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DIGGING INTO RESEARCH

Tall stubble improves pulse yield and water use efficiency

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Averaged across 4 years, tall stubble increased yields by about 13% and short stubble increased yields by about 4% compared to yields from cultivated stubble treatments.

On the semi-arid Prairies, moisture is often the limiting factor in pulse crop production. While this research is 20 years old, the concepts are as relevant now as they were in the early 2000s.

The objective of this research was to determine the effects of different heights of standing stubble on in-crop microclimate, and growth and yield of desi chickpea, field pea and lentil.

The research was conducted at Agriculture and Agri-Food Canada Swift Current over 4 years from 1996 to 2000. Wheat stubble was left standing over the winter, and three treatments were set up in the spring of each year. This meant that any differences in pulse growth and yield was due to differences in spring micro-climate within the standing stubble.

The three treatments were cultivated, short and tall stubble. The cultivated plots had about one-third of crop residue left on the soil surface with the remaining residue buried – roughly equivalent to two passes of a cultivator with mounted harrows.

The short stubble treatment was cut to a height of 6 to 7 inches (15 to 18 cm) tall. The tall stubble height varied and ranged from 10 to 14 inches (25 to 36 cm tall).

Desi chickpea (Cheston), field pea (Grande) and lentil (Laird) were seeded into the plots in late April to early May. Stubble treatment did not affect stand density for any pulse in any year, so any differences in the treatments were due to differences in microclimate. The pulses were grown with standard agronomic practices.

Generally, the average growing season temperature was close to the long-term average. Rainfall during this period was similar to the long-term average except in 2000 with 150% of normal rainfall.

Soil temperature was measured at 5 and 30 cm soil depths. Above the soil surface, air temperature and wind speed were measured at 50 and 100 cm heights.

A better micro-climate in standing stubble

Before pulse crop flowering, the rate of water loss decreased linearly as stubble height increased. After flowering, there were no differences. Tall stubble reduced evaporation rate by 20 to 25%, and short stubble reduced evaporation rate by 10%, compared to the cultivated treatment.

Before flowering, tall stubble reduced wind speed by 70% at the 6 inch height, and by 8% at 40 inches above ground, and short stubble reduced wind speed by 25% at the 6 inch height, compared to the cultivated treatment.

Soil temperatures decreased as stubble height increased.

Higher yields with tall stubble

Statistical analysis found that the pulse species respond similarly to treatment, so their yield, evapotranspiration and water use efficiency were pooled together across years. There was no statistical difference for evapotranspiration between cultivated and stubble height treatments.

Average grain yield was statistically lowest for cultivated plots at 1586 lbs/ac (1782 kg/ha), and tall stubble statistically highest yielding at 1787 lbs/ac (2008 kg/ha), with short stubble yielding intermediate at 1654 lbs/ac (1858 kg/ha).The research showed that tall stubble increased yields by

about 13% and short stubble increased yields by about 4% compared to yields from cultivated stubble treatments.

Water use efficiency was also statistically highest with tall stubble at 7.74 lbs/ac of pulse yield per mm of moisture (8.70 kg/ha/mm), and cultivated stubble at 6.67 lb/ac/mm (7.49 kg/ha/mm), with short stubble intermediate at 7.17 lbs/ac/mm (8.06 kg/ha/mm). Tall stubble increase water use efficiency by 16%, and short stubble by 8% compared to cultivated stubble.

Overall, the research found that tall stubble had the highest pulse grain yield and water use efficiency. This was mainly due to improved microclimate effects near the soil surface with reduced soil temperatures, solar radiation, and wind speed, especially with the tall stubble. The researchers noted that crop water use was not affected by stubble height so the increased grain production was due to increased water use efficiency.

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H. W. Cutforth, B. G. McConkey, D. Ulrich, P. R. Miller, and S. V. Angadi. 2011. Yield and water use efficiency of pulses seeded directly into standing stubble in the semiarid Canadian Prairie. *Canadian Journal of Plant Science*. **82**(4): 681-686.

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