AVENACEUM AND FUSARIUM ROOT ROT SEVERITY IN NARROW-LEAVED LUPIN IN RESPONSE TO SEEDING DEPTH UNDER GREENHOUSE CONDITIONS

Chang, K.F., Hwang, S.F., Bowness, R.T., Gossen, B.D., Bing, D.J., Howard R.J. and Strelkov, S.E.

Alberta Agriculture, Food and Rural Development (AAFRD), Lacombe, AB, Canada. Email: kan.fa.chang@gov.ab.ca

Root rot, caused by *Fusarium* spp., is prevalent on narrow-leaved lupine (*Lupinus angustifolius L.*) in central Alberta. To assess the impact of seeding depth on root rot development, lupine seeds were sown at 2-, 5-, 7- and 10-cm depths in soil inoculated with an aggressive isolate of *Fusarium avenaceum* (Fr.) Sacc. (collected from lupine) and compared to a non-inoculated control. In the inoculated treatment, root rot severity was significantly ($P \leq 0.05$) higher in pots seeded at 7- to 10- cm than at a 2-cm depth. Seedling emergence, dry weight, shoot height and root length were lower in treatments seeded at 7- to 10-cm than at 2- to 5-cm, in both inoculated and non-inoculated soils. To assess the host range of the pathogen, seeds of cereal, oilseed, pulse and forage crops were sown in inoculated soil and compared to a non-inoculated control. Inoculation reduced seedling survival in all species, except dry bean and oat, and reduced shoot dry weight in all species, except dry bean. Canola developed the highest disease severities, followed by lentil, chickpea, clover and alfalfa. No symptoms developed on the leaves of triticale or barley, and wheat showed only mild yellowing of the leaves. Trials to assess these factors under field conditions are being initiated.

HOST RANGE AND CULTIVAR RESPONSE TO FUSARIUM ROOT ROT OF FIELD PEA

Chang, K.F., Hwang, S.F., Bowness, R.T., Gossen, B.D., Turnbull, G.D., McLaren, D.L., Conner, R.L. and Bing, D.J.

Alberta Agriculture and Food, Field Crop Development Centre, Lacombe, AB, Canada Email: kan.fa.chang@gov.ab.ca

Root rot, caused by Fusarium spp., is prevalent on pea (Pisum sativum L.) in the Canadian prairies. Cultivar reaction to root rot was assessed in 16 lines of green or yellow pea and 12 lines of variegated pea in a field trial, using a split plot design (lines = main plots and inoculated vs control treatments = subplots), at Lacombe, AB. Inoculation with Fusarium significantly reduced emergence compared to the non-inoculated control. Variation in disease reaction was observed among the pea lines, but generally, seedling establishment was more successful for brown/mixed cultivars compared to yellow and green cultivars. However, the higher rates of seedling establishment were offset by lower yields in the brown/mixed cultivars. To assess host range under greenhouse conditions, seeds of 17 crops (cereals, oilseeds, pulses, forages) were planted into inoculated soil and compared to a non-inoculated control. Inoculation reduced seedling survival for all species, except for dry bean, barley and oat, and reduced shoot dry weight for all species except dry bean. Root rot severity was highest in the forage and pulse crops, with the exception of dry bean.

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

Clayton, G.W., Harker, K.N. and O'Donovan, J. T.

Agriculture and Agri-Food Canada, Lacombe, AB Canada. E-Mail: claytong@agr.gc.ca; HarkerK@agr.gc.ca; O'Donovanj@agr.gc.ca

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.

A SCOPING STUDY OF LIVESTOCK PHARMACEUTICALS IN AGRICULTURAL STREAMS

Francine Forrest[1], Julia Keenliside[2], Joe Kendall[3], Tom Thompson[3], Don Noot[3] and Jamie Wuite[1]

Alberta Agriculture Food and Rural Development, [1]Resource Management and Irrigation Division, [2]Agriculture Research Division, [3]Food Safety Division, 7000 – 113 Street, Edmonton, AB, T6H 5T6

Pharmaceuticals are commonly used in the livestock industry for growth promotion, disease prevention and disease treatment. There is limited knowledge on fate and transport of parent drugs and their metabolites in the environment. Many compounds are excreted virtually intact. Studies have demonstrated that persistent pharmaceuticals can reach receiving water bodies through runoff and leaching of manure.

