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Promoting chickpea maturity through fertility management

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Promoting Chickpea Maturity through Fertility Management

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INTRODUCTION

Chickpea is a crop with strong indeterminate growth habit. In the short-seasoned western Canada, late maturity is one of the biggest challenges for chickpea production. During the past decade, there were at least three years (1999, 2002, 2004) when Saskatchewan producers faced difficulties to harvest their chickpea crops by the onset of late-fall killing frost. Late-matured chickpea produces seed with poor quality or high proportion of green seed which is unfavourable by buyers.

OBJECTIVES

This study determined the effect of preceding stubble type (barley, wheat, and summerfallow) and fertility/inoculation management on chickpea maturity. The ultimate goal was to develop strategies to promote early maturity.

EXPERIMENTS

Field experiments were conducted at Swift Current and Shaunavon, Saskatchewan from 2004 to 2006. At each of the 6 site-years, large-sized kabuli 'CDC Xena', medium-sized kabuli 'CDC Frontier', small-sized kabuli 'Amit', and desi type 'CDC Anna' were grown on wheat and barley stubble and on conventional summerfallow. The following fertility treatments were applied to each variety x stubble type combination:

1) No-N and no-inoculant (control)
2) No-N, granular (GR) inoculant
3) N=28 kg ha^{-1}, no-inoc.
4) N=56 kg ha^{-1}, no-inoc.
5) N=84 kg ha^{-1}, no-inoc.
6) N=112 kg ha^{-1}, no-inoc.
7) N=28 kg ha^{-1} with GR
8) N=84 kg ha^{-1} with GR

Treatments were compared in a split-plot design with stubble type as the main plot, and variety x fertility levels as subplots (subplot was 2 x 10 m in size). Plant maturity was recorded every 6 to10 days starting when plants first began to turn colour. The degree of maturity was quantified using a scale of 1 to 10, with 1 being when <10% of the plants had begun to turn colour, and 10 being when 100% of the pods were ripe. This rating was referred to as "Maturity Index". A Maturity Index of 8 meant 80% of the pods had turned colour and the plants had reached physiological maturity (Fig. 1).

RESULTS AND DISCUSSION

There was a large variation in chickpea maturity among site-years, among preceding stubble type, and between fertility treatments (Fig. 2). In the cool wet year of 2004,

chickpea plots took an average of 138 days to reach maturity (from seeding), compared to 115 days in the normal year of 2005 and 93 days in the dry year of 2006.

Growing season precipitation in 2004 was 40% above the long-term average (204 mm), while moisture in 2005 was near normal and the 2006 moisture was 25% below normal.

Chickpea grown on summerfallow did not reach full maturity by the onset of late-fall frost in 2004 at Shaunavon, and was delayed by 6 days in 2005 and 2006 compared to barley stubble. Chickpea on barley stubble matured 5 days earlier than when grown on wheat stubble in 2004 when the two stubble types were in adjacent fields, but there was no difference in maturity between the two stubble types in 2005 or 2006 (Fig. 3).

There were large differences in maturity among varieties (Fig. 4). In general, CDC Frontier matured latest and Amit the earliest under the same growing conditions.

Plots that received no-N and no-inoculant or no-N with granular inoculant matured latest in the wet to normal years at both locations (Fig. 5). Averaged across six site-years, the application of N fertilizer at the rates of 28 to 56 kg ha^{-1} but with no inoculant, advanced maturity by 9.1 days for CDC Anna, 6.1 days for Amit, 5.6 days for Frontier, and 4.3 days for Xena compared to the no-N no-inoculant treatment.

The number of days of maturity advance was greater in the wet year of 2004 when the use of 28 to 56 kg N ha^{-1} fertilizer without inoculant improved maturity by 15 days for CDC Anna, 13 days for CDC Frontier, 12 days for Amit and 8 days for CDC Xena. However, in the dry year of 2006, only marginal differences were found among the fertility treatments. Drought conditions in the late growth stage in 2006 accelerated crop maturity regardless of soil fertility.

In general, the differences in maturity due to fertility management were greater at Shaunavon compared to Swift Current.

