

Previous Management Practices Change the Responsiveness of Oats to Nitrogen Fertilizer

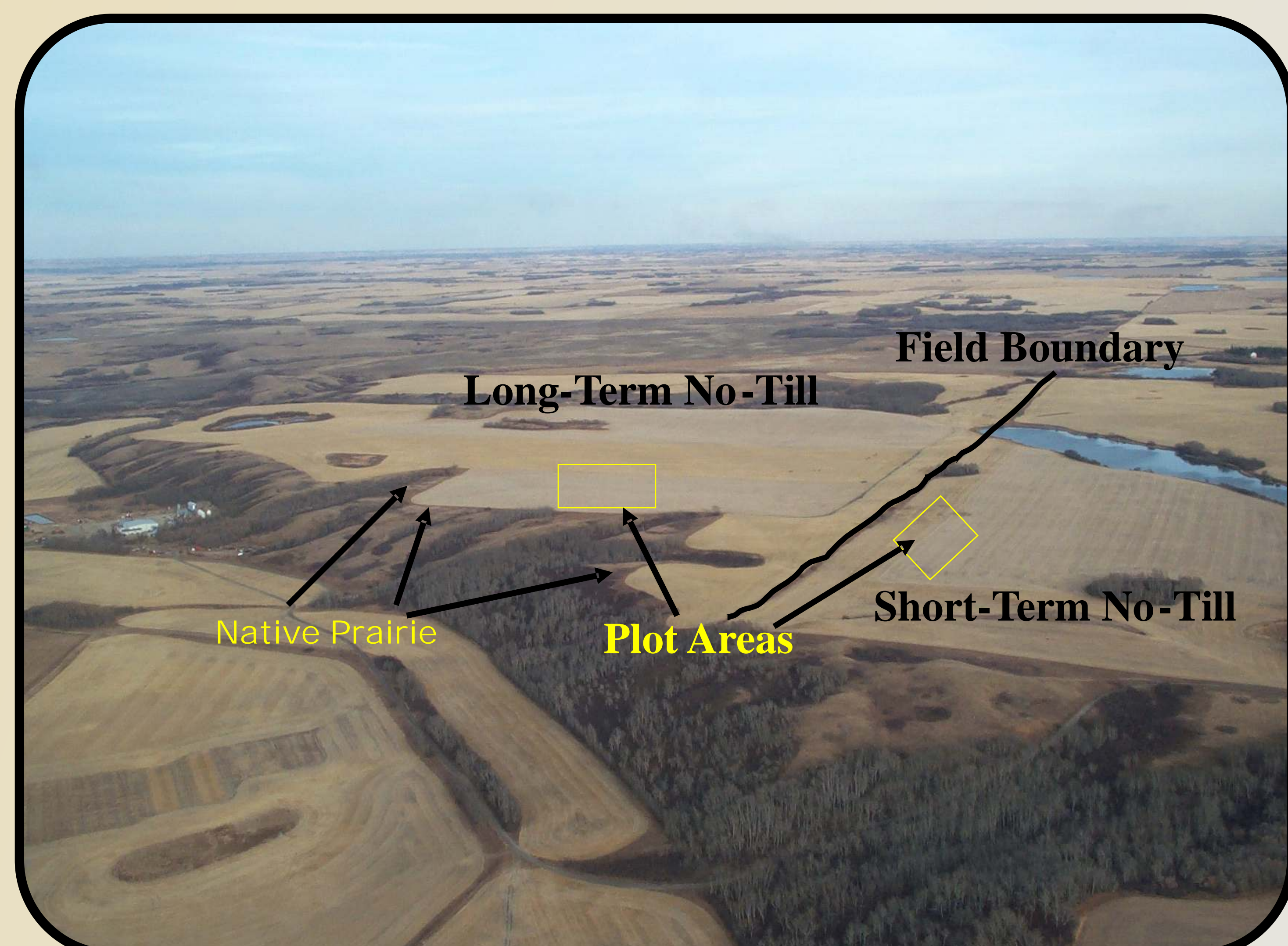
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Introduction

On the Northern Great Plains of North America, the use of nitrogen (N) fertilizer in oat increases grain yield but lowers test weight (Jackson et al. 1994, May et al. 2004; Mohr et al. 2007). The research showed that the largest grain yield increase occurred mainly between 0 and 40 kg ha⁻¹ with applications greater than 40 kg ha⁻¹ providing smaller yield increases. The amount of N fertilizer needed to maximize yield has varied between sites and years. Some of this variation may be due to previous cropping history. Very little information exists to show how previous cropping history can affect the general N recommendations for oat. Short term studies have shown that legume cover crops and green manuring reduce the N requirement of oats (Peltonen-Sainio, P. 1996; Thiessen Martens et al. 2005). The effects of long-term previous cropping history on the response of oat to N have not been extensively studied. The switch to a no-till cropping system on the Northern Great Plains represents a radical change in management practices that has provided the opportunity to explore the effects of such a change on oat production. This study was initiated to compare the long-term and short-term effects of no-till on the N fertilizer requirements of oats.

