THE IRRIGATOR

ICDC 2014 Board Report

19th Annual Irrigation Conference held in Moose Jaw

I am pleased to report on the operations of the Irrigation Crop Diversification Corporation for 2014. ICDC is an organization directed by a producer board and carries out applied irrigation agronomy research and demonstration on behalf of Saskatchewan irrigators.

In 2014, a new 5 year Framework Agreement was signed by the 5 parties that operate out of the Canada-Saskatchewan Irrigation Diversification Centre in Outlook: Agriculture and Agri-Food Canada, Saskatchewan Agriculture, the Irrigation Crop Diversification Corporation (ICDC), the Saskatchewan Irrigation Projects Association (SIPA), and the University of Saskatchewan. This Agreement represents a commitment of the parties to continue to collaborate in the promotion and facilitation of irrigation-related research, demonstration, and education. ICDC's Research Director, Garry Hnatowich, located at the Centre, will continue to carry out the majority of ICDC's R & D program at CSIDC.

The focal point of ICDC's work continues to be varietal development and assessment under irrigation. However, ICDC also undertook a number of other agronomy-type irrigation projects at CSIDC in 2014. In total, ICDC was involved in seeding and maintaining 51 projects, which were carried out on more than 5,000 plots.

The Ministry of Agriculture is still very much involved with ICDC as well, with 3 Irrigation Agrologists, a Regional Forage Specialist, and a Regional Crops Specialist, all located in Outlook, who carried out several ICDC projects every year. In addition to being involved with projects on-site at CSIDC, Ministry staff carried out 9 other field-scale projects across 15 different locations around Saskatchewan in 2014.

Highlights from extension activities in 2014 include 2 Irrigation Agronomy Workshops held in March, one in Outlook and one in Riverhurst; the CSIDC Field Day & Trade Show in July; a Riverhurst Demonstration Field Tour in August; and a Forage Field Day at CSIDC in August. ICDC also established a twitter account, @ICDC_SK to provide timely information and advice on irrigation agronomy. As well, ICDC updated its website to ensure that the results of its current and past research are more accessible to producers.

ICDC has undergone major changes in recent years. However, the objectives of the organization remain the same, and the R & D program is still being carried out to meet the needs of Saskatchewan's irrigators. I look forward to the coming year as the organization continues to evolve to meet the challenges brought by recent changes.

Jay Anderson, Chairman, ICDC

ICDC
Irrigation Crop Diversification Corporation

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Research Director's Update

Garry Hnatowich, PAg
ICDC Research Director

As we enter 2015, I am taking this opportunity to update members as to the changes, challenges and opportunities that can impact ICDC. The past several years have seen a number of structural changes that have altered the dynamics in how we operate, and how we are dealing with filling a void.

Over the past number of years, we have seen a gradual decline in applied agronomic research by the public sector. Varietal development, from initiation through to commercialization, and production agronomy are no longer a priority at the federal level. Many federal research stations have seen an erosion in "tire kicking" production-orientated agronomists who can discuss everything from iron to inputs. As these positions become vacant, they are being replaced (or not) with *specialists* who are usually lab-based. Further, several years ago, the University of Saskatchewan terminated their agriculture extension division and eliminated a valuable resource of information dissemination from that institute. These changes have and continue to create challenges to the research community.

Increasingly, we see roles and responsibilities that were previously in the domain of public institutions being downloaded onto the private sector. To fill the research void, the AgriARM system was formed, a group of eight independent but closely allied organizations. A significant portion of the agriculture demonstration and research in Saskatchewan is now undertaken by these groups. ICDC is now a member of AgriARM. The Saskatchewan Ministry of Agriculture (SMA) provides annual funds to each group for structural support and is a major funder of each group's demonstration programs. However, by being appointed to AgriARM ICDC has undergone some fundamental changes in its operation. We are now responsible for all levels of administration, a function once managed by SMA. In effect, the ICDC Board of Directors has had to take a much more active role in the daily management of ICDC. Ms. Desseri Ackerman has been retained to act as our Administer, and assists the Board with all aspects of policy and finances. In addition to the increased importance of the AgriARM research and demonstration programs, numerous commodity organizations have also risen to the fore by providing research funding.

ICDC, with our associate organization, the Saskatchewan Irrigations Projects Association, and in conjunction with the University of Saskatchewan (U of S) and the Saskatchewan Ministry of Agriculture have recently renewed and approved a five-year partnership with Agriculture and Agri-Food Canada (AAFC) which allows ICDC access to the infrastructure at the Canada-Saskatchewan Irrigation Diversification Centre (CSIDC) in Outlook. This partnership is essential for the fulfillment of our mandate to assist in the development of varieties of crops suitable for irrigation and to research/demonstrate profitable agronomic practices. We have a strong affiliation with the staff at CSIDC who extend their full cooperation to ICDC wherever possible. Our working relationship with the SMA has been outstanding and ICDC is indebted to the Irrigation Agrologists and Crop Specialists with the SMA in the Outlook office. These staff are the individuals that conduct the majority of our demonstration program. Moving forward, we need to foster closer affiliation with the U of S, AAFC and Agri-ARM agronomists and work in joint cooperation where appropriate.

I was hired in 2012 to act as ICDC's research agronomist due to changes in program direction at CSIDC and to ensure the types of research programs identified as important to irrigation production are maintained. To this end, varietal evaluation of field crops has continued to be of primary importance and maintains much of my focus. However, the last couple of years have also

seen a growth in our agronomy program, and this component of our efforts will expand. Mindful of the costs of conducting these trials, part of my responsibilities are to seek and secure outside funding.

As our field program continues to expand, we are exploring the possibility of increasing our involvement and opportunities with private industry. This past year, we received funding support from such commodity associations such as the Canola Council, Saskatchewan Pulse Growers, Wheat and Barley Commissions, the Western Grains Research Foundation and others. In turn, I have become involved in the extension activities of these organizations when requested. Informal discussions on possible projects have also occurred, and are on-going, with a number of multinational agribusiness organizations.