CONCLUSION

Largest differences in chickpea maturity were found among years. Between 2004 (wet year) and 2006 (dry year), the difference in maturity was as many as 45 days. In wetter to normal years, use of nitrogen fertilizer at the rates of 28 to 56 kg ha^{-1} with no inoculant, advanced maturity by 4 to 9 days, and in the wet year the advancement ranged from 12 to 15 days compared to no-N no-inoculant treatment. Late-maturing varieties such as CDC Frontier received greatest benefits from the application of N fertilizer. However, in dry years, only marginal differences were found between fertility treatments. Therefore, use of nitrogen fertilizer in chickpea can be considered as a tool to reduce risks associated with indeterminate growth habit of chickpea.

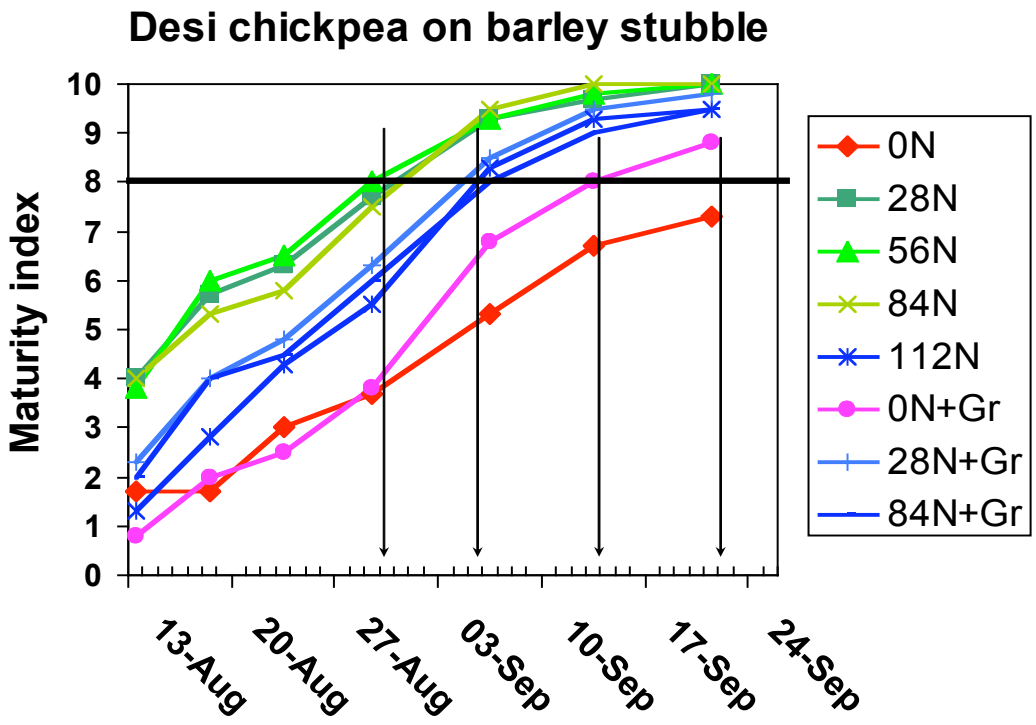

Fig. 1. Using desi chickpea grown on barley stubble at Shaunavon in 2004 as an example, crop maturity was quantified using a "Maturity Index" and the Index rating started when plants first began to turn colour. A Maturity Index of 8 meant 80% of the pods had turned colour and the plants had reached physiological maturity.

2004 Shaunavon **2005 Shaunavon**

Fig. 2. Substantial differences in chickpea maturity were observed in the wet year of 2004 and in the normal year of 2005, whereas the differences between treatments were marginal in the dry year of 2006.

