Benefits of Early Seeding

With everything a grower has to worry about in the spring, the last thing that is probably on his mind is "how much yield will I loose every day I delay seeding?" This is, however, one of the areas where significant yields are lost every year.

Since most crops grown in western Canada will germinate at 5ºC (see table 1), and since this temperature is achieved in most fields in late April or early May, seeding of many crops could conceivably start at that time. Germination and seedling growth are, however, more variable and slow at low soil temperatures. As temperature increases, germination and emergence become faster and more uniform. Generally, the time to emergence is reduced by one half for every 5ºC increase between 5°C and 20ºC. Warmer soil temperatures also result in a higher percentage of plant emergence.

Several factors influence soil temperatures and the rate of warming. Soil temperature varies with time and depth, and is determined by the radiation reaching the soil surface. Type and quantity of surface residue as well as the heat capacity of the soil will also influence rate of soil heat gain.

Table 1. Germination Temperatures for Field Crops

	Minimum (°C)	Preferred (°C)
Cereals and Oilseeds		
Wheat	4	20
Barley	3-5	20
Oats	5	20-24
canola/rapeseed	5 (Argentine)	15-20
	7-10 (Polish)	15-20
Forage Crops		
alfalfa	1	25
birdsfoot trefoil	1	26
red clover	3	25
sweet clover	1	18-25
white clovers	5	18-20
fescues	3	13-18
orchardgrass	4	18-20
timothy	4	18-22

Why Early Seeding Pays

Generally speaking, early seeding results in maximum yields for most crops. There are several factors that contribute to this:

1. Early seeded crops will better utilize available soil moisture. Later seeding will reduce the probability of receiving a given level of total precipitation during the growing season. Environment Canada data from southwest Manitoba indicates that the probability of receiving sufficient moisture based on initial soil moisture is reduced from 50% for a crop seeded on May 1, to 36% if seeded on May 22.
2. A heat stress during flowering can negatively impact flowering and subsequently seed set. By seeding early, the crop flowers earlier and thus avoids the heat that is typically associated with July. This is especially important in canola, as it is very sensitive to heat during flowering.
3. Early seeded crops avoid many insect and disease problems by beating the peak infestation or infection period.
4. There is a wider window of opportunity for timely weed control in early seeded crops.
5. Early seeding leads to earlier harvesting. Generally, harvesting conditions are much more favorable during August and early September compared to the conditions that follow.

6. Late seeding often leads to taller plants and increased chance of lodging at maturity

Consistent Research Findings

The following is a summary of some seeding date studies that have been conducted in western Canada. All studies tend to report increased yields with early seeding.

Wheat: A study done in Brandon over an 11 year period showed wheat yields drop 11% when seeding was delayed from the first of May until the end of May and 17% if delayed until the second week of June (see Figure A). Another study in Swift Current compared 3 seeding dates and saw spring wheat yields decline 11% from early May until late May (Yanti Gan and Perry Miller). A third study under irrigation in Saskatchewan saw wheat yields reduced from 13% to 25% depending on variety and by 19% (average of 7 varieties). (Irvine unpublished)

Barley: Barley yields and quality characteristics can also be affected by seeding date. The Brandon study saw barley yields reduced by 5% from the early May to late May seeding dates. Reductions amounted to 25% if seeding was delayed until mid-June (see Figure A). The likelihood of producing malting barley increases substantially with early seeding. An Alberta Wheat Pool survey of B1602 growers in 1990-91 revealed that seeding before mid-May resulted in a malting barley acceptance rate of nearly 50%. If seeding was delayed until the third week of May, acceptance for malting was reduced to 34%. A further reduction in acceptance occurred (16%) if seeding took place in the last week of May.

