

**Saskatchewan Alfalfa Seed Producers
Development Commission
(SASPDC)**

Current SASPDC research & development initiatives - May 2023

1. Improving alfalfa leafcutting bee health and pest control to enhance pollination and seed production in forage agroecosystems (2023 - 2025)

The alfalfa leafcutting bee (*Megachile rotundata* Fab.) is an essential pollinator of alfalfa and hybrid canola grown for seed production. Each year, over 4 billion alfalfa leafcutting bees are responsible for pollinating alfalfa seed and hybrid canola seed fields in western Canada. *Pteromalus venustus* is a small chalcid wasp that parasitizes the bees and can cause serious economic losses. Currently, there are limited options for controlling *P.venustus*. The most common control method has been utilization of dichlorvos resin strips; however, the domestic registration of the dichlorvos resin strip has recently been cancelled by the Pest Management Regulatory Agency (PMRA). There is thus a pressing need to develop alternatives to use of the dichlorvos resin strip, such as plant-based essential oils containing bioactive compounds, which have the potential to act as insecticidal fumigants, repellants, and reproductive antagonists, thus significantly reducing target insect populations. Each plant family has a unique combination of bioactive compounds that can exhibit insecticidal properties; one of the objectives of this alfalfa leafcutting bee research project, which is being co-funded by the Natural Sciences & Engineering Research Council (NSERC), the SASPDC, ASC (AB), and MFSA, is to identify the bioactive compound that produces the most effective insecticidal activity against adult *P. venustus* without adversely affecting developing and emerging alfalfa leafcutting bees in commercial incubators.

2. Developing alfalfa cultivar blends for forage production based on sub-species, fall dormancy, and root type (2023 - 2026)

Alfalfa (*Medicago sativa* L.) is one of the most important forage crops in Canada. In the Canadian prairies alone, approximately 4.5 million ha of alfalfa are in production either in alfalfa or grass-alfalfa mixed stands, accounting for 76% of the total national alfalfa production area. Alfalfa is a high yielding, high quality perennial legume. Considerable progress has been made in alfalfa breeding for specific traits such as disease resistance and improved winter hardiness in Canada. However, yield improvement in alfalfa has been slow. The yield increase of newer alfalfa cultivars is attributed to greater regrowth in the spring and fall for the less dormant types of alfalfa. However, the majority of alfalfa cultivars grown in western Canada have been dormant types, as greater fall dormancy is positively correlated to improved winter-hardiness. Alfalfa cultivars with different root types, such as tap-rooted or creeping-rooted, have been commercialized in Canada. Creeping-rooted alfalfa is reported to have improved persistence under grazing, along with superior cold-hardiness and winter survival as compared to the tap-rooted alfalfa. There is still a knowledge gap on forage performance of tap-rooted alfalfa, creeping-rooted alfalfa, and the potential to include less dormant alfalfa in cultivar blends. This research project, undertaken by the U of S Crop Development Centre (CDC) and co-funded by the SASPDC and the SMA Agriculture Development Fund (ADF), will involve work to determine forage yield and nutritive values of alfalfa cultivar blends with:

- 1) different fall dormancy rating (1 - 5 rating with 1 being dormant and 5 being less dormant).
- 2) different root type (tap-rooted alfalfa, creeping-rooted alfalfa) and flower colour.

3. Development of salt tolerant alfalfa cultivar adapted to western Canada (2021 - 2025)

Alfalfa is the most important forage legume, highly valued in the Canadian prairies for its high nutritional value, high yield, perennial growth habit, and nitrogen fixing capabilities. Since excessive soil salinity adversely affects the productivity of more than 15 million acres of agricultural land in the prairies, the expansion of alfalfa production areas to include high salinity regions will positively impact overall forage production and increase farm profitability in areas where annual crop production is not economical. There is thus a need to develop a salt tolerant alfalfa cultivar with improved tolerance from seedling to mature growth stage, without reducing the winter hardiness in western Canada. This research project undertaken by the U of S Crop Development Centre (CDC) and co-funded by the SASPDC, the SMA Agriculture Development Fund (ADF), and the Saskatchewan Cattlemen's Association (SCA) will evaluate, develop, and select alfalfa breeding lines under salt stress in the greenhouse and in the field in order to develop new breeding lines with superior salt tolerance. The project will also evaluate major salt tolerant genes to identify molecular markers for salt tolerant selection in alfalfa. A controlled environment study will be conducted to determine water-logging resistance of the salt tolerant alfalfa breeding lines, an important trait for survival of plants in saline regions.