The objective of this study was to determine the concentration and frequency of some commonly used livestock pharmaceuticals in streams with agricultural activity in their watersheds across Alberta. A list of target analytes was established based on usage, treatment type, potential impact to mammals and laboratory capabilities. Samples were collected monthly and following storm events in 22 streams during the summer and fall of 2005. The streams drained watersheds with varying agricultural intensity, climate and runoff potential across the province. Over 100 water samples were analyzed for 27 compounds using a liquid chromatograph coupled with a tandem mass spectrometer.

Overall, trace concentrations of pharmaceuticals were detected in 38% of the samples (44 of 116 samples). Seventeen of the twenty-two watersheds had between one and five detections. Monensin and sulfamethazine were the detected most frequently (29% and 11% of samples, respectively). All detected levels were below one part per billion, and as such, compounds detected are present at very low concentrations. These findings are similar to results found in European and other North American surveys.

Results from this study can be used in future monitoring programs and toxicity studies to better evaluate potential risks on the aquatic ecosystems and human health. Despite the lack of knowledge of the effects of pharmaceutical residues in the environment, agricultural producers can take pro-active steps to reduce their presence in the environment.

LIMING EFFECT OF CATTLE MANURE INCREASES CROP YIELD IN A NORTHERN ALBERTA ACID SOIL

Xiying Hao1*, George W. Clayton[2], John T. O'Donovan[3], C. Chang1, and M. Hall[4]

Agriculture and Agri-Food Canada, [1]Lethbridge, [2]Lacombe, [3]Beaverlodge, Alberta Canada; [4]Alberta Agric. Food and Rural Development, Fort Vermilion (Current address: Cargill Ltd. Canada, Yorkton, Saskatchewan)

*Corresponding author: E-Mail: haoxy@agr.gc.ca; Phone 1 403 317-2279; Fax: 1 403 317-2187.

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 crop yield from acid soil at Fort Vermilion in 2004, 2005 and 2006. 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. Soil pH was significantly increased by both lime and cattle feedlot manure applications. In 2004, barley biomass yield was higher for the manured treatment but there were no differences in barley grain yields among the 5 treatments. The low grain yields across all 2004 treatments and the lack of significant differences among them were mainly due to the very dry May and June and extreme heat in July. In 2005, canola biomass, seed yield, seed TN and TP content and total seed nutrient uptake were all significantly higher in the manured treatment than the Control. In 2006, soil pH, barley silage, grain and biomass yield were all significantly higher in the manured treatment than the Control. Canola will be seeded again in 2007 to continue investigating the residual effect of lime and manure application on soil pH and crop yield.

A COMPARISON OF YIELD AND LAND EQUIVALENCY BETWEEN CANOLA-WHEAT INTERCROPS AND MONOCULTURES

Hummel, J.D.[1], Dosdall, L.M.[1], Clayton, G.W.[2], and O'Donovan, J.T.[3]

[1]Department of Agricultural, Food, and Nutritional Science,
4-10 Agriculture-Forestry Centre, University of Alberta, Edmonton, AB T6G 2P5.
E-Mail: jhummel@ualberta.ca; Lloyd.dosdall@ualberta.ca

[2]Agriculture and Agri-Food Canada, Lethbridge, AB. E-Mail: claytong@agr.gc.ca
[3]Agriculture and Agri-Food Canada, Lacombe, AB. E-Mail: odonovanj@agr.gc.ca

Monocultures dominate modern North American agroecosystems. By contrast, plant communities found in nature are generally comprised of several different plant species in close association with each other. Complex interactions among these species serve to limit the damage insect pests cause and often also limit a pest species' population. In the simple plant communities of modern agriculture where these natural controls are significantly reduced, insect pest outbreaks are a source of real concern. Intercropping is an attempt to increase the diversity of the agricultural landscape in order to gain some of the benefits inherent in complex natural plant communities. The success of an intercrop cannot be measured solely on control of a given insect pest; intercrops must produce competitive yields to monocultures of their component species. To compare intercrop yields to those of the component monocultures, the land equivalency ratio (LER) is most commonly used. A field study, conducted in Lacombe, Edmonton, and Ft. Vermilion, Alberta in 2005 and 2006, investigated the affect of canola-wheat intercrops on several insect pests, including flea beetles and root maggots (Delia spp.), as well as on beneficial carabid beetles. Yield and crop quality were also investigated, as these factors are foremost among the determinants of the viability of any canola-wheat intercrop. Yield results and LER values from both field seasons will be presented.