Materials and Methods

- ❖ Two adjacent fields
 - 1) Long-term no-till field, converted to a no-till continuous cropping system from a wheat-fallow cropping system in 1978 (30 years of no-till)
 - 2) Short-term no-till field, converted to a no-till continuous cropping system from a wheat-fallow cropping system in 2001 (7 years of no-till)
- ❖ Since 2001 both fields have been managed using the same no-till production system
- ❖ Crop Rotation
 - Oat-canaryseed-flax rotation with all crops grown in each year
 - Oat is seeded into flax stubble
- ❖ Nitrogen, 11 rates, 0,10,20,30,40,50,60,70,80,90 and 100 kg ha⁻¹
The N treatments are applied to the same plots every year
- ❖ Duration
2003 to 2007
- ❖ Statistical analysis
Proc Mixed (Littell et al., 1996).



Results and Discussion

Grain Yield

- ❖ Long-term no-till had a higher grain yield than short-term no-till when between 0 and 70 kg ha⁻¹ of N fertilizer was applied (Fig. 1).
- ❖ Above the 70 kg N ha⁻¹ rate there was no difference between the two cropping systems.
- ❖ The short-term no-till treatment required approximately 20 kg N ha⁻¹ more N than the long-term no-till treatment to achieve a similar grain yield.

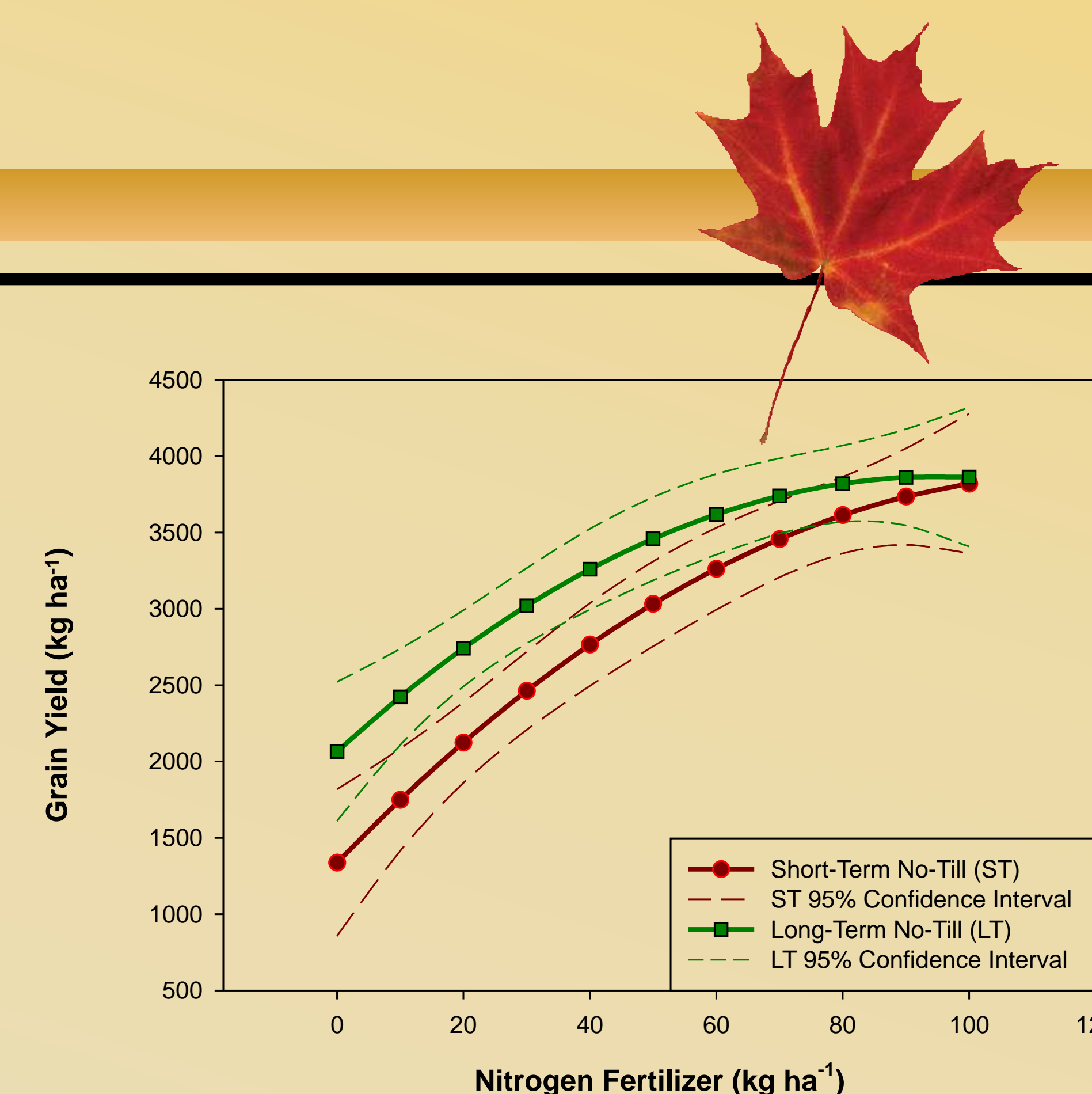


Fig. 1 The effect of previous crop management on the grain yield of oats.