For our long-term viability, we need to consider, when finances allow, permanent technical staffing and a capitalization program. We have just ordered our first significant piece of small-plot equipment: a high clearance plot sprayer; two-thirds of the cost of this equipment is being provided by the SMA. This strategy is on the understanding that we may not always be able to rely on the availability of AAFC equipment and need to move towards a position of self-reliance.

There are opportunities ahead for ICDC. The 2014 season saw us evaluate a record number of cereal, canola, dry bean, flax, soybean, and silage and grain corn varieties. We anticipate that the variety evaluation program in 2015 will be similar in size. We are also optimistic about leveraging additional research funds in 2015. At present, we have submitted a total of 24 grant applications to various funding sources for consideration. Some of these are listed in this edition of the *Irrigator*.

Watch for our extension events this year. ICDC is negotiating with SMA to host the 2015 Crop Diagnostic School in July at CSIDC. If finalized, we will host between 75 and 100 producers, agronomists and agribusiness representatives per day for three days. We would also like to extend an invitation to all our members to attend the CSIDC/ICDC Annual Field Day, which will be held on July 9, 2015.

Wishing you all an ideal growing season in 2015.

Garry Hnatowich
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What's the Life Expectancy of a Center Pivot and Its Components?

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Unlike most farm machinery, center pivots are exposed to the vagaries of the weather continuously. The freeze/thaw cycles of late fall and early spring, along with winter winds, all affect the useful life of the structural parts of a center pivot. Generally, the useful life of a pivot is expected to be 25 years or more. However, several factors can change that prediction drastically. Corrosive water, lack of preventive maintenance, high winds, ice storms, tornadoes, lightning and obstacles (parked tractors, etc.) affect the life of a pivot. Not all the component parts of a pivot have the same life span as the structural members of the pivot.

Tires

You should expect the tires on a pivot to last for at least 10 years, provided you keep the tire pressure at recommended levels. However, the quality of the tires has a large effect on their life span. Poor-quality tires will crack, and poorly applied recaps will separate from the tire proper.

Gearboxes

Generally, gearboxes on the pivot towers are the most common cause of pivot breakdown. With good maintenance, they should last for 15 years. To achieve this life expectancy, accumulated water in the gearboxes should be drained and replaced with new oil every year. Quite often, irrigators check the water and oil level on the gearboxes driving the wheels but forget about the center drive gearbox. The oil in the gearboxes should be replaced every three to five years, depending on the hours of use each growing season.

Because they run more often, the gearboxes on the outside towers of a pivot will accumulate more wear than the towers near the pivot point. The gearboxes on the first and second towers usually will accumulate more water.

Hilled potatoes are very hard on gearboxes. The up and down motion puts added strain on the gears and causes them to wear faster. Older pivots (more than 10 years old) used to irrigate potatoes for the first time most likely will have gearbox problems. Deep wheel tracks, high hills and muddy low spots also reduce the useful life of gearboxes.

Tower Drive Motors

The drive motors (electric and hydraulic) should last the life of the pivot. Lightening and submergence in water are probably the biggest factors that affect their useful life.

Tower Control Box

Barring lightening, contactor and micro-switches in the tower control box should last from 10 to 15 years. However, a good preventative maintenance program would replace them about every 6,000 hours of pivot operation.

Sprinkler Head and Pressure Regulator

The array of sprinkler heads and pressure regulators along a center pivot make up the "sprinkler package." Properly spaced and with correct nozzle sizes at the right locations, the sprinkler package will apply the proper amount of water uniformly over the field.

Given the importance of these components and remembering that the sprinkler package is only about 10 percent of the cost of the pivot, irrigators

should pay particular attention to the condition of the sprinkler heads and regulators. These two components have a useful life ranging from 5,000 to 8,000 hours of center pivot operation. Sand, pumping and corrosive water, along with deterioration of plastic and rubber parts, are the primary causes of problems.

Nozzles

With no sand or other mineral particles in the water, the nozzles should last as long as the sprinkler head. If minerals are in the water, the nozzle diameter should be checked every two years to make sure it is the correct size. Plastic and brass nozzles have about the same life span except with corrosive environments. In these conditions, plastic nozzles are the preferred choice. Due to the improved design of plastic sprinkler heads, replacing or exchanging nozzles is very easy.

Endguns

The new designs using the vertical swing arm should last the life of the center pivot. However, the bearings sometimes can wear out, which requires them to be replaced. Endguns have tapered bore nozzles, so only gritty debris in the water will affect their life. Older endguns with the horizontal swing arm and whipping return motion usually last about 10 years.

Endgun Booster Pumps

The endgun booster pump should last the life of the pivot, barring any lightening hits. The electric motor on booster pumps may burn out, especially with sprinkler packages mounted on top of the span pipe. Pivots with sprinkler heads mounted on drop tubes appear to have less electric booster pump trouble.

NOTE: Given the differences in water sources, the component life expectancy hours mentioned in the article may be different for Saskatchewan and could vary by project as well. ICDC recommends contacting your local center pivot dealer to confirm life span of your equipment and parts.

Including Forages in Crop Rotations

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Establishing forages on marginal lands is a commonly accepted agriculture practice. The question to ask is, "Does establishing forages on good quality soils and including forages into the crop rotation provide a benefit?"

The benefits of forages can include improved soil quality, fertility and organic matter, along with reduced weed and disease pressure.

Forage legumes fix nitrogen from the atmosphere. On average, nitrogen fixation from alfalfa can contribute 45 pounds of nitrogen per acre annually. Fixation potential varies with growing conditions. Moisture conditions and the amount of legume present in the forage stand are also critical factors in nitrogen fixation potential and the subsequent crop yield benefit.

The nitrogen release rate to the subsequent crop will depend on the amount of nitrogen fixed and the organic matter present in the soil. Moisture, temperature and soil conditions will also affect microbial activity and the rate of nitrogen release. The total nitrogen benefit to subsequent crops may range from 100 to 200 pounds of nitrogen per acre over a 2–3 year period following stand termination.