IMPACT OF PLANT AGE ON MYCOSPHAERELLA BLIGHT OF FIELD PEA

Hwang, S.F., Chang, K.F., Gossen, B.D., Conner, R.L., Turnbull, G.D., Lopetinsky, K., Olson, M. and Bing, D.J.

Alberta Agriculture and Food , Edmonton, AB, Canada. Email: sheau-fang.hwang@gov.ab.ca.

Mycosphaerella blight, caused by Mycosphaerella pinodes, is the most prevalent and destructive disease of field pea in Canada. Three studies were conducted to determine how plant age affects disease severity, and how mycosphaerella blight affects yield losses in plants of varying ages and growth stages. Eight field pea cultivars were established on two dates, one in early May and the other in mid to late May. Disease was suppressed by treatment with chlorothalonil in one set of plots and enhanced by inoculation with infected straw in the other for each seeding date. Disease severity was greater and yield was reduced in early-seeded compared to late-seeded plots for both disease-suppressed and disease-enhanced cultivars. Enhancement of disease reduced yield in both early-seeded and late-seeded cultivars. In a separate study, field pea plots were inoculated at different dates spaced at one-week intervals, beginning in mid June. The fungicide was applied beginning in early July until 2 wk before inoculation to minimize the effects of early epidemic development. Disease severity was highest when the disease was initiated before early July, and was reduced as the disease initiation date was delayed. Yield was reduced when the disease was initiated between mid to late June. A third study was conducted to determine the effect of leaf position on the rate of lesion growth by M. pinodes. Leaves of field-grown plants were removed from the upper, middle and lower canopy just prior to flowering. Leaf lesion growth was slower in successively higher positions in the plant canopy. These studies indicate that pea plants become more vulnerable to infection by mycosphaerella blight with increasing age, but that the impact of the disease on yield becomes progressively weaker as plants age.

UNDERSEEDING CEREALS WITH LEGUMES: AN INTEGRATED CROP MANAGEMENT STRATEGY

[1]Kosinski, S.M., [1]King, J.R, [2]Harker, K.N., and [2]Turkington, T.K.

[1]Department of Agricultural, Food, and Nutritional Science, University of Alberta, Edmonton AB.
E-mail: smk1@ualberta.ca; jane.king@ualberta.ca
[2]Agriculture and Agri-Food Canada, Lacombe, AB. E-mail: HarkerK@AGR.GC.CA; TurkingtonK@AGR.GC.CA

Consumers are interested in environmentally-friendly agricultural production and farmers desire to be ecologically responsible. Current agricultural production, however, is heavily dependent on chemical inputs, such as fertilizers and pesticides. Excessive fertilizer and pesticide use has the potential to contaminate ground water supplies. Reducing chemical inputs is ecologically responsible and can increase farm profit margins.

We are investigating the potential of a "perennial legume living-mulch" to reduce input costs, increase crop species diversity, control weed and disease infestations, and reduce agriculture's ecological 'footprint'. A living-mulch is created when a row crop is under-seeded with a plant that can decrease soil erosion, weed and disease pressure, and insect damage. If the living-mulch is a legume, it can also supply nitrogen to the current and subsequent crops.

Field experiments, conducted at the University of Alberta Edmonton Research Station (ERS) and at Agriculture and Agri-Food Canada (AAFC), Lacombe, are investigating the use a of kura clover living-mulch in a cereal silage production system. The experiment examines the effect of two cereal rotations, three levels of N fertilizer, and herbicide applications, in the presence or absence of the living-mulch. Initial results indicate that the presence of the living mulch reduced early season leaf disease incidence in barley (at ERS and AAFC Lacombe), and weed numbers (at ERS).

A second study is evaluating the potential of four forage legumes, red clover, white clover, kura clover, and birdsfoot trefoil, as a living mulch with wheat for grain. Preliminary data indicate that crops containing red or kura clover had significantly fewer weeds compared to wheat growing alone. However, wheat yields were reduced in the presence of these faster growing legumes.

Including a living-mulch in cereal production systems in Alberta has the potential to increase agricultural sustainability and profitability, and reduce dependence on chemical inputs.

QUANTITATIVE ANALYSIS OF GALACTOMANNAN, DIOSGENIN AND 4-HYDROXYISOLEUCINE IN FENUGREEK SEEDS

Lee, E.L., Bandara, M. and Driedger, D.

