Chickpea Seed Yield in Response to Stubble Type and Fertility

Y. Gan[1], T. Warkentin[2], B. Vandenberg[2], R.P. Zentner[1], C.L. McDonald[1]

[1]Agriculture and Agri-Food Canada, Swift Current, SK, S9H 3X2
[2]Crop Development Centre, University of Saskatchewan, Saskatoon, SK, S7N 5A8

INTRODUCTION

Chickpea is a long-season crop with a strong indeterminate growth habit. When moisture conditions are favourable for plant growth, chickpea will continue its vegetative growth without setting pods or will fill only a few pods before the onset of late-fall frost. Studies have shown that the type of stubble the previous year and soil fertility affect the maturity of chickpea cultivars, but no information is available in regard to the effect on seed yield. This study determined the effect of stubble type and soil fertility treatments on seed yield of different chickpea varieties.

MATERIALS AND METHODS

Field experiments were conducted at Swift Current and Shaunavon, Saskatchewan in 2004 through 2006. Four chickpea varieties were grown on wheat and barley stubble and on conventional summerfallow under 8 inoculation/fertilization management regimes.

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

The experiment was set up as a split-plot design with stubble type being the main plot, and variety x fertility levels being subplots (2 m x 10 m in size). Plots were harvested at maturity with a plot combine and seed yield determined on a dry weight basis.

RESULTS AND DISCUSSION

Averaged over both Swift Current and Shaunavon, seed yields were highest in 2004 (2240 kg ha^{-1}), intermediate in 2005 (2070 kg ha^{-1}) and lowest in 2006 (1200 kg ha^{-1}). In the wet year of 2004, the average seed yield of chickpea was 10% higher when grown on barley stubble, and 21% higher when grown on wheat stubble, compared to summerfallow (Fig. 1). Chickpea grown on summerfallow at Shaunavon did not reach full mature due to excessive moisture in the fall, whereas chickpea grown on summerfallow at Swift Current in 2004 contained 45% green seeds due to incomplete maturity before frost (data not shown). In the normal year of 2005, crops grown on the

three stubble systems performed similarly, with no significant differences found in seed yield. In the dry year of 2006, chickpea yields averaged 67% higher when grown on summerfallow compared to barley stubble, and nearly double the yield of chickpea grown on wheat stubble.

On average, CDC Frontier produced highest seed yield and CDC Xena the lowest under the same growing conditions (Fig. 2). The ranking of varieties in seed yield were consistent across the three years; CDC Frontier >CDC Anna >Amit >CDC Xena. Overall, seed yield was higher at Shaunavon than at Swift Current in 2005, but it was lower at Shaunavon than at Swift Current in 2006, and yields were similar in 2004 at the two sites (Fig. 3). Crops at the Shaunavon site were in a more intensive drought condition in 2006.

Averaged over the six site-years, plots that were not supplied with either N fertilizer or inoculant (i.e., 0N check treatment) produced seed yield of 1500 kg ha^{-1} or less, whereas the seed yield of chickpea that was inoculated with *Rhizobium* was 27% higher than the check. The seed yield of chickpea supplied with N fertilizer at the rates of 28 and 56 kg N ha^{-1} but no *Rhizobium* was 18% greater than the no-N no-inoculation check at both sites (Fig. 3). Plots that received *Rhizobium* inoculant plus N fertilizer at the rates of 28 kg N ha^{-1} produced yields similar to those that were inoculated with *Rhizobium* without fertilizer.

The proportion of green seed in the harvested seed lots was influenced by soil fertility management (Fig. 4). In the wet year of 2004, the plots received N fertilizers at the rates of 28 and 56 kg N ha^{-1} produced greater proportion of high quality, marketable seeds due to earlier maturity, whereas the plots that were inoculated with *Rhizobium* produced a larger portion of green seed due to delayed maturity. Percent of green seed was lower than 2% in 2005 and near zero in 2006 regardless of fertility treatment.