Production benefits from including perennial forages in a crop rotation are optimized at 2–3 years, but forage production is often extended past this time to account for the cost of establishment. Whether production is terminated after 3 or more years, a producer who incorporates perennial forages into an annual crop rotation should consider the timing and method of terminating the stand, as the rate of nitrogen mineralization is affected by the termination method used. Stands terminated with only herbicide have slower mineralization and nitrogen release rates compared to tillage or tillage-herbicide systems. Earlier timing of stand termination also plays a role in nitrogen mineralization and ensures that an adequate supply of nitrogen is available for the following crop to use. Early termination also provides more opportunity to replenish soil moisture levels.

Often the goal of forage production is to maximize forage stand life and forages are rotated only when production declines beyond the point of efficient harvesting. Research has shown that nitrogen accumulation and weed suppression from an alfalfa stand is optimized after 2–3 years. The economic optimum for stand duration is 4–5 years. Rotating forages more quickly through a crop rotation on good quality land may provide greater agronomic and economic benefits compared to establishing forages for longer periods of time.

For further information, regarding forages in crop rotations, please contact the Saskatchewan Agriculture Regional Forage Specialist at (306) 867-5559 or contact the Agriculture Knowledge Centre at 1-866-457-2377.

Choosing the Right Seed Variety for Irrigation

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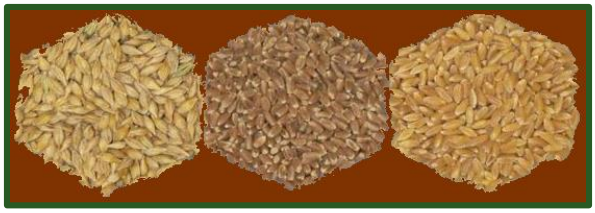
Irrigation is an intensive, high management production system that requires careful attention to detail to capitalize on potential high net returns. One of the first and most important management decisions is choosing the right seed variety. There are several attributes that should be considered when selecting a variety; simply considering yield is not enough. Each crop type and class has strengths and weaknesses for irrigated production. Different varieties express these strengths and weaknesses in different ways.

Cereals

Irrigated production of cereals in Saskatchewan accounts for approximately 30 percent of all irrigated production acres (ICDC 2014 Irrigation Crop Survey). Although most cereals do not



provide the highest returns compared to other crop types, they are important for crop rotation. Therefore, given the tight margins typical in cereal production, varietal selection becomes that much more important to assure a profit.

Choosing a variety that ranks high in yield will capitalize on water supplied by irrigation. Other important aspects to consider when selecting a cereal variety for irrigation production include lodging and disease rating. The lodging rate is primarily dictated by plant height. Some cereal varieties and classes have a more upright structure that will stand up better in the high nutrient and high moisture environment of irrigation.

Disease resistance is also a necessary attribute. Varieties bred with resistance or partial resistance to common cereal diseases will generally have higher profit potential. Irrigation creates an environment favorable for disease to flourish. Therefore, selecting a variety with the best disease protection possible is important. Diseases of most concern with irrigated cereals are leaf disease and Fusarium head blight (FHB). Different classes of cereals have different tolerance to FHB; durum is least tolerant, and oat is most tolerant. Midge is an insect that can affect yield of some classes of wheat. Choose a varietal blend (VB) if midge tolerance is important.

Oilseeds

Oilseeds account for almost 40 percent of the irrigated acres in the Lake Diefenbaker Development Area (LDDA), with the main crops being canola and flax (*ICDC 2014 Irrigation Crop Survey*). These two crops are very important for irrigators because of the higher potential for yield and return. Oilseeds are very similar to cereal production when it comes to choosing varieties. Selecting a high yielding variety is important, but it is important to also consider other aspects such as lodging and disease resistance.

Several canola varieties have good black leg resistance and some varieties show partial tolerance to sclertinia. Bertha army worm, diamond back moth and cabbage seedpod weevil are insects of concern. At this time, there are no varieties that give an advantage against these insects. Chemical control may be required if the insects reach population thresholds that warrant control.

When choosing a flax variety, lodging is the main consideration. Flax has been traditionally perceived as a low-input crop, but this is not the case under irrigated production. No major insect problems currently threaten flax yields.

Producers have recently begun growing soybean as an oil seed crop under irrigation in Saskatchewan. When choosing a soybean variety, it is imperative to look at the heat unit requirement and days to maturity of a variety. Soybeans are not adapted to our cold spring soil temperatures and short growing season. The Lake Diefenbaker area needs a variety that requires less than 2400 corn heat units and has less than 120 days to maturity for a reasonable chance of maturing. Lower corn heat unit varieties have lower yield potential. But don't be fooled! This crop can be lost to an early frost. Disease and insects are relatively minor risks for soybeans at this time. Be sure to understand production practices for soybeans in Saskatchewan before selecting a variety.

Pulses

Pulses are important to the crop rotation for irrigation. Peas and Lentils are the most widely grown pulse crops in Saskatchewan, but not the best candidates for irrigated production. Dry beans and faba beans are more suitable for irrigation production. These four pulses represent about 13 percent of the irrigated production acres, with 8 percent represented by dry bean, 4 percent field pea and lentil, and 1 percent faba bean (*ICDC 2014 Irrigation Crop Survey*).

Lentil and pea crops are vulnerable to the higher moisture environment produced by irrigation. Several root diseases persist early on in the growing season. Ascochyta blight and sclerotinia are threats later, during flowering and pod fill. Both crops can be grown with minimal irrigation, however it is important to choose a variety that better withstands moist, humid conditions. Small red lentils are the best market class option for lentils, as they are not subject to significant grade reductions for colour, as other classes are. A good disease resistance package is very important. When choosing a variety for field peas, lodging resistance will be one of the most important parameters to consider. With the addition of irrigation, a pea crop is very likely to lay flat and be difficult to harvest. Like lentils, a good disease resistance package is important as well.