Figure A. Seeding Date Study at Brandon *(Johnston & Metcalfe)*

Canola: A study near Edmonton showed that delaying seeding from early May to late May resulted in a 4% increase in dry matter production but a 20% decline in grain yield (Degenhart and Kandra 1981). Gan and Miller's study at Swift Current also showed yield research by Kirkland and Johnson at Scott in 1998 showed a 55% yield advantage to seeding in April vs. mid-May on stubble, and 26% advantage to early seeding on fallow.

Six years of seeding date trials were conducted by the Canola Council of Canada's agronomists at Canola Production Centres across western Canada. The Centres have amassed 26-station years of data on seeding date. Since the trials were conducted with field-scale equipment on farm fields, the management situations the agronomists faced are identical to those growers face.

The trials consisted of:

• 'Early seeding' – sown at or before seeding became general in the area.

• 'Normal seeding' – sown at the same time seeding became general in the area.

• 'Late seeding' – sown seven to 10 days after seeding became general in the area.

The results show that early seeding of canola had a significant benefit for both yield and oil content. The following is a summary of what the agronomists found:

Early Seeding

• Average seeding date was May 6th (plus or minus five days in 90% of the trials).
• Yields were the highest seven times out of ten.
• Oil contents were the highest.
• Swathing was earliest for the early-seeded treatments

Normal Seeding

• Average seeding date was May 18th (plus or minus six days in 90% of the trials).
• Yields were 94.5% of the early-seeded canola and were the highest only three times out of every ten trials.
• Oil contents averaged 0.25% lower than early-seeded canola.
• Swathing began an average of eight days later than the early-seeded canola.

Late Seeding

• Average seeding date was May 27th (plus or minus eight days in 90% of the trials).
• Yields were 88.4% of the early-seeded canola.
• Oil contents averaged 0.87% lower than early-seeded canola.
• Swathing began an average of 19 days later than the early-seeded canola.

Flax: A North Dakota study saw yields reduced by 20% from early May until late May seeding dates. Delayed seeding also resulted in taller plants and more lodging (Thompson et al 1988).

Peas: Four planting dates were evaluated in a 1997-98 North Dakota study. The first seeding dates were May 1 and April 24 for 1997 and 1998, respectively. Planting intervals were about every two weeks after this. From the earliest to the latest seeding date, a yield reduction of 86% occurred. A similar study showed the average yield of the 2nd, 3rd and 4th planting date was decreased by 15, 36, and 69 percent, respectively, when compared to the first planting date. Much of the decreased yields in 1998 and 1999 were associated with increased levels of powdery mildew. The decrease in yield with later planting dates was also reflected in significantly more seeds/lb (smaller seed size). Test weight was not affected by planting date. Days to flower and mature both decreased as planting date was delayed. Lodging was generally lower at the later planting dates. (Hanson 2000)

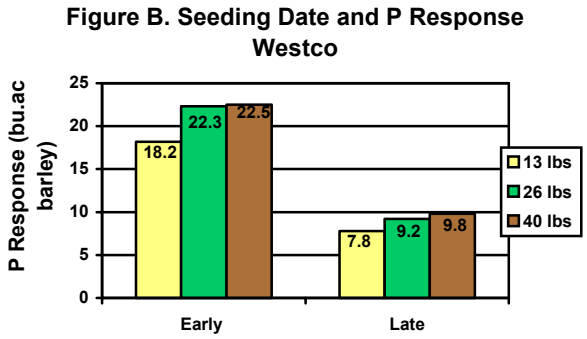
The Gan and Miller study at Swift Current found a 20% reduction in yields by delaying seeding.

Oats: Four seeding dates and four cultivars were tested at Indian Head, Melfort, and Brandon over 3 yr. Moving the seeding date from mid-June to early May increased oat yield, seeds per panicle, kernel weight, test weight and plump seed by 76, 33, 10, 13 and 11%, respectively, when averaged across all locations and years. This increase in yield and quality was probably due to improved environmental conditions and a reduction in crown rust infection (Puccina coronata Corda). Crown rust has a larger effect on seed yield and quality at Indian Head and Brandon, and as seeding was delayed from early May. Early seeding of oat decreases the risk of obtaining low yield and/or quality, and should be considered a best management practice for growing milling oats, especially in the southeastern prairies of Canada. (May et al, 2004)
Alberta Management Insights and Manitoba Management Plus Program have, over the years, monitored seeding dates vs. yields of actual farmers. In both cases, their findings confirm the information found in the research trials. Information on both programs can be found on the web at sites provided at the end of this paper.