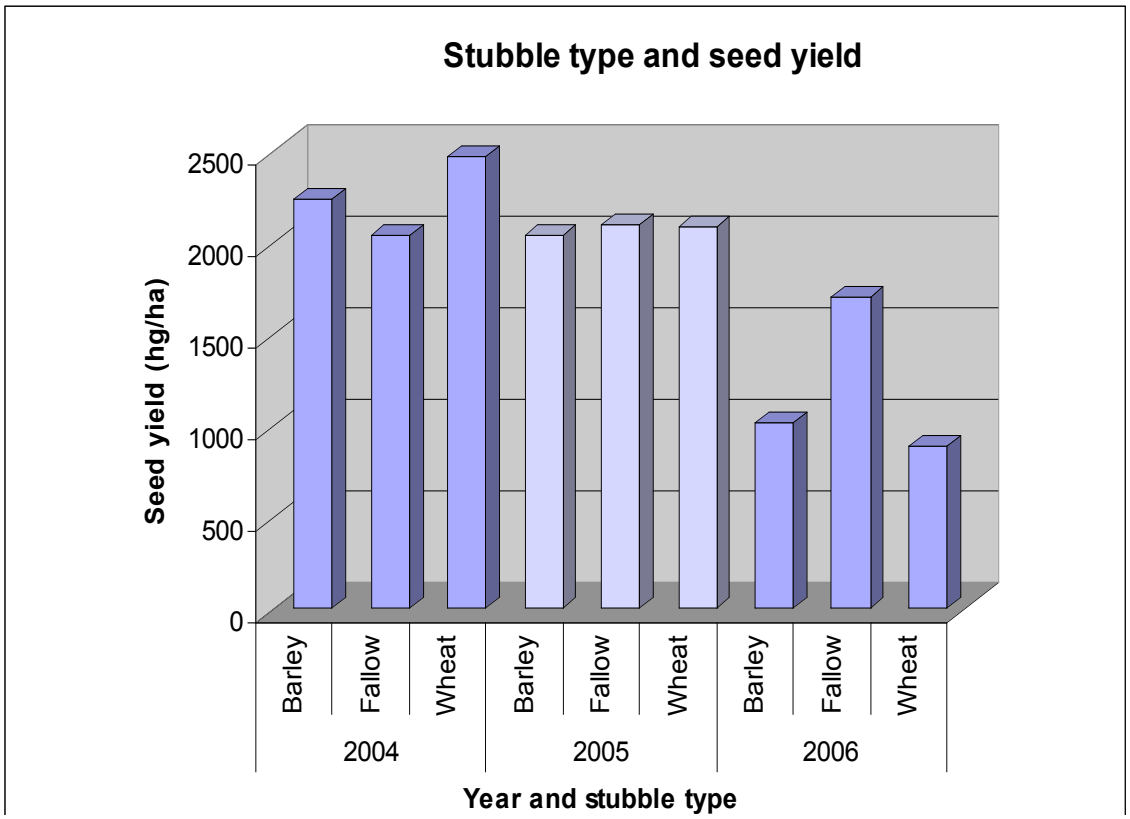

Fig. 1. Seed yield of chickpea grown on barley and wheat stubble and on conventional summer fallow in 2004, 2005, and 2006, in southwest Saskatchewan.