Crop Diversification Centre South, Brooks, AB Canada.
E-mail: eelynn.lee@hotmail.com; manjula.bandara@gov.ab.ca; darcy.driedger@gov.ab.ca

This project aims to commercialize fenugreek as a functional food in the raving natural health product industry. In order to provide a better understanding of the economic potential of each cultivar, this project will experiment with the extraction and subsequent quantification of bioactive compounds from selected fenugreek lines. Fourteen lines from Canada, Afghanistan, Italy, India, Iran, Pakistan and Turkey have been selected and grown satisfactorily in Southern Alberta. Three geographically different locations were selected; Lethbridge, Brooks and Bow Island with each site receiving two separate treatments; rain fed and irrigated. Three major bioactive compounds of interest in this project are galactomannan, a soluble fiber; diosgenin, a steroidal compound; and 4-hydroxyisoleucine, the most abundant free amino acid in fenugreek seed. Each of these bioactive compounds have been individually studied using animal and human clinical trials to test for potential health benefits involving regulation of plasma cholesterol levels, reduction of triglyceride levels and insulin stimulation for control of blood glucose levels. Results were positive and indicated that the tested compounds extracted from the plant exerted beneficial effects to the human health. Analysis conducted till date in Brooks revealed decent amounts of galactomannans (15-23%). Method development for analyses of diosgenin and 4-hydroxyisoleucine using high performance liquid chromatography (HPLC) is currently in process.

FIELD PROOFING A DISEASE PREDICTION SYSTEM FOR ASCOCHYTA IN FIELD PEA IN ALBERTA

Ken J Lopetinsky[1], Christy Hoy[1], Mark Olson[2]

[1]Ag Research Division, Barrhead, Alberta Agriculture, Food and Rural Development,
[2]Ag Research Division, CDC North, Alberta Agriculture, Food and Rural Development

Ascochyta blight is a fungal disease that, under favorable disease development conditions, can severely reduce field pea yields and seed quality, and cause crop lodging. In 2005 and 2006, field trials were conducted at 5 sites in north central Alberta to test a disease prediction system and evaluate pea yield response, thousand kernel weight, and level of ascochyta infection of seeds when Headline® was applied to control ascochyta blight. The experimental design was a randomized complete block with 4 replicates for each of the sprayed and not sprayed treatments. Each plot had dimensions of approximately 200 ft by 80-100 ft, depending on the size of the sprayer used. All field sites had: 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 detect 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. Once the total prediction score reached or exceeded 65 and disease was present, a single application of Headline was immediately made. In 2005, all 5 locations reached the minimum 65 prediction score. The final yields revealed a significant yield increase from Headline application at all 5 locations with a range of yield increase of 14-35%. In 2006, all 5 locations reached the minimum 65 prediction score and 3 out of 5 showed a significant yield increase with at range yield increase of 15-25%. The average yield increase from Headline application over the 5 locations in 2005 was 26%; and in 2006 was 15.5%. In 2005, three of the five sites showed a significant difference in thousand kernel weight, with the treated plots having larger seed. There was a slightly higher ascochyta infection level in the seed samples that were not treated with Headline, but no statistically significant results were observed (10% infection versus 5% infection). The results showed that Headline was effective in reducing yield losses due to ascochyta blight and that the ascochyta prediction system proved to be helpful in predicting the onset of disease and fungicide application timing.

TIME OF WEED REMOVAL EFFECTS ON ZERO TANNIN FABA BEAN AND NARROW LEAFED LUPIN YIELDS

Ken J. Lopetinsky[1], Sheri Strydhorst[2], Neil Harker[3] and George Clayton[4],

[1]Alberta Agriculture, Food and Rural Development, [2]Univ of Alberta,
[3]Agriculture and Agri-Food Canada, Lacombe, [4]Agriculture and Agri-Food Canada, Lethbridge
E-Mail: ken.lopetinsky@gov.ab.ca; sheryl@ualberta.ca; harkerk@agr.gc.ca; claytong@agr.gc.ca