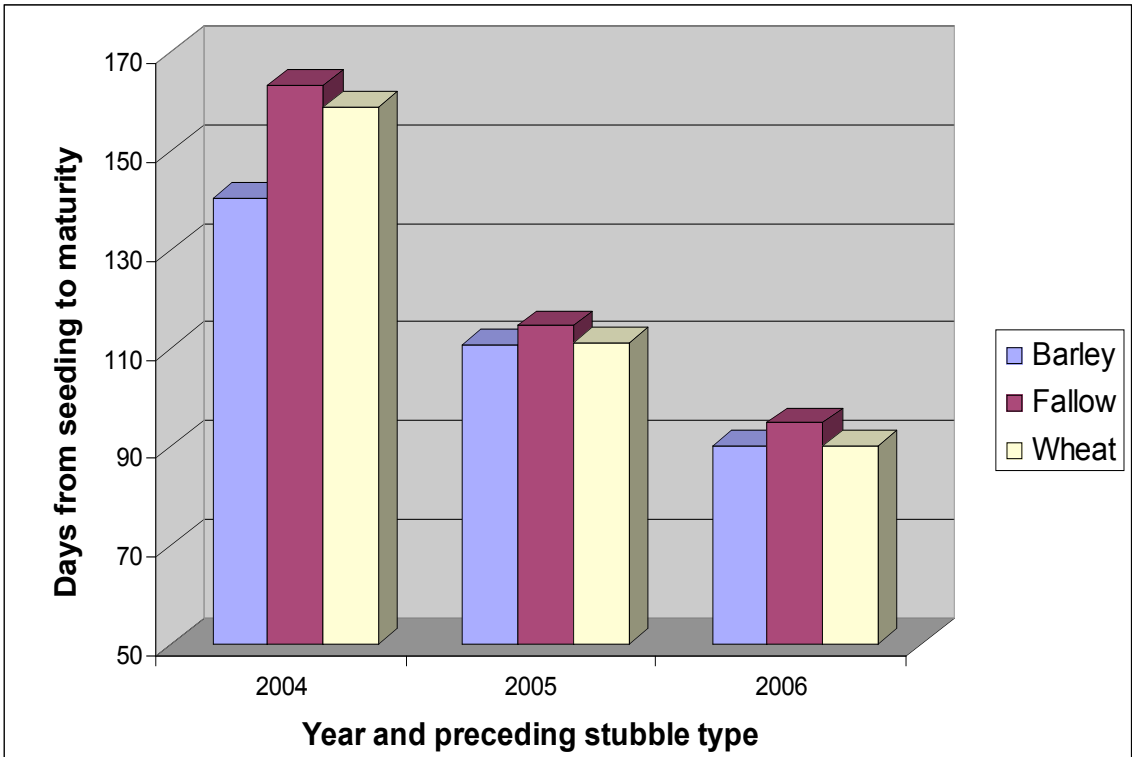

Fig. 3. Effect of preceding crop type on the maturity of chickpea grown in 2004, 2005, and 2006 (Note that the different stubble types in 2004 were in adjacent fields).