Test weight

- ❖ The test weight did not differ between the short-term and long-term no-till treatments at any N rate (Fig. 2).
- ❖ Contrasts indicate that the test weight of long-term no-till treatment decrease linearly as N fertilizer rate increased. The decrease in the short-term no-till treatment was not significant.

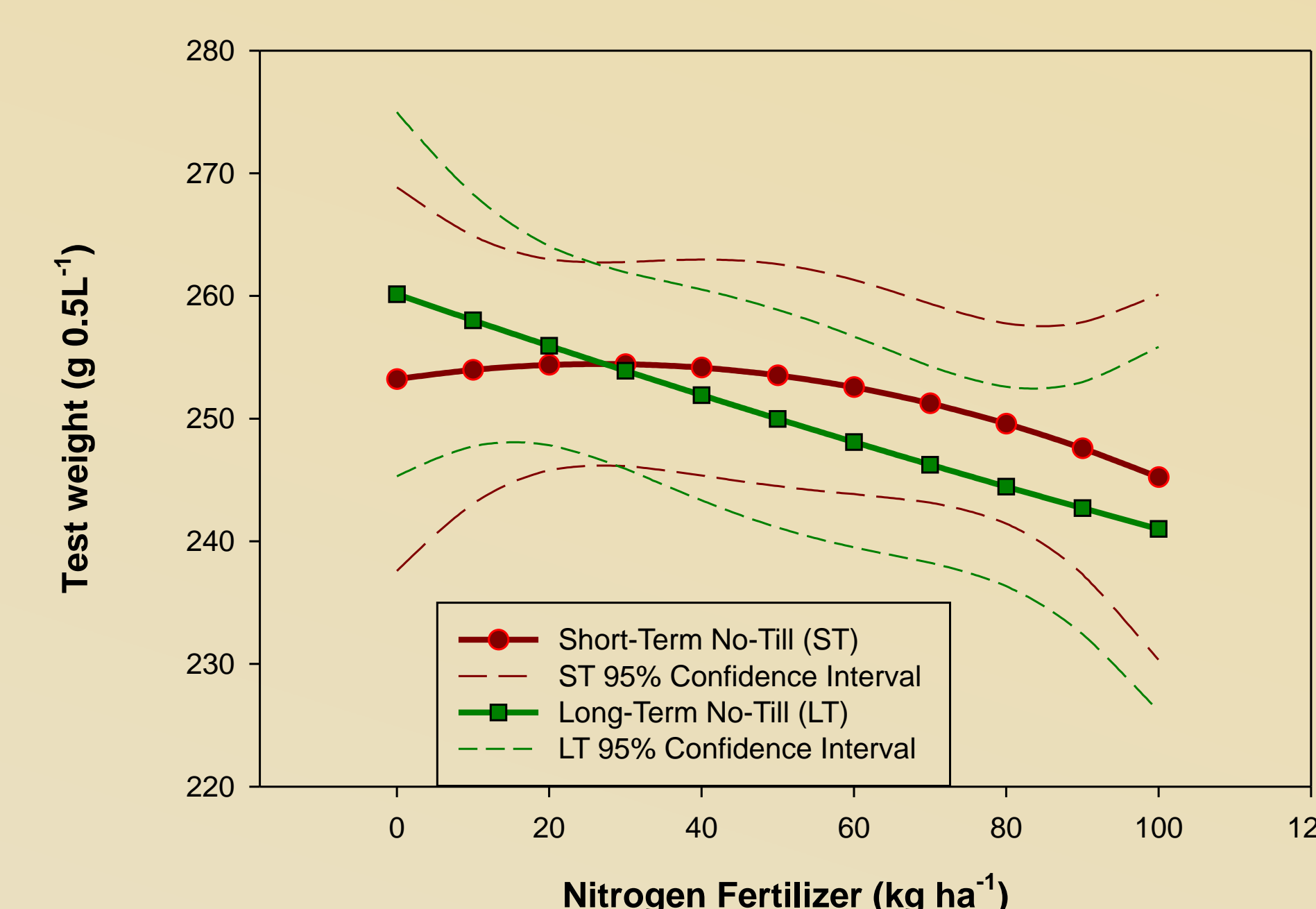


Fig. 2. The effect of previous crop management on the test weight of oats.

Plump Seed

- ❖ Plump seed did not differ between the short-term and long-term no-till treatments regardless of N (Fig. 3).
- ❖ Contrasts indicate that the percentage of plump seed of long-term no-till treatment decreased linearly as N fertilizer rate increased. The decrease in the short-term no-till treatment was not significant.