Pulse crops generally compete less strongly with weeds than cereal or canola crops. Previous research on field pea suggests that weed removal two weeks after crop emergence resulted in a substantial pea yield decline. Research is being conducted to determine yields of two new pulse species: zero tannin faba bean (Vicia faba), and narrow leafed lupin (Lupinus angustifolius) when weed removal occurred 1, 2, 3, or 4 weeks after pulse crop emergence (ACE). Field experiments were conducted over three years (2004-2006) at two sites in north-central Alberta. Faba bean and lupin were planted at the normal planting density (PD), and barley was seeded at 0.25x the normal PD to provide grassy weed competition. Weekly weed (barley) removal was accomplished with sethoxydim (Poast Ultra) applications over the four week period. At harvest, pulse yields were determined on a clean harvested seed basis. Significantly lower lupin seed yields were achieved when weed removal occurred 2, 3, and 4 weeks ACE. Significantly lower faba bean seed yields occurred only at the final weed removal timing (4 weeks ACE). Seed yields of faba bean were similar for the 1,2 and 3 weeks ACE treatments. Site differences will be discussed. Although both pulse crops benefit from early weed removal, it is critical to remove weeds from lupin crops early to avoid yield decreases. This early weed removal timing would be based on grassy weed leaf stage and whether or not weeds emerge at the same time as the crop.

DESIGNING THE OLDS COLLEGE AND UNIVERSITY OF ALBERTA INTEGRATED CROP MANAGEMENT SCHOOL, JULY 4TH AND 5TH 2007

Stefan Meyer, Erin Mcleod, Colin Rice, Nahid Mohamed, Brian Markert, Melissa Nikkel, Joel Conrad, and Blake Gamroth.

The University of Alberta Capstone Class, Plant Science 499, developed an integrated field school to be implemented at Olds College in July 2007. The objective was to integrate students' knowledge and experience in agronomy gained from summer employment from their post secondary education, and develop new concepts for the Olds Field School. The class discussed with Olds College instructor Jack Payne the field's previous cropping history, general climate and local pests, chemical rotations, and its future intended use. The students scouted the area for weeds, topography, straw residue levels and conducted soil sampling to determine the fields nutrient status. The field school was divided into four modules: soils and fertility, agronomy, weeds and herbicides and insect pests and disease. We developed educational goals, plot layouts, hypotheses, treatment lists, implementation plans and background information. The team also developed a new crops section, and diagnostic field tools in addition to an agenda, budget, pamphlets and signage. This class challenges the field school instructors to an Olympic and Economic canola challenge. Who will grow the highest yielding and most profitable canola crop?

POTENTIAL OF FENUGREEK AS A FORAGE FOR DAIRY CATTLE

J. E. Montgomery, J. R King, L. Doepel

University of Alberta, Edmonton, AB, Canada
Email: jem10@ualberta.ca, jane.king@ualberta.ca, lorraine.doepel@ualberta.ca

Fenugreek (Trigonella foenum-graecum) is an annual legume, originating from the Indian subcontinent and Mediterranean regions. Fenugreek is traditionally used as a spice or dye and can be used in the derivation of artificial flavours. Fenugreek also has potential neutraceutical qualities, some of which could be of benefit to dairy cows.

Development of forage-type varieties of fenugreek has occurred 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, allowing greater flexibility of harvest timing, and nitrogen fixation in the soil. Research in Lethbridge found that one cut of fenugreek is 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 on the U. of A. Edmonton Research Station in 2006. Small test plots were grown to determine growth characteristics of fenugreek. Ten acres, five acres for each variety, were grown for silage production. Wrapped bales of haylage were harvested from the 5 acre plots, and sampled in order to determine the fermentation curve and the nutrient profile of the bales.

In December 2006, in vivo digestibility studies were conducted at the AAFC Research Station in Lethbridge, AB. In vivo degradation studies will occur in spring 2007, at the Dairy Research and Technology Centre, located at the U. of A.

Further studies (2007) will include three fenugreek varieties, CDC Quatro, AAFC F70, and AAFC Tri-Star, grown in test plots to compare growth characteristics, and grown in mixes with cereals for silage.

Potential of fenugreek as a forage for dairy cattle

J. E. Montgomery, J. R. King, L. Doepel

Department of Agricultural, Food, and Nutritional Science

University of Alberta

Hypotheses

Fenugreek can be used as a viable alternative to alfalfa in the dairy industry in that 1) fenugreek yield is equivalent to alfalfa, and 2) the feeding value and digestibility of fenugreek forage is equivalent to that of alfalfa forage.