Dry beans have provided some of the highest net returns of all crops grown under irrigation in LDDA, but this doesn't come without risk. Dry beans have relatively low moisture requirements in comparison to other crops commonly grown under irrigation. However, to optimize yield, it is critical that they receive sufficient moisture during the reproductive stages. For this reason, the majority of dry beans produced in Saskatchewan are grown under irrigation. There are many market classes of dry beans. Within these market classes, there are three plant types: Type 1—determinate bush, Type II—indeterminate bush and Type III—indeterminate sprawling vine. Type II varieties are most common; they have better pod clearance and a more open plant structure that is less susceptible to disease. When choosing a dry bean variety, the first parameter to consider is days to maturity. Dry beans are similar to soybeans in that they don't do well when seeded into cold soil. Spring planting usually occurs toward the middle of May to ensure that dry beans hit maturity prior to the first frost. Varieties that have a maturity rating of 100 days or less are best adapted to the LDDA. Yield, as for all crops, is an attribute to consider, but the top-yielding variety may not always be the best fit for your operations. White

mold is the most detrimental disease for dry bean; newer varieties withstand the disease better. Often, one or two fungicide applications are required to suppress the disease depending on disease pressure and conditions. Bacterial blight can also be highly detrimental to yield, and a copper-based fungicide can be used to control blight. Breeding has not yet generated any resistance to these diseases.

Faba bean is a crop that has been grown on larger acres in the past, but in the last couple years, is seeing resurgence into irrigated crop production. Before choosing a variety of faba bean, consider market class and marketing contracts. The two market classes include Tannin, suitable for human consumption, and Zero Tannin, for livestock feed. Days to maturity are important, since it is a relatively long season crop. Higher yielding varieties should be considered. Chocolate spot is the disease that growers need to watch for. Breeding has not yet generated any resistance to it. Insects that may be a problem in pulse crops are grasshoppers and pea leaf weevil. No resistance for insects is available for pulses.

When making your variety selections, remember that a different variety might be necessary for production under irrigation than for dryland production. The Irrigation Crop Diversification Corporation evaluates crop varieties specific to irrigation. Refer to the annual edition of ***Crop Varieties for Irrigation*** to assist you in selecting the most suitable variety for irrigated production.

The Next Crop for Irrigation …

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In the history of irrigated crop production, there are several crops that have come and gone and in some cases resurfaced. Since irrigation gives a producer the ability to apply additional moisture when nature does not provide it, high value/high input crops not traditionally grown in a dryland setting can be grown. This gives irrigation producers an advantage to capture high returns in niche markets.

Currently, under irrigation production in the Lake Diefenbaker area, potato and dry bean are a significant part of the crop mix. The small, but growing, fresh vegetable industry also relies on irrigation. However, crops such as hemp and quinoa have recently been introduced on small acres in the Lake Diefenbaker area. Neither of these crops is considered a new crop on a world scale, but both seem to carry consumer interest as a health food.

Hemp

Historically, hemp has been grown mainly as a fibre for use in textile manufacturing. Although the fibre is still widely used in parts of the world, there are no hemp fibre processors of note in western Canada. Therefore, most locally grown hemp is produced for its seed, which has value in the food, textile and cosmetics industries. Hemp appears to have significant market potential with consumers trending towards healthy/ functional foods. As a food, hemp seed is consumed whole or ground and can be added to several foods as an added nutrient. Hemp oil can be added to almost any processed food to improve its nutritional value. The fibre component of hemp, although not currently utilized in western Canada, has potential in the production of paper, biodegradable plastics and construction materials.

Hemp Field. Riverhurst, SK, 2013.

Quinoa Plots. Scott, SK, 2014.

Legal issues impede hemp production because of its close genetic relationship to marijuana, although it has much lower tetrahydrocannabinol (THC) content. Until 1998, it was illegal to grow hemp. While industrial hemp production is now legalized, it is still highly regulated. To be considered industrial hemp, THC levels in the plant residue must be lower than 0.3%.

Quinoa

Similar to hemp, quinoa has been in cultivation for thousands of years, but has recently found its way into the Canadian food market partially because of its nutritional benefits. Quinoa is a small seed. Because of the bitter flavour and toxicity of the seed coat, quinoa must be processed to remove the seed coat prior to consumption. Quinoa is considered a grain (cereal) and is processed similar to wheat or rice. Only one processor in Saskatchewan accepts quinoa and the grain can only be grown under contract. Recent high market demand has resulted in large increases in production during the last couple of years, and this trend is expected to continue.

Both hemp and quinoa have the potential to be the next high-value crop adopted by irrigators, but adoption is dependent on continued market expansion. Increased manufacturing and processing operations are needed in western Canada to keep pace with market demand and allow continued increase in production.

Development of the agronomic practices for both crops is also required, although significant work is ongoing on the prairies. No herbicides have been registered for either crop. This creates challenges for conventional agriculture that is highly dependent on herbicides to control weeds. ICDC has submitted a proposal to conduct plot tests of some of the newer varieties of hemp and quinoa in 2015. It is hoped that will be the beginning of research and demonstration of both these crops in an irrigated environment. Results will be available in ICDCs *2015 ICDC Research and Demonstration Program Report*.

Variance in Crop Water Use

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Crop water use, or evapotranspiration (ET), is the amount of water a plant requires to achieve optimal growth rates. ET is calculated by taking the total evaporation from the soil and the plants' surfaces together with the amount of water that is transpired through the stomata (the small pore-like holes in leaves). During seed germination and crop establishment, the majority of water use occurs from evaporation at the soil surface. As the crop grows and produces more foliage, the primary water use is through evaporation from the stomata (also known as transpiration). The total seasonal water requirement of a crop will depend on the type of crop grown and the climatic conditions encountered through the growing season.

Factors that influence crop water use include solar radiation, temperature, wind speed and humidity. Solar radiation is the energy that a crop uses for its metabolism. The more sunlight that a crop absorbs, the more water that will be required to keep up with plant metabolism. Heat and wind will increase evapotranspiration by removing and changing the air around the crop canopy. As humidity increases, plants will transpire less, reducing the amount of water the crop requires.

The 2014 growing season was cool and rainy, and crop water use was below average. During such cool and rainy conditions, a plant's stomata closes, reducing crop water needs. Humid conditions during the 2014 growing season created lower evaporation rates due to the higher humidity. The combination of higher-than-average precipitation and below-average crop water use resulted in decreased irrigation needed to support optimal plant growth.

