Pushing the Geographic Envelope: How Far do we go with Warm Season Crops?
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With rising input costs and unstable commodity prices, growers are constantly seeking new and innovative ways to make their farms more profitable. Over the past several years, growers have been experimenting with non-traditional crops as a way to improve their bottom line. Gone are the days of the traditional cereal and oilseed rotation across our landscape. Today many growers in Southern Manitoba are growing significant acres of warm season crops such as grain corn, sunflowers, edible beans and soybeans. With the potential for increased revenue from these crops there also comes considerably more risk to growing these warm season crops versus more traditional ones. Warm season crops have, and will, continue to be profitable when grown under the right conditions. However, many growers are trying to raise these crops in areas generally considered to be “fringe” areas not suitable for growing warm season crops for many reasons. Even with advancements in the genetics of these warm season crops, the summer of 2004 was a cruel reminder that you still need the heat. Our experiences from 2004 also make us ask the question of how far into these non-traditional geographies do we push these crops before we realize that they were maybe just not meant to be grown there? The following paper will examine management variables that a first time producer needs to look at before attempting to grow a warm season crop in a non-traditional area. We will examine specifically the influence of soil type and drainage, tolerance to excess and lack of moisture, frost-free period, available heat units, photoperiod and topography.

In general, most crops will grow well on most types of soils, anything from a sandy loam to a clay loam soil so long as the particular soil type has good structure, good internal drainage and other fertility attributes like high CEC and organic matter. A well-drained soil is one that can hold the adequate amount of moisture a crop requires and also has the ability to shed the excess moisture before it becomes a stress on the crop. Unfortunately we don’t live in a perfect world and quite often end up dealing with periods of excess or lack of moisture. Tolerance and adaptation of a crop to excess moisture is plant species dependant. Most annual crops, especially cereal grains, can tolerate 3 to 7 days of water stress depending on the soil type, plant species and soil temperature. For example, corn which is fairly tolerant to excess moisture in and of itself can actually only tolerate no more than a 24 hour period of excess moisture stress when the soil temperature is 24 C or above. Plants adapt to water stress in the short term by slowing growth of the shoot and reducing respiration rates to conserve oxygen that is needed by the roots. Supplemental nitrogen fertilizer can sometimes benefit an oxygen-deprived crop by supplying the oxygen gas that is needed but this is only a temporary fix. Longer-term solutions require the implementation of systems like tile and surface drainage. When excess moisture is not a concern as much as a lack of moisture, tolerance again is plant species dependant. Warm season crops like corn and sunflowers have generally deeper root systems that explore more of the soil profile and can access subsoil moisture better than pulses like soybeans and edible beans. They are more shallow rooted and grow more lateral root growth therefore exploring more of the A horizon that is subject to drying out quicker. Tolerance of excess moisture from best to worst can be described as corn>soybeans>sunflowers>edible beans, whereas tolerance to drier conditions can be described as sunflowers>corn>edible beans>soybeans.

Frost-free period can be defined as the number of days between the last spring frost and the first fall frost. This range determines the length of growing season and the types of crops that can be grown to maturity in those areas. Every crop requires a certain number of frost-free days. With regards to warm season crops, grain corn generally requires 110 to 120 days, sunflowers require 90 to 120 days, soybeans require 108 to 125 days and edible beans require 99 to 114 frost-free days to mature. Each of these crops also varies in their tolerance to frost. Looking at these crops from most tolerant to least tolerant would look something like this: sunflower>corn>soybeans>edible beans. Grain corn can be damaged by frost up to the 5 leaf stage but will still re-grow new leaves because the plant’s growing point remains under the soil surface until that critical point. In most cases pulses are the weakest when it comes to frost. Both
soybeans and edible beans can be damaged by spring frosts but soybeans would be slightly more tolerant. Soybeans have very fine hairs over their leaf surface. This, combined with the newest growth being held tight to the plants growing point, help act like insulation from a minor frost event. We would consider sunflowers to be one of the most tolerant. They can tolerate spring frost up to \(-4\) C when emerging but then lose their tolerance after the 2 leaf stage of growth.

Another variable to consider is the influence of corn heat units. While all the warm season crops we are looking at in this paper are heat “loving” crops, some respond to heat unit accumulation more than others. Heat units are calculated on a daily basis using maximum and minimum temperatures to come up with the amount of heat that was produced that day to grow a crop. The maximum daytime temperature uses a low of 7 to 10 C as a base and 30 C as the optimum because warm season crops do not develop below 7 to 10 C and develop fastest at 30 C. One consideration that producers need to be aware of is that a heat unit in September is not the same as one in June or July. Many acres of grain corn, soybeans and even edible beans and sunflowers did not reach physiological maturity in 2004 because the cool summer and lack of heat units that were produced. In general, most of Manitoba received only 85% of normal corn heat unit accumulation.

Besides heat units, many warm season crops also respond to photoperiod. Photoperiod can be described as the duration of light within a particular time span usually a 24 hr period. For example a 12 hr photoperiod consists of 12 hours of light and 12 hours of darkness. Photoperiodism is the actual response of a plant to the relative light and dark periods. Research has shown that it is the dark period more than the light period that is of importance to plants for controlling photoperiodic responses. Even though soybeans are rated presently on heat units, they are the most sensitive to photoperiod. The shift from vegetative growth to flowering in soybeans is because of the length of darkness at or around the longest day of the year in Manitoba. Other crops like corn are not as sensitive to photoperiod but only at a particular time in the plants growth cycle. Corn is sensitive at about 4 to 8 days prior to tassel initiation. During periods of intense sunlight, corn is producing about 1½ bushels/10 hour day/acre. On a cloudy day, about 20% of this is produced. Sunflowers, as well, respond mainly to heat units, but photoperiod also triggers the plant to begin flowering.

In general certain crops are more suited to certain topographical changes in landscape. Warm season crops can adapt well to most topographies but attention has to be focused on the seeding and harvesting operations mainly. Quick and even emergence is always crucial with warm season crops to get them out of the ground and growing. Seed depth and placement is key to success. Harvest loss issues can be more an issue with certain crops like soybeans and edible beans on rolling or stony topography. Pulse generally need level seedbeds to reduce the risk of harvest loss whereas corn and sunflowers are better suited to a wider range of topographies.

It is not the attempt of this paper to discourage agronomists and producers from looking at cropping alternatives in non-traditional areas. Agronomists and producers need to make sure, however, to take the time to examine the above management variables and others to see whether growing a warm season crop can be done successfully in a non-traditional area. We need to be more aware and better utilize the Manitoba producer information that is at our fingertips to help with these important decisions. We also need to make sure producers look at the long term averages for growing these crops versus yearly data. In addition we need to set realistic expectations. For example, yield expectations should not be the same for a producer growing sunflowers north of Brandon verses a producer growing sunflowers south of Altona. Before we can look at warm season crops we have to be able to also ask ourselves if we truly have examined every management step to improve profitability in our traditional crops like wheat, barley canola and flax. Don’t be afraid to tell a producer that the risks are too great and that it just doesn’t work to grow a warm season crop in that particular area but be prepared to back up your recommendations. If I were to give these warm season crops we’ve looked at an adaptability ranking based on the above
management variables, I would rank them sunflowers>soybeans>edible beans>corn and examine each one as to whether it has a fit in a non-traditional area.

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