4. Improving the vigour of forage legumes using automated image analysis technology (2021 - 2023)

The SASPDC is collaborating with the SMA Agriculture Development Fund (ADF) in co-funding an AAFC research project to develop and evaluate new methodology for increasing seedling vigour in forage legumes using “*Raspberry pi*” technology for plant breeding and genetic mapping applications. The availability of appropriately adapted forage legumes such as alfalfa may be limited due to challenges posed by a lack of genetic improvement for traits which facilitate stand establishment. Seedling vigour is a critical trait for stand establishment in forage legumes and is a common target in forage breeding programs for improving productivity. In species such as alfalfa, seedling vigour is often assessed using methods such as timing of seedling emergence from different depths, measurement of plant growth, or subjective visual rating; all of these methods require labour intensive evaluation of a large number of seedlings. Development of appropriate tools to increase the throughput of plant selections is a key component in plant breeding efforts. Automation of plant phenotyping using digital image analysis will reduce costs and increase efficiency in forage legume breeding programs.

5. Evaluating AAC Trueman Alfalfa in Saskatchewan (2021 - 2024)

The SASPDC, in partnership with the SMA Agriculture Development Fund (ADF), is co-funding an AAFC research project to assess the potential of AAC Trueman alfalfa in Saskatchewan. Alfalfa is an important feed source for livestock in Western Canada, with characteristics including high yield per hectare and high nutritional quality. Under changing climatic conditions, there is a need for forage cultivars which can withstand the possible adverse effects of climate change. For example, flooding can be a major limitation to alfalfa production; the development of alfalfa varieties tolerant to water-logging will provide producers with additional cropping options in wetter soil conditions. AAC Trueman is characterized by its unique rhizomatous growth, late flowering habit, winter hardiness, mid-summer drought tolerance, tolerance to spring / fall water-logging and tolerance to frequent grazing. The large root system of AAC Trueman alfalfa can act to limit soil and nutrient loss, increase soil carbon deposition, and improve soil quality traits. This research project will assist in building a resilient, stable, and productive forage system in a changing climate.

6. Seasonal distribution of economic pests occurring in alfalfa seed production on the Canadian prairies

The SASPDC is currently providing in-kind support and funding for a five-year research project being undertaken by AAFC, in collaboration with university researchers in Saskatchewan and Alberta, to determine seasonal distribution of economic pests occurring in alfalfa seed production on the Canadian prairies. This research work involves monitoring of alfalfa seed fields to determine the presence and abundance of important economic pests and their natural enemies; the project also involves the characterization of insecticide resistance mechanisms in western Canada alfalfa weevil populations and the development of a single-step multiplex PCR diagnostic assay to determine levels of parasitism in alfalfa weevil populations.

7. Monitoring of parasites and disease in Saskatchewan alfalfa leafcutting bee populations

Saskatchewan alfalfa seed producers are committed to insuring that the province’s alfalfa leafcutting bee populations are free of parasites and disease. The SASPDC supports the Canadian Cocoon Testing Centre (CCTC - Brooks), which evaluates alfalfa leafcutting bee samples from producers throughout western Canada; the SASPDC encourages Saskatchewan producers to submit samples to the CCTC for determination of bee quality, including testing for parasites and disease, in order to assist producers in maintaining high quality bee populations. Data collected from Saskatchewan alfalfa leafcutting bee samples evaluated by the CCTC is carefully analysed to assist in alfalfa leafcutting bee quality control.

8. SASPDC alfalfa seed production disease control / agrology monitoring initiative

The SASPDC alfalfa disease research project was initiated in 2001 with producer-cooperators establishing large-scale fungicide treatment plots in alfalfa seed fields at locations throughout the province; the research project was subsequently expanded to include the collection of weather data. The objectives of this research project have been to develop fungicide application recommendations and to utilize weather data in order to predict disease potential / disease severity. Saskatchewan alfalfa seed producers have utilized information from this research project in making fungicide application decisions. The current SASPDC disease control / agrology monitoring initiative, undertaken during the 2009 through 2022 field seasons in collaboration with alfalfa seed producers throughout the province, has involved evaluating alfalfa disease risk and providing recommendations to control alfalfa disease.

9. Development of Locally Adapted Alfalfa Cultivars in Saskatchewan

The objective of this alfalfa breeding project, undertaken by the U of S Crop Development Centre (CDC), is to create new alfalfa populations by intercrossing alfalfa plants collected from long-term alfalfa seed production and alfalfa grazing sites. Research involves assessment of alfalfa cultivar gene expression in response to grazing, identification of top-yielding alfalfa cultivars and top-performing creeping-rooted alfalfa cultivars, and evaluation of alfalfa cultivar performance in Saskatchewan. Work also includes intercrossing of the genotypes from top-performing alfalfa cultivars to create new alfalfa breeding lines, along with testing of the performance and forage yield of these new lines in replicated field plots. This alfalfa breeding project is supported by the SASPDC and co-funded by the SMA Agriculture Development Fund (ADF) and the Western Grains Research Foundation (WGRF).