As noted above, crop water use varies from year to year and varies between crop types. With 2014 data now collected from the Outlook weather station, the average crop water use has been calculated for a variety of different crops based on 10 years of climatic data (Table 1). This data indicates that actual crop water use in the Outlook area was lower during the last 10 years than previously published in Saskatchewan's *Irrigation Scheduling Manual*, which was based on southern Alberta data. A more detailed view of day-to-day crop water use data from the Outlook weather station is available at http://www.demofarm.ca/cropetdata.htm.

Crop water use data is a useful tool for predicting the actual amount of water that a crop will require, and thus the amount of irrigation that should be applied. The Alberta Irrigation Management Model (AIMM) uses weather data from the Outlook weather station. Using this tool can help you predict irrigation requirements for most crop types grown in Saskatchewan. AIMM is a great tool that can help you schedule your irrigation. The information is freely available at: http://agriculture.alberta.ca/acis/imcin/aimm.jsp.

Current crop water use information for the Outlook area is updated on the Irrigation Management Climate Information Network's (IMCIN) website courtesy of Alberta Agriculture and Rural Development. http://www.imcin.net/AIMM/WeeklyForecast/Weekly%20Forecast.mht

ICDC also sends out a tweet displaying weekly crop water use throughout the growing season. Follow ICDC's twitter account @ICDC_SK to view this information as it becomes available.

As seen in the table below, the amount of crop water use varies between crops. The table summarizes the past 10 years of ET data. This data is a fairly accurate indication of the water that a specific crop will use. The deficit value shows how

much irrigation a crop will need to optimize conditions for maximum potential growth. It is important to note that the deficit value will vary greatly by how much natural precipitation actually occurs. Crop water use data from Outlook will continue to be recorded and processed through water use models in upcoming years, which will improve the accuracy of the averages.

This information is accessible on ICDCs website at http://www.irrigationsaskatchewan.com/ICDC/icdc_index..htm

Crop	Crop Water Use Southern Alberta *mm (inch)*	Average Crop Water Use Outlook 2004-2014* *mm (inch)*	Average Growing Season Precipitation *mm (inch)*	Average Deficit *mm (inch)*
Alfalfa	620 (24.4)	454 (18.1)	267 (10.7)	196 (7.8)
Grass	500 (19.7)	345 (13.8)	267 (10.7)	96 (3.8)
Wheat	460 (18.1)	337 (13.5)	267 (10.7)	91 (3.6)
Barley	430 (17.0)	271 (10.8)	267 (10.7)	50 (2.0)
Barley Silage	390 (15.4)	247 (9.9)	267 (10.7)	36 (1.4)
Canola	430 (17.0)	372 (14.9)	267 (10.7)	117 (4.7)
Potato	520 (20.5)	359 (14.4)	267 (10.7)	109 (4.4)
Dry Bean	380 (15.0)	299 (12.0)	267 (10.7)	67 (2.7)
Corn	470 (18.5)	339 (13.6)	267 (10.7)	92 (3.7)

Use of Nitrogen Efficiency Enhancers in Irrigation

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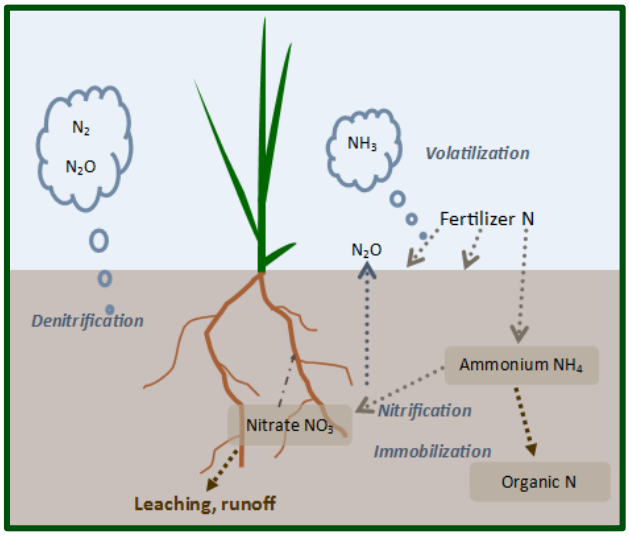
Urea fertilizers can lose over 30 percent of their nitrogen (N) content if they are not incorporated into the soil through precipitation or tillage. Nitrogen efficiency enhancers are products that reduce N losses due to volatilization and nitrification. The figure below shows how N can be lost through reactions once nitrogen fertilizer is applied. Currently, there are several products available on the market, which may cause confusion when determining the best choice to ensure minimal N loss. These products carry a price premium compared to standard urea, so economic benefit must also be considered.

To utilize nitrogen efficiency enhancer technology properly, a producer must understand how the



different modes of action work. Currently, there are three kinds of nitrogen efficiency enhancer products available: nitrification inhibitors, urease inhibitors and controlled release urea.

Nitrification inhibitors work by delaying ammonia nitrogen (NH_3) from conversion to nitrate (NO_3). Nitrate is a form of nitrogen that, in soil, is susceptible to leaching from water movement. Leaching is a greater concern in coarse-textured soils under irrigation because of the larger volume of water that flows through the soil. Nitrification inhibitor products currently registered for use in Canada include Agrotain Plus and SuperU. These two products use urease inhibitors in combination with nitrification inhibitors. Products such as N-Serve and Instinct use nitrogen inhibitor technology as well, although they are not currently registered for use in Canada.

Urease inhibitors are used in Agrotain Ultra, Super U and Agrotain Plus. Urease inhibitors work by delaying the breakdown of urea, thus delaying conversion into ammonia. Ammonia is susceptible to losses through volatilization, which means it is taken into the atmosphere as vapour. Slowing the volatilization process down reduces the risk of N loss until irrigation or rainfall can move the N into the soil. A product like Agrotain Plus can be mixed with UAN, which is commonly used for top dressing nitrogen. When the soil is subject to a quick, frequent cycle of becoming wet then dry, there is greater risk of volatilization. Under these circumstances, urease inhibitors help protect against N losses.