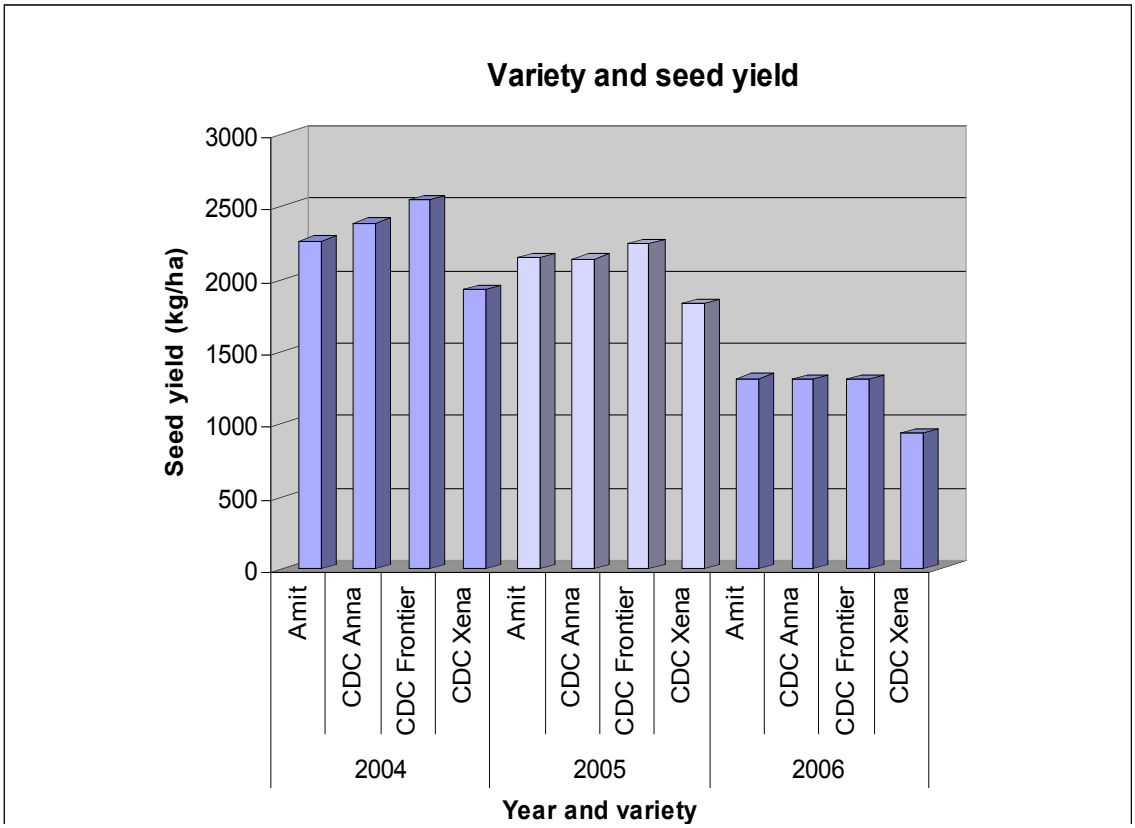

Fig. 2. Seed yields of four chickpea varieties tested in 2004, 2005, and 2006, in southwest Saskatchewan.

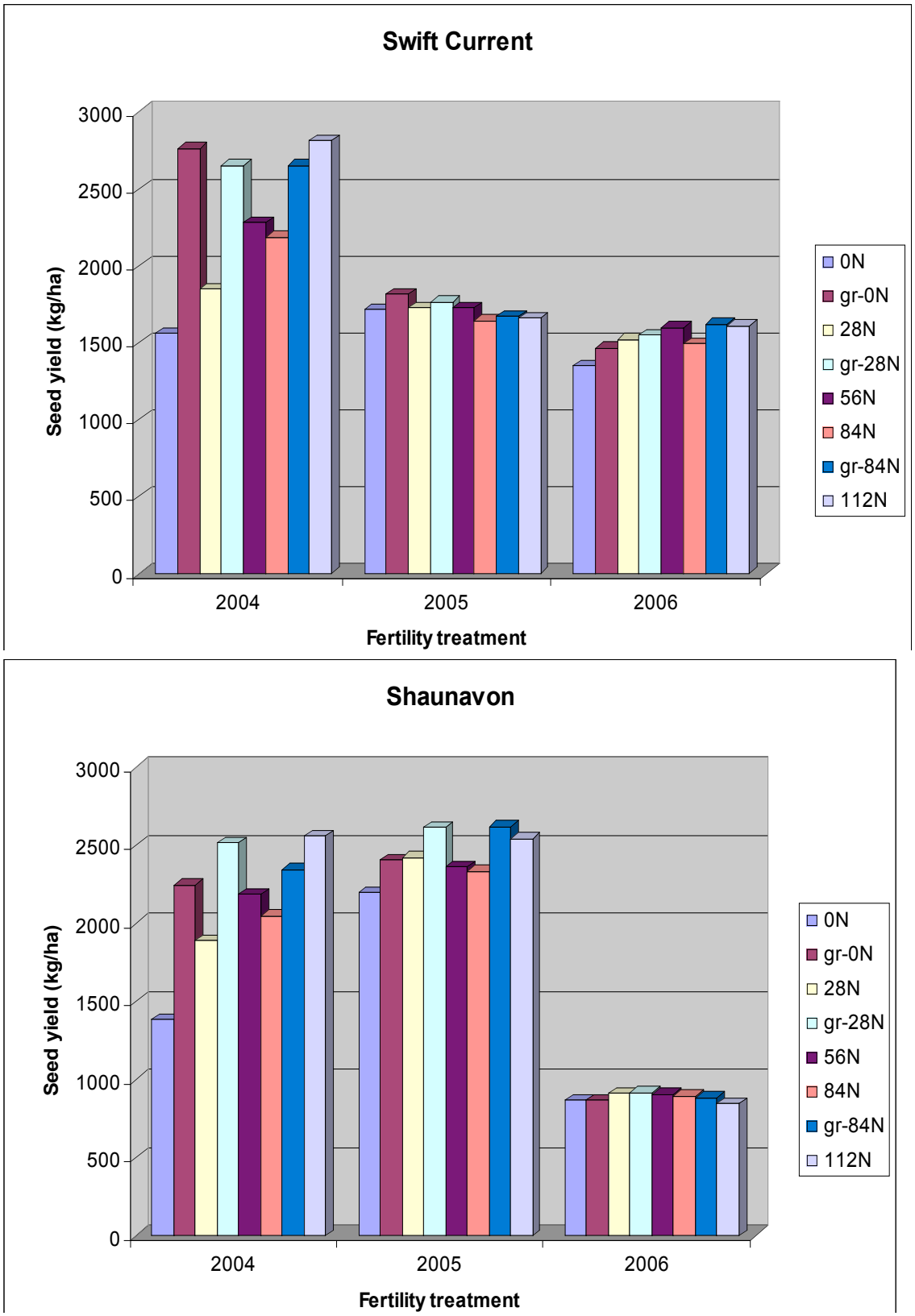

Fig. 3. Seed yield of chickpea grown under various inoculations/fertilization regimes at Swift Current (top) and Shaunavon (bottom) in 2004, 2005, and 2006.