In summary, crop yields will generally increase with early seeding (i.e., late April or early May in western Canada).

While most crops will germinate at 5ºC, the speed of crop emergence will increase as the soil temperature increases. While there is an increased risk to frost and poor emergence due to disease, most early seeded crops will out-yield later seeded crops in most years. Keep in mind that crops can tolerate a spring frost much better than an early fall frost. To offset the cold stress associated with early seeding, it is recommended that producers follow the following “best management practices”.

- Seed Shallow. As moisture is usually ample early in the spring, most crops can be seeded at the low end of recommended seeding depths. This would be 1 – 1.5” for cereals and peas and .5” for canola. This will allow crops to germinate and get out of the ground as soon as possible.
- Use a Seed Treatment. As germination and emergence is slower at lower temperatures, germinating seeds are subjected to disease organisms on the seed and in the soil for longer periods of time. The largest benefits from seed treatments are seen on early seeded fields.
- Use “Better” Quality Seed. Again, for the reasons discussed in the previous point, emerging seedlings need any extra energy that can be given to it in early seeding situations.
- Apply “Starter” Fertilizer. Early seeded crops benefit from seed-row applied starter phosphate fertilizer. Yield and maturity benefits from seed-row phosphate are maximized in early seeding situations. If reduction in rates of Phosphate fertilization is being planned, early seeded crops are **not** the place to start. See figure B above. As seed-row nitrogen can add additional stresses to emerging crops, do not go beyond recommended rates of seed-row urea applications.
- Early weed control is essential for top yields. Oat seeding may be delayed for control of wild oats. However, seeding early and increasing seeding rates have proven to limit the impact of wild oats in light to moderate infestations.



- Canola that is seeded early will often "harden off" and often be able to withstand frost below –5°C. However, extensive frost damage has been observed in areas of the field where heavy crop residue is present. Only fields with good residue spreading should be considered for early direct seeding of canola.

There are indications that we are experiencing a trend towards a longer growing season (more frost-free days) on the western Canadian prairies. However, the first fall frost date is remaining relatively constant and we are seeing the lengthening due to earlier last spring frosts. (Anderson 2006). In order to take advantage of the increase in frost free period, earlier seeding must be practiced.

Web links

Wise Seeding Date Decisions --- Discover the Hidden Value
Yantai Gan, Bob Zentner, and Brian McConkey
http://res2.agr.ca/swiftcurrent/news-nouvelles/000414_e.htm

Seeding Canola:The Ideal Timing - Canola Council publication
http://www.canola-council.org/PDF/CPCseeding.pdf

Field Pea Planting Date Effects on Yield and Various Agronomic Traits, Langdon ND, 1998-2000.
Brian Hanson
http://www.ag.ndsu.nodak.edu/langdon/04data/field%20pea%20planting%20date.htm

Early seeding dates improve oat yield and quality in the eastern prairies
William E. May, Ramona M. Mohr, Guy P. Lafond[1], Adrian M. Johnston, and F. Craig Stevenson
http://pubs.nrc-cnrc.gc.ca/aic-journals/2004ab/cjps04/apr04/cjps02-157.html

Effect of Seeding Date on Canola Yields as Reported by Alberta Farmers (AMI)
http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/crop5758

No more blind dates: Crop yield response to SEEDING DATES (MMPP)
http://www.mmpp.com/mmpp.nsf/Seeding_Dates_and_Yield_Page.html?OpenPage&charset=iso-8859-1

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