The third group of nitrogen efficiency enhancers available for use in Canada are controlled-release products. These products are either urea bonded to molecules that degrade slowly or urea that is coated with a polymer that slowly breaks down and gradually releases nitrogen. ESN is by far the most commonly used product in this category. ESN uses a polymer coating that breaks down slowly, allowing moisture to infiltrate the granule so the urea will diffuse into the soil. Another benefit of ESN is that seed-placed fertilizer can be increased by up to three times the recommended rate of nitrogen without harming the seed. Due to its polymer coating, the urea is protected in the prill and therefore does not clump.

The benefits derived from these products will depend on the method of fertilizer application and the conditions encountered after application. These products can be beneficial for surface-applied fertilizations and/or when excess moisture conditions are encountered after application. If these situations do not occur, nitrogen efficiency enhancers may not provide any economic benefit given their higher price. Other practices, such as increasing applied nitrogen by 15% can help reduce risk of N loss as well. These products should be used as insurance rather than as direct yield boosters.

Impact of Irrigation on Soil Fertility

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Irrigation management is the practice of applying water to crops to supplement natural precipitation. Irrigation is generally accompanied by increased fertilization and cropping intensity. This implies that irrigation is more than simply applying water to soil. Irrigation requires changes to dryland agricultural practices if a producer is going to realize increased productivity from irrigation. One change is an increase in fertilization. Irrigation provides plants with an increased growth potential; in order to support that potential growth, increased fertilization is needed.

The greater quantity of organic residues produced within the soil-plant system when there is more moisture available for crop growth does increase the organic matter content of soil over time. While the accumulation of organic matter in the soil occurs over a long timeframe, it is moderated by a number of factors. Some irrigated cropping systems require increased tillage intensity. Cultural practice for potato, dry bean and corn is to incorporate greater tillage intensity compared to cereals and canola. The plant residues produced by crops under irrigation must be processed within the soil or removed from the field to ensure efficient cropping operations. Higher frequency and intensity of tillage reduces the content of organic matter in soil. When buried, plant residues break down faster. Tillage aids drying of soil, which helps warm the soil. This is important because the warmer temperature will speed up the breakdown of plant residues.

Contrary to expectation, there are situations in which irrigation does not increase organic matter content in soil. For example, when a producer includes potato, bean or corn in their crop rotation, they also incorporate intensive tillage. This counteracts the benefit of greater plant residue in an irrigated field.

Our local irrigation industry may benefit from increased feeding of livestock from their irrigated crops. Irrigation districts that have a significant livestock component benefit from livestock manure. Addition of livestock manure to a field has been shown to increase the level of organic soil matter and leads to increased microbial activity and nutrient cycling.

Adjacent dryland and irrigated fields within the South Saskatchewan River Irrigation District (SSRID) were compared to determine changes in soil properties associated with irrigation. The study revealed that 20 years of irrigation had minimal impact on the physical properties of the soils. Although a greater amount of nutrients had been applied to the irrigated land, the additional fertilization had no impact on bulk density or soil pH. Both the dryland and the irrigated areas in the study had remained essentially the same over the 20 years of irrigation.

The wet aggregate stability of dryland soils was significantly higher than that of the irrigated soils. The continual waterdrop impact or enhanced breakdown of organic matter may have contributed to the reduction in aggregate stability of the soil of the irrigated fields.

The impact of irrigation management on nutrient availability in the SSRID study was found to be significant. Irrigation increased the nitrate concentration. There may have been three contributing factors: 1) a higher rate and greater frequency of ammonia-based fertilizer applications compared to the dryland fields, 2) the annual application of fertilizer in the irrigated area, and 3) a greater mineralization of nitrogen (N) in the irrigated area. N mineralization under irrigation occurs more quickly with the more labile organic matter and the higher moisture content of the soil.

Levels of phosphorus (P) were also higher in the irrigated soils because of higher rates of P fertilization every year. To support the higher target yields and nutrient removal under irrigation, the recommended rate of P fertilization of soil under irrigation is substantially higher. Fertilization of the irrigated area occurred annually because fallow is eliminated on irrigated fields.

Sulphate levels were slightly higher as a new equilibrium with the sulphate in the water was established over the 20 years of irrigation. For this reason, sulphur fertilization is generally unnecessary on irrigated soils. An exception to this occurs during growing seasons where frequent rainfall in amounts adequate to makes irrigation unnecessary. When rainfall is adequate for several weeks early in the growing season, sulphur is not usually applied with irrigation water. This can lead to sulphur deficiency.

In another study, the potassium (K) balance for a Dark Brown Chernozemic loam soil for 66 years of irrigated cropping was evaluated. As K fertilizer is not commonly applied to irrigated soils, the level of K in the soil decreased over the 66 years. But it should be noted that the observed reduction in exchangeable K did not hurt crop production. Saskatchewan's glaciated soils have high inherent K fertility. This, together with the supplies of K from crop residues, manures and K dissolved in irrigation water, did maintain an adequate level of K for many irrigated crops.

In conclusion, the primary impact of irrigation on soil properties is an improvement in soil fertility. This is encouraged by more frequent and higher rates of nutrient application compared to dryland farming. Producers can benefit from this information when they test their soil. Soil testing is a low-cost strategy that can guide decisions on fertilizer inputs. Recommendations from the testing are an effective way to identify fertilization strategies for increasing yield potential and guiding efficient management of investment in nutrient applications under irrigation.

Update on Copper Fertility on Irrigated Soils

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Copper (Cu) is supplied to growing crops from soil minerals and organic residues. The nutrient has low mobility in soil and enters a plant through direct interception by plant roots. Aeolian soils, which are developed on wind-deposited materials, have less than half the levels of copper that soils developed on parent materials that are deposited by water or glacial activity (Table 1). This suggests that soils developed from aeolian parent material are more prone to copper deficiency than soils developed from other types of parent material. The accompanying map (Figure 1) shows general areas of aeolian parent material within the Outlook area. The potential for copper-responsive soils is higher on these aeolian parent materials. Frequently, these marginal soils, which are light textured, are used for pasture until they are developed for irrigation. Once irrigated and annually cropped, the low level of copper fertility becomes significant.