Questions

- Will fenugreek be a successful crop in central Alberta in terms of production and quality?
- What are the ensiling characteristics of fenugreek?
- Will the flavour of fenugreek deter cows from consuming fenugreek forage?
- What is the digestibility of fenugreek?
- How will fenugreek silage consumption affect milk production in dairy cows?

Fig 1 Fenugreek [illegible] at the Edmonton Research Station on July 25, 2006

Background information

- Fenugreek (*Trigonella foenum-graecum*) is an annual legume, originating from the Indian subcontinent and Mediterranean regions[4].
- Fenugreek is traditionally used as a spice or dye. It can be used in the derivation of artificial flavours. It is now being studied for potential neutraceutical qualities[4], some of which could be applicable to dairy cows with benefits to herd health.
- The use of fenugreek seed in dairy rations has been shown to decrease cholesterol levels in both cows and their milk, with a concomitant improvement to the profile of functional fatty acids in the milk[3]. Approximate seed content of fenugreek harvested at maturity is 5%[1].
- Development of forage-type varieties of fenugreek have occurred at the Agriculture and Agri-Food Canada research station in Lethbridge, as well as at the University of Saskatchewan.

Benefits

- Fenugreek silage has a similar nutrient composition to alfalfa silage, and a lower ammonia concentration[2].
- In-vitro dry matter digestibility of fenugreek is superior to that of alfalfa, which could lead to reduced costs of protein supplementation[1].
- Research in Lethbridge has found that the dry matter yield of one end of season cut of fenugreek is equivalent to that of two cuts of alfalfa[4].
- Fenugreek maintains high protein levels throughout the growing season, making it a good potential forage for dairy cows, which have higher nutritional requirements due to the metabolic demands of lactation[4].
- Fenugreek's indeterminate growth allows producers a wider window of harvesting time, reducing work load during harvest[4].
- Because it is a legume, fenugreek can provide soil benefits through nitrogen fixation[1].

Work so far

- Two varieties of fenugreek, CDC Quatro and AAFC F70, were grown on the Edmonton Research Station in the summer of 2006.
  - Small test plots were grown to determine growth characteristics of fenugreek. These plots were harvested sequentially every two weeks, and data was collected, including information on height, dry weight, stage of development, and leaf area. Harvests continued until the 12th of October.
  - Ten acres, five acres for each variety, were grown for silage production. The same growth characteristics were measured as for the small plots.
- Wrapped bales of haylage were harvested from the 5 acre plots. Sequential samples were taken from the bales before and after wrapping in order to determine the fermentation curve and the nutrient profile of the bales.
- Alfalfa haylage bales were also made in order to have a comparable feed when determining the feeding value of fenugreek haylage in dairy cows.

Fig 2 Fenugreek subsample for staging – August 2, 2006

Future research

Feeding study

- Beginning in February 2007, 6 ruminally cannulated dairy cows will be used in a replicated 3 x 3 Latin square with 21-day periods. Diets will consist of 40% forage and 60% concentrate. The forage component will constitute the dietary treatments:
  1. CDC Quatro fenugreek haylage
  2. AAFC F70 fenugreek haylage
  3. Alfalfa haylage
- For each period, dry matter intake, milk production, rumen fermentation, and rumen and total digestive tract digestibility, will be determined.

Plant growth characteristics – summer 2007

- Small test plots will be grown to collect data as in the 2006 season, with the inclusion of a third variety of fenugreek (AAFC Tri-star).
- Small plots will also be grown to test the growth characteristics of fenugreek when grown in a binary mixture with cereals commonly grown for use as silage.

Fig 3 Fenugreek in bloom at the Edmonton Research Station on July 25, 2006

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DESIGNING AGROECOLOGY – THE HENDRIGAN PLOTS AT BRETON

Shirley Ross, Jim Robertson[1], Dick Puurveen[1], Cesar Izaurralde[2] and Henry Janzen[3]

[1]Dept. of Renewable Resources, University of Alberta; [2]Joint Global Change Research Institute, Pacific Northwest National Lab and University of Maryland; [3]Agriculture and Agri-Food Canada, Lethbridge