10. Comprehensive initiative in support of the registration of crop protection products

In order to facilitate the minor use registration of crop protection products required by the alfalfa seed industry, the SASPDC is a member of the Prairie Pesticide Minor Use Consortium (PPMUC). This consortium of western Canadian producer organizations works to obtain user-requested minor use label expansions (URMULE) for crop protection products currently registered in Canada on other crops, user-requested minor use registrations (URMUR) for crop protection products registered in the USA or OECD countries but not in Canada, and emergency crop protection product registrations. Membership in the PPMUC allows the SASPDC to obtain minor use registrations for fungicides, herbicides, and insecticides which are important management tools for use in alfalfa seed production.

Recent SASPDC research & development initiatives

1. Alfalfa leafcutting bee parasite and disease control research

The alfalfa leafcutting bee is an important pollinator of alfalfa grown for seed production, used by Saskatchewan alfalfa seed producers as a dependable pollinator for over forty years. Factors limiting alfalfa leafcutting bee reproduction include infestations of chalcid parasites and incidence of fungal pathogens. Since these factors have the potential to damage Saskatchewan alfalfa leafcutting bee populations, the objective of research undertaken by the SASPDC has been to develop parasite and disease control strategies to assist Saskatchewan alfalfa seed producers in maintaining high quality alfalfa leafcutting bee populations, enhancing bee reproduction and alfalfa seed production. Parasite control research has involved investigation into the use of essential oil / volatile organic compounds, along with evaluation of a potential parasite male-killing bacterium. Disease control research has involved work with anti-microbial compounds and evaluation of pollinator bio-control vector technology. Utilization of newly-developed parasite and disease control strategies by producers increases the value of Saskatchewan alfalfa leafcutting bees as pollinators in the hybrid canola seed production and blueberry production sectors, and in conventional alfalfa seed production export markets. The SASPDC alfalfa leafcutting bee research project "Development of new strategies for control of parasites and disease in alfalfa leafcutting bee populations" was co-funded by the SASPDC, the SMA Agriculture Development Fund (ADF), and the Western Grains Research Foundation (WGRF Endowment Fund).

2. Demonstration Project - Soil nitrogen content following inclusion of alfalfa in crop rotation

The purpose of this project was to demonstrate that including alfalfa grown for seed in a cropping rotation benefits the nitrogen content of the soil and subsequent annual crops. The results of this demonstration project indicated that seed alfalfa in a crop rotation can increase available nitrogen, soil organic matter, and nitrogen in the crop biomass. This project was undertaken by the Prairie Agriculture Machinery Institute (PAMI) and was supported by the SASPDC through funding and in-kind support, and by the SMA Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada - Saskatchewan Growing Forward 2 bi-lateral agreement.

3. Demonstration Project - Sod Seeding of Forage Legumes

The purpose of this project was to explore cost-effective pasture rejuvenation by sod-seeding forage legumes (alfalfa / alfalfa - sainfoin mixture) into grass pastures. This project was undertaken to demonstrate that alfalfa can be sod-seeded into grass pastures to improve forage quality and yield. Sainfoin was included in this demonstration project since it is a bloat-safe legume which works well for pasture seeding in a mixture with alfalfa. This project was undertaken by the Prairie Agriculture Machinery Institute (PAMI) and was supported by the SASPDC through funding and in-kind support, and by the SMA Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada - Saskatchewan Growing Forward 2 bi-lateral agreement.

4. Promotion of alfalfa as a forage crop in North America

The SASPDC, with co-funding from Canadian Adaptation and Rural Development Saskatchewan (CARDS), worked to develop a publication for promotion of alfalfa as a perennial forage legume crop throughout North America. This promotional publication outlines the dependability of alfalfa as a valuable forage legume crop and also highlights the nutritional, economic, and conservation advantages associated with growing and utilizing alfalfa as a forage legume crop in dairy and beef operations. By targeting groups including dairy and beef producers throughout Canada and the midwestern United States, many of whom currently grow corn or other crops for silage feed, increased sales of Canadian alfalfa seed into new Canadian and U.S. markets will serve to enhance the value of Canadian alfalfa seed and stabilize alfalfa seed prices over a long-term period.

5. Understanding changes in alfalfa seed and forage markets

In order to better understand the role of alfalfa seed in North American forage markets, the SASPDC contracted agricultural economists in the U of S Department of Agricultural Economics to undertake a market research initiative entitled "Understanding changes in the alfalfa seed and forage market". This project was co-funded by the SASPDC, the Alfalfa Seed Commission (Alberta) and the Manitoba Forage Seed Association (MFSA) and is of importance to all western Canadian alfalfa seed producers in that it provided an understanding of factors involved in changing alfalfa seed market conditions. This key information will assist alfalfa seed producer organizations in the development of strategic planning which will ensure the future of the western Canadian alfalfa seed industry.