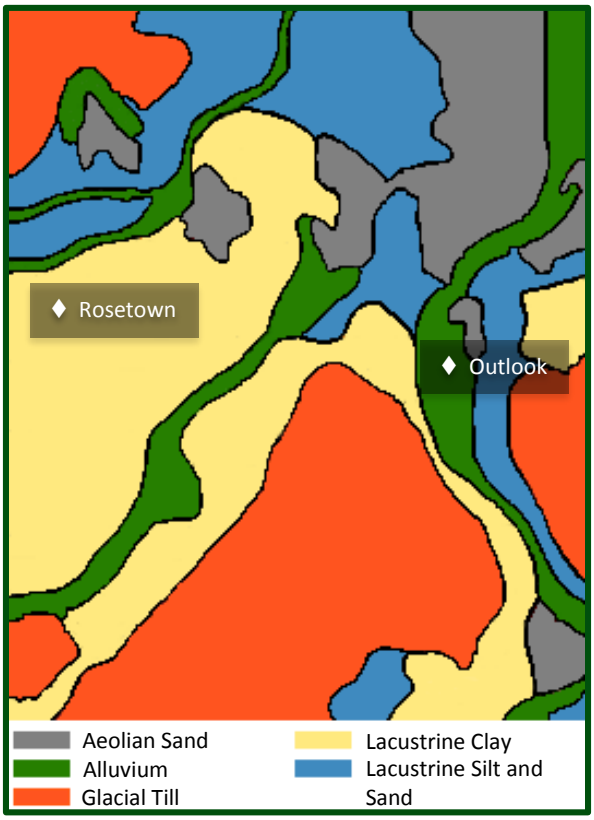
Production of potatoes and beans are ideally suited to light textured soils, which tend to have good permeability and favorable soil tilth. Production of these two crops often requires application of copper fungicide to control bacterial blight in dry beans and late blight in potatoes. Rates of application can be as high as 0.5 lb Cu per acre for each application. Up to 6 applications to beans and 10 applications to potatoes per growing season are registered for the control of disease.

When beans or potatoes are not grown in the crop rotation, the recommended application rate of copper fertilizer on copper deficient sites is between 3.5–5 lb Cu per acre. Experience has shown that a soil application at this rate is sufficient to correct copper deficiency for 10–20 years. Applications at lesser rates are often ineffective due to inadequate distribution of the copper fertilizer and the restricted mobility of copper in soil.

Survey of metal content of parent materials in the Outlook area.

Parent material	Cu *ppm*	Mn *ppm*	Zn *ppm*	Fe *%*
Lacustrine clay	21.7	392	79	2.3
Lacustrine silt and sand	14.3	340	65	1.6
Glacial till	14.8	370	60	1.6
Alluvium	12.1	328	61	1.6
Aeolian deposits	5.0	164	27	0.7

The removal of Cu in an 80 bu wheat crop is only 20 g Cu per acre. When the Cu is applied as a fungicide, the “nutrient” is uniformly applied to the field in an effective form. Fungicide use on beans and potatoes could easily substitute as a source of copper fertilizer to correct the need for copper nutrient on these light-textured soils that might otherwise be responsive to copper fertilizers.



ICDC Publications

Copies of the publications below and others are available from the Ministry of Agriculture's Irrigation Branch office in Outlook, SK, or from the ICDC website at www.irrigationsaskatchewan.com.

ICDC Research and Demonstration Program Report 2014 Detailed descriptions of the projects undertaken and funded by ICDC.

Irrigation Economics and Agronomics An annual ICDC budget workbook designed to assist irrigators with their crop selection process. Irrigators can compare their on-farm costs and productivity relative to current industry prices, costs and yields.

Crop Varieties for Irrigation A compilation of yield comparison data from irrigated yield trials managed by CSIDC. It is useful as a guide for selecting crop varieties suitable for irrigation.

Irrigation Scheduling Manual Provides technical information required by an irrigator to effectively schedule irrigation operations for crops grown under irrigation in Saskatchewan.

Irrigated Alfalfa Production in Saskatchewan Provides technical information regarding the production practices and recommendations for irrigated alfalfa forage production.

Management of Irrigated Dry Beans This factsheet provides a comprehensive overview of agronomic management requirements for producing dry beans under irrigation.

Corn Production This factsheet provides information on corn heat units, variety selection and an overview of agronomic management requirements for producing grain, silage and grazing corn under irrigation in Saskatchewan.

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ICDC and SIPA joint booth at the 2015 Crop Production Show in Saskatoon.

2015/16 Work Plan Budget

The Work Plan budget is submitted annually to the Minister of Agriculture for approval. Below, is the approved 2015/16 Work Plan Budget.

Projected Income:		
Member Levies *($1/acre)*	$100,000.00	
Operating Grant *($1/acre)*	100,000.00	
Interest	1,600.00	
ADOPT Funding	75,000.00	
Project Funding (GH)	75,000.00	
AgriARM Funding	75,000.00	
AgriARM Capital Grant	50,000.00	
Spring Agronomy Updates	1,000.00	
TOTAL Projected Income		**$477,600.00**
Projected Expenditures:		
R & D Projected Expenses		
R & D Projects	$ 15,800.00	
Field Supplies/Soil Testing	5,400.00	
Contract Researcher & Technician	147,500.00	
Students & Tech Assistants	20,000.00	
Conferences & Reporting	7,000.00	
Total Projected R&D Expenses		**$195,700.00**
Administration Projected Expenses		
Communications	$ 10,000.00	
Audit/Insurance/Legal	6,800.00	
Administration & Bookkeeping	24,125.00	
Website	500.00	
Advertising	2,000.00	
Meeting Expenses	12,000.00	
Computer & Telephone	2,400.00	
Licence of Occupation	19,000.00	
Lease of Truck & Equipment	8,000.00	
Lease of Land	2,500.00	
Purchase of Equipment	50,000.00	
Total Projected Admin Expenses		**$137,325.00**
TOTAL Projected Expenditures		**$333,025.00**
Projected Surplus *(Income less Expenditures)*		**$144,575.00**

ICDC Project Proposals for 2015

ICDC encourages irrigators to contribute ideas and thoughts on projects to be pursued in 2015.