The Hendrigan Plots were established in 1980 to test three distinctly different agroecosystems on a Gray Luvisolic soil at the site of the Breton Classical Plots. The cropping systems are: continuous perennial fescue-white clover forage (CF), an agroecological 8-year rotation (AER), and continuous grain (CG). The CF system was designed by a local farmer, Lou Hendrigan, who pioneered forage-livestock systems for the grey-wooded soils in west-central Alberta. Soil scientist Bill McGill designed the AER system as a diverse rotation with nitrogen (N) provided by legume-based biological sources rather than synthetic fertilizer. Ecological approaches to agriculture place emphasis on long-term maintenance of land resources, and minimal reliance on artificial inputs from outside the farm system. The CF and AER systems were designed to improve the quality of the soil, not just to maintain the low fertility soils. Lou Hendrigan advised farmers to "put power in the soil not on it". The Plots raise management questions about using legumes in systems and how much biological N input is optimal. Our study looks at the impact of the three agroecosystems on N balances, soil N reserves and N losses to the environment: questions that are best answered by long-term experiments.

DECOMPOSITION OF FIELD PEA, FABA BEAN AND LUPIN CROP RESIDUES

Sheri Strydhorst[1], Jane R. King[1], Ken J. Lopetinsky[2]

[1]Univ of Alberta, [2]Alberta Agriculture, Food and Rural Development.
E-Mail: sheryl@ualberta.ca; Jane.King@afhe.ualberta.ca; ken.lopetinsky@gov.ab.ca;

The benefits of pulse species in crop rotations are widely known. However, nutrient release from pulse straw decomposition may vary between species, and tillage practices. Field experiments were conducted at Barrhead in north-central Alberta, Canada, to determine if different pulse species, grassy weed status, and decomposition location influence decomposition dynamics. Aboveground crop residues of faba bean (Vicia faba), lupin (Lupinus angustifolius) and pea (Pisum sativum) were placed in mesh litterbags as either sole pulse (non-weedy) or pulse + barley (weedy). Litterbags were placed on the soil surface or buried at a depth of 5cm to compare decomposition in a no-tillage or conventional-tillage system. Decomposition dynamics were determined by measuring mass loss and nutrient content (C and N) of material contained in the litterbags collected over a 22-month period from September 2004 to July 2006. There were some differences in mass loss between the different residue types but, with the exception of rapid lupin residue decomposition, the differences are minor. All fiber types experienced rapid decreases in the C:N ratio and began mineralizing N in the spring of 2005 and continued for the remainder of the experiment. Based on these findings, there does not appear to be accelerated N mineralization from the pulse residues. Our results suggest that yield increases in cereal crops grown on pulse stubble may not be primarily attributed to the decomposition rate and N mineralization of pulse crop residues. Non-N benefits such as: reduced root and leaf diseases, reduced weed pressure, increased PKS availability, and improved soil structure may be playing a more dominant role in determining yield differences in cereal crops grown on the different pulse stubble types than pulse N benefits. Based on this finding, future research should place more emphasis on studying non-N benefits of pulse crops.

FIELD PEA, FABA BEAN AND LUPIN CONTRIBUTIONS TO A SUBSEQUENT WHEAT CROP

Sheri Strydhorst[1], Jane R. King[1], Ken J. Lopetinsky[2], George Clayton[3], and Neil Harker[4]

[1]Univ of Alberta, [2]Alberta Agriculture, Food and Rural Development, [3]Agriculture and Agri-Food Canada, Lethbridge, [4]Agriculture and Agri-Food Canada, Lacombe,
E-Mail: sheryl@ualberta.ca; Jane.King@afhe.ualberta.ca; ken.lopetinsky@gov.ab.ca; claytong@agr.gc.ca; harkerk@agr.gc.ca

Pulse species fix atmospheric nitrogen (N) and reduce N fertilizer input costs, but they also contribute N and non-N benefits to the subsequent year's crop. Research is being conducted to determine if different pulse species, pulse planting densities and cropping systems differ in their positive contributions to a subsequent wheat crop. Field experiments were conducted at three sites in north-central Alberta, Canada. In 2004, faba bean (Vicia faba), lupin (Lupinus angustifolius) and pea (Pisum sativum) were grown at four planting densities (0.5x, 1.0x, 1.5x, 2.0x the recommended monoculture planting density (PD)) as monocultures, and intercropped with barley (at 0.25x normal PD). At harvest, above ground pulse crop residues were removed to simulate straw baling. In 2005, the pulse stubble was seeded to hard red spring wheat (Triticum aestivum) and fertilized with P, K and S to meet the wheat crop nutrient requirements. No nitrogen fertilizer was applied. Wheat plant heights and straw dry matter production differed depending on the previous year's stubble type. Seed size, as measured by 1000 kwt, was significantly affected by the previous year's cropping system, pulse species and pulse seeding rate ($P<0.001$). Preliminary results indicate significantly higher wheat yields (4.9 t ha-1) were produced on pea monoculture stubble compared with wheat yields from faba bean and lupin monoculture stubble (4.3 t ha-1) ($P<0.001$). Significantly lower wheat yields were achieved on lupin intercrop stubble (3.8 t ha-1) compared to faba bean or pea intercrop stubble (4.4 t ha-1) ($P<0.001$). Higher pulse planting densities in the previous year tended to increase wheat yields. Based on first year results, field pea monoculture stubble produced the highest subsequent wheat seed yield, 1000 kwt and straw yield.