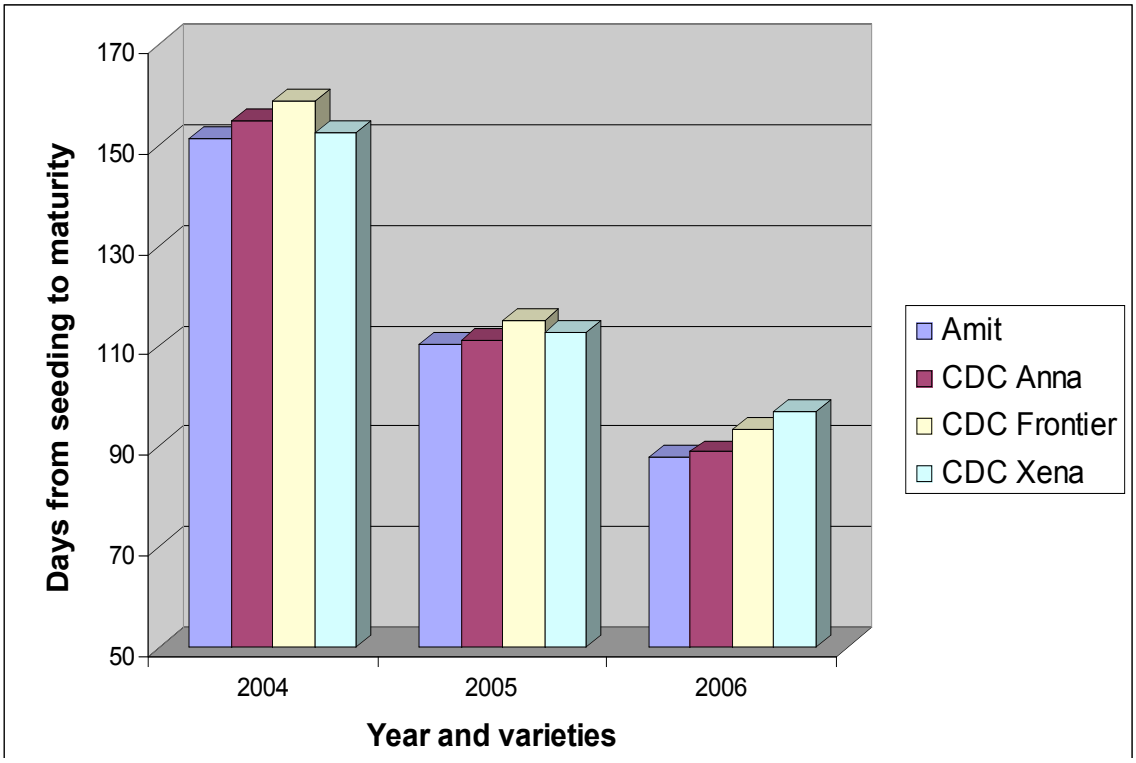

Fig. 4. Differences in maturity among the four chickpea varieties grown in 2004, 2005, and 2006, averaged from Swift Current and Shaunavon.

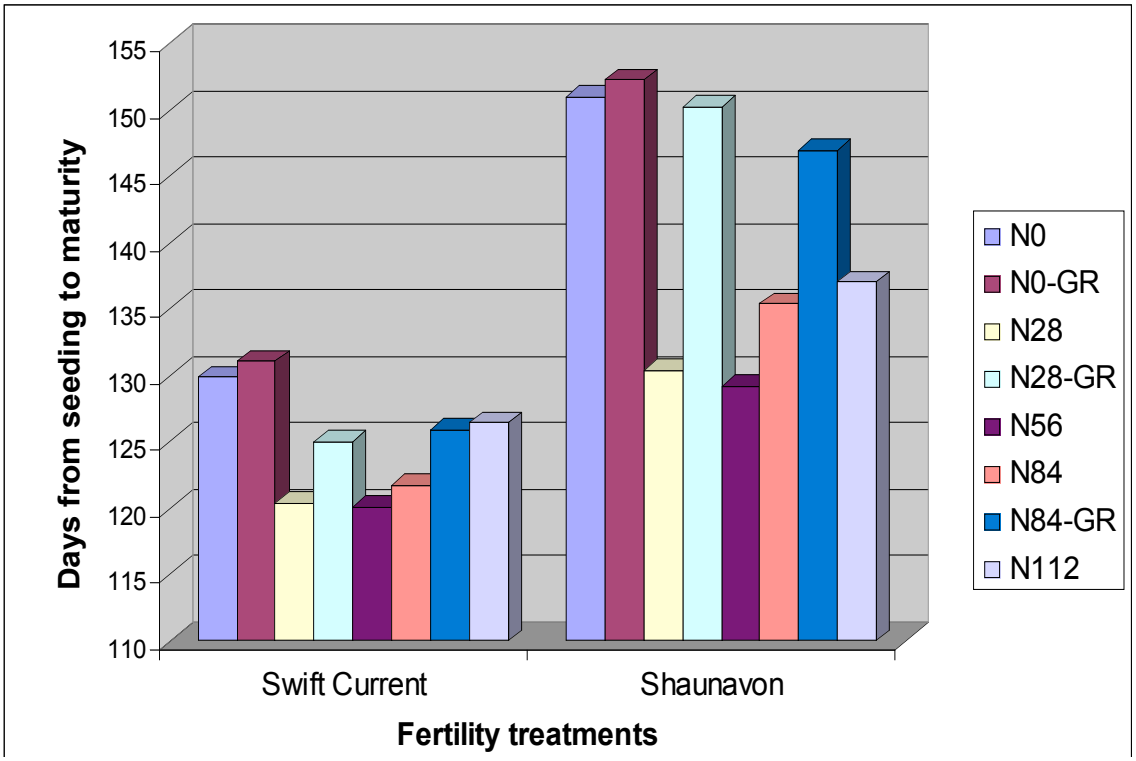

Fig. 5. Days to maturity of chickpea grown at Swift Current and Shaunavon, Saskatchewan using various fertility and inoculation management schemes (Note: N0-GR means the crop received no nitrogen fertilizer but Granular inoculant). Data were averages between the wet year of 2004 and the normal year of 2005. Data from 2006 were not included since no differences were found between the fertility treatments in 2006.