Gary Kruger

Cu and Zn Fertilization of Alfalfa

Copper Fertility on Low Fertility Irrigated Soils

Phosphorus, Potassium, and Zinc Fertilization of Alfalfa Under Flood Irrigation

Variable Rate Fertility under Irrigation

Increasing Efficiency of Nitrogen Application for Irrigated Crops

Winter Wheat Production under Flood Irrigation

Sarah Sommerfeld

Pizza Farm Demo

Salt Tolerant Forage Demo

Corn Variety Demo for Silage & Grazing

Saline Tolerant Forage Demo

Jeff Ewen

Fertigation Application Timing on Irrigated Canola

Evaluation of Straight Cut Canola under Irrigation

Demo of Plant Growth Regulator Application in Irrigated Wheat Production

Fusarium Head Blight Fungicide Application Through Center Pivot

Field-Scale Plant Growth Regulator Demo in Irrigated Cereal Production

Joel Peru

Response of S Fertilization of Canola Under Irrigation in a Sandy Soil

Response of Foliar Applied Boron on Canola during Early Flower

Demo of Potential Irrigated Crops- Hemp, Quinoa, Safflower

Demo of Ethnic Vegetable Production in Saskatchewan

Demo of Cantaloupe and Watermelon Production in Saskatchewan

Demo of Horseradish Production in Saskatchewan

Treatments to Improve Plant Health and Productivity in a Mature Saskatoon, Haskap, and Sour Cherry Orchard Located in High pH Soil

Grain Corn Variety Study

Irrigators who have suggestions for projects or questions regarding specific crops or production practices are asked to contact us and to become involved with the ICDC program. Contact information for the agrologists involved in the ICDC program is found on page 23.

Intercrops, while interesting in theory, have proven to be difficult to scale up to a commercial level due to many factors. Issues around separating grain, timing of harvest, and weed control restrain many potential crop pairings. There must be a compelling agronomic reason to add the extra complication of an additional crop to get farmer and industry adoption of this new practice. In 2014, a joint-project investigating the viability of a chickpea flax combination. This just may be an intercrop that will work on a commercial scale in Saskatchewan. Seeding, weed control, harvest timing, and separation are all very manageable. Given the agronomic problems with chickpeas in Saskatchewan, an intercrop may be a way to alter the area of adaptation or production systems for chickpea in the province and possibly into irrigation production. This project is being continued by Garry Hnatowich in 2015. See the entire report in the 2014 ICDC Research and Demonstration Program Report.

Introducing ICDC's Board of Directors

ICDC directors are elected at its annual general meeting by delegates from Saskatchewan's various irrigation districts. Each irrigation district (ID) is entitled to send one ICDC delegate per 5,000 irrigated acres, or part thereof. By law, the majority of the board must be comprised of irrigators.

The four ICDC development areas defined by ICDC's bylaws are represented on ICDC's board of directors by: Lake Diefenbaker Development Area (LDDA), two directors; South West Development Area (SWDA), two directors; Northern Development Area (NDA), one director; and South East Development Area (SEDA), one director. Non-district irrigators elect one director. In addition, two ICDC directors are appointed annually by the Saskatchewan Irrigation Projects Association (SIPA) and two by the Saskatchewan Ministry of Agriculture. The current ICDC directors are:

Producer Board Members	Irrigation District	Development Area	Term Ends
Jay Anderson, Chair	South Saskatchewan River	LDDA	2017
Greg Oldhaver, Alt Vice-Chair	Miry Creek	SWDA	2017
Paul Heglund		SWDA	2017
David Bagshaw	Luck Lake	LDDA	2016
Ryan Miner	Riverhurst	SEDA	2015
Colin Ahrens	Individual	Non-District	2015
Vacant		NDA	

Appointed Board Members	Organization	Term Ends
Robert Oldhaver	Saskatchewan Irrigation Projects Association	December 2015
Joel Vanderschaaf	Saskatchewan Irrigation Projects Association	December 2015
Kelly Farden, Vice-Chair	Manager, Agronomy Services, Crops & Irrigation Branch, Saskatchewan Ministry of Agriculture	January 2017
Penny McCall	Manager, Value-Added Unit, Regional Services Branch, Saskatchewan Ministry of Agriculture	January 2017

Directors for 2015 from left to right: Kelly Farden, Colin Ahrens, David Bagshaw, Jay Anderson, Doug Pchajek, Paul Heglund, Robert Oldhaver, Penny McCall. Absent: Ryan Miner, Greg Oldhaver

Staff

In addition to ICDC staff and contract positions, support of the ICDC is provided by the Saskatchewan Ministry of Agriculture through the Crops and Irrigation Branch in Outlook.

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ICDC Research Director
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Specialty Areas: variety testing and agronomy

Kelly Farden PAg
Manager-Agronomy Services
Crops and Irrigation Branch
Ministry of Agriculture
(306) 867 5528

Specialty Area: ICDC program and administration

Gary Kruger, PAg, CCA
Provincial Irrigation Agrologist
(306) 867-5524

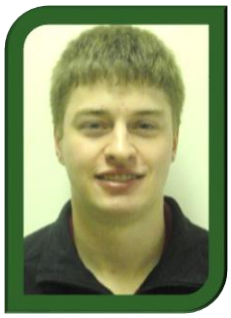
Specialty Areas: South West Program, Soil Fertility and Crop Rotations

Sarah Sommerfeld, PAg
Regional Forage Specialist
(306) 867 5559

Specialty Area: Forage Crops

Jeff Ewen, PAg
Provincial Irrigation Agrologist
(306) 867-5512

Specialty Areas: Cereals, Oilseeds, Pulses, Technology, and Economics



Joel Peru, PAg
Provincial Irrigation Agrologist
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Specialty Areas: Horticultural Crops, Specialty Crops, Fertility

Desseri Ackerman, BComm
ICDC Administrator
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2015 Events

Irrigation Agronomy Update
April 1, 2015 – Heritage Centre, Outlook
April 2, 2015 – Community Hall, Riverhurst

CSIDC Irrigation Field Day
CSIDC Research Station, Outlook
July 9, 2015

Crop Diagnostic School
CSIDC Research Station, Outlook
July, 2015

SIPA/ICDC Annual Conference & AGMs
Moose Jaw, SK
December 8 & 9, 2015

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