FLEA BEETLE SPECIES RESPOND DIFFERENTLY TO SOME NEONICOTINOID INSECTICIDES

James Tansey, PhD student, University of Alberta

Different susceptibilities to insecticidal compounds can lead to shifts in prevalence of herbivorous insect species. These compounds include relatively recently developed neonicotinoids. Here we present evidence that the canola pests, Phyllotreta cruciferae Goeze and P. striolata F. respond differently to the neonicotinoid seed treatments HelixÆ (thiamethoxam: 200g AI/100kg), Helix XtraÆ (thiamethoxam: 400g AI/100kg) and Prosper 400Æ (clothianidin: 400g AI/100kg) in greenhouse experiments. Crucifer flea beetles suffered higher mortality and fed less when exposed to these compounds and interactions of competition and seed treatments were more pronounced. Given that competitive release of P. striolata occurs when P. cruciferae are excluded, these seed treatments are likely contributing to a shift in the dominant pestiferous flea beetle species towards P. striolata.

INCREASING YIELD AND PROFIT BY STRAIGHT-CUTTING CANOLA

Watson, P.W.[1], Harker, K.N. [2], Brandt, S.A.[2] and Clayton, G.W. [2]

[1]Alberta Research Council, Bag 4000, Vegreville, AB Canada
[2]Agriculture and Agri-Food Canada, Scott SK Canada
E-Mail: paul.watson@arc.ab.ca; HarkerK@agr.gc.ca; BrandtS@AGR.GC.CA; ClaytonG@agr.gc.ca

Straight combining canola can save producers time, fuel costs, and equipment wear. However, it is uncommon since the risk of shatter losses are perceived as substantial. Recent producer experience suggests that risk of shattering may mitigated by increasing yield potential. Therefore, the objective of this research is to determine if straight combining shatter losses would be reduced sufficiently with higher yield potential to make straight combining viable. Research was undertaken at ARC Vegreville, AAFC Lacombe & AAFC Scott to evaluate shatter loss under different potential yields. Factors used to reduce potential yield included target crop density, fertility, weed removal timing and harvest time. Results indicate shatter loss was predominantly affected by harvest timing. Preliminary results indicate that straight-cutting canola is a viable option.

PRAIRIE CARNATION®: A NEW CROP FOR THE CANADIAN PRAIRIES

Watson, P.W.[1], Oelck, M.[2], Johnson, E.[3], Kharbanda, K.[1], Yang, J[1]. and Steinmann-Oelck, E.[2].

[1]Alberta Research Council, Bag 4000, Vegreville, AB Canada
[2]SAPONIN Inc. NRC - PBI Industry Wing, 110 Gymnasium Place, Saskatoon, SK Canada
[3]Agriculture and Agri-Food Canada, Scott SK Canada
E-Mail: paul.watson@arc.ab.ca; Michael.Oelck@Saponin.ca; JohnsonE@agr.gc.ca; prem@arc.ab.ca; Jian.Yang@arc.ab.ca; elke.steinmann-oelck@saponin.ca

Prairie Carnation (*Saponaria vaccaria* L.) is a member of the family Caryophyllaceae. The crop is intended for large-scale contract production on the prairies. Several members of this plant family are grown as ornamentals. No members of the Caryopyhllaceae are used as food or feed products in Canada. 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 2005 and 2006 at the Alberta Research Council (ARC) in Vegreville, Alberta. Trials included seeding date, seeding rate x spatial arrangement, fertility, timing of fungicide application and crop tolerance to herbicides. Preliminary results indicate that Prairie Carnation® has considerable potential to be a commercially and agronomically successful crop.