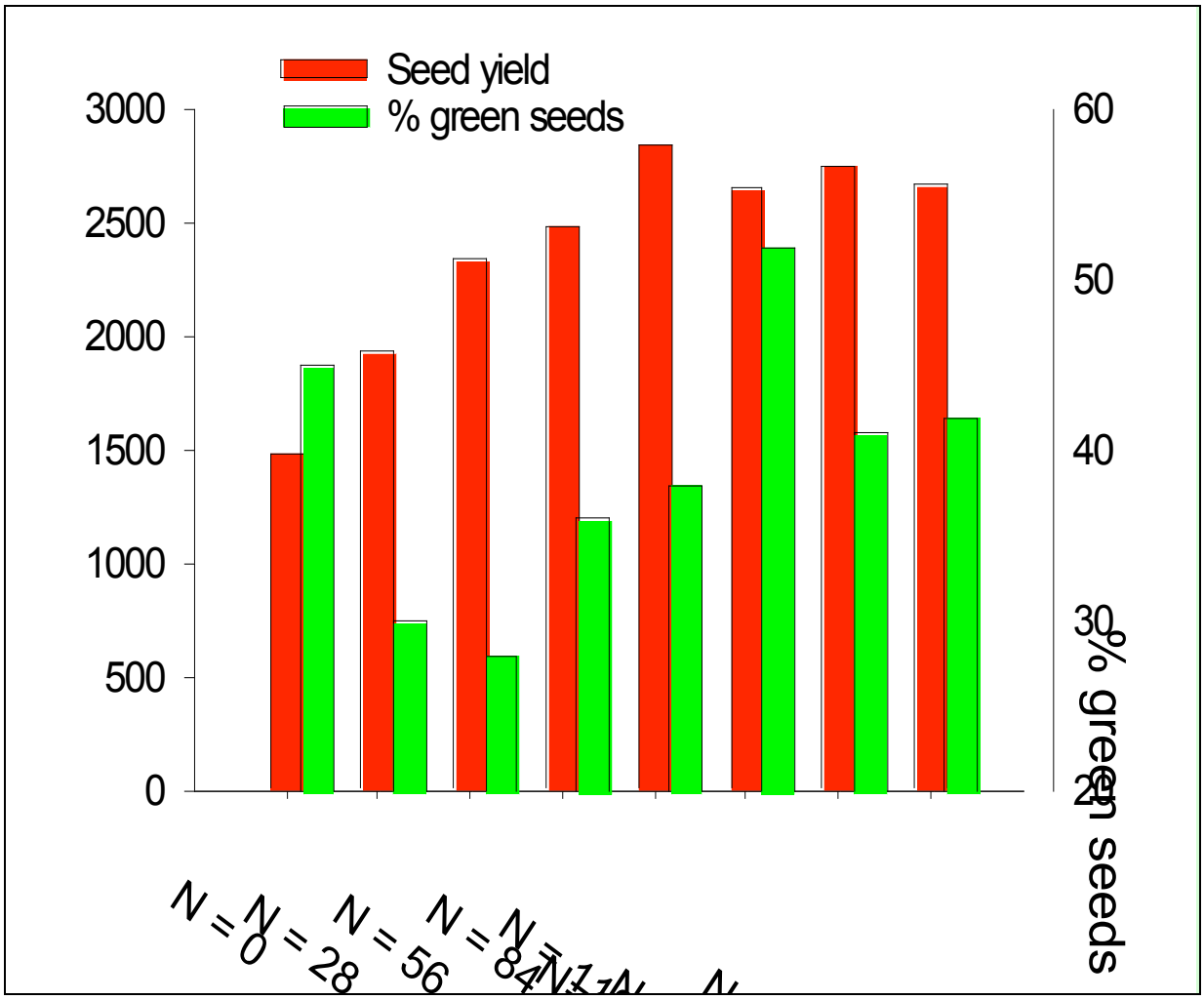

Fig. 4. Seed yield and percent of green seed in harvested seed lot for chickpea grown in the wet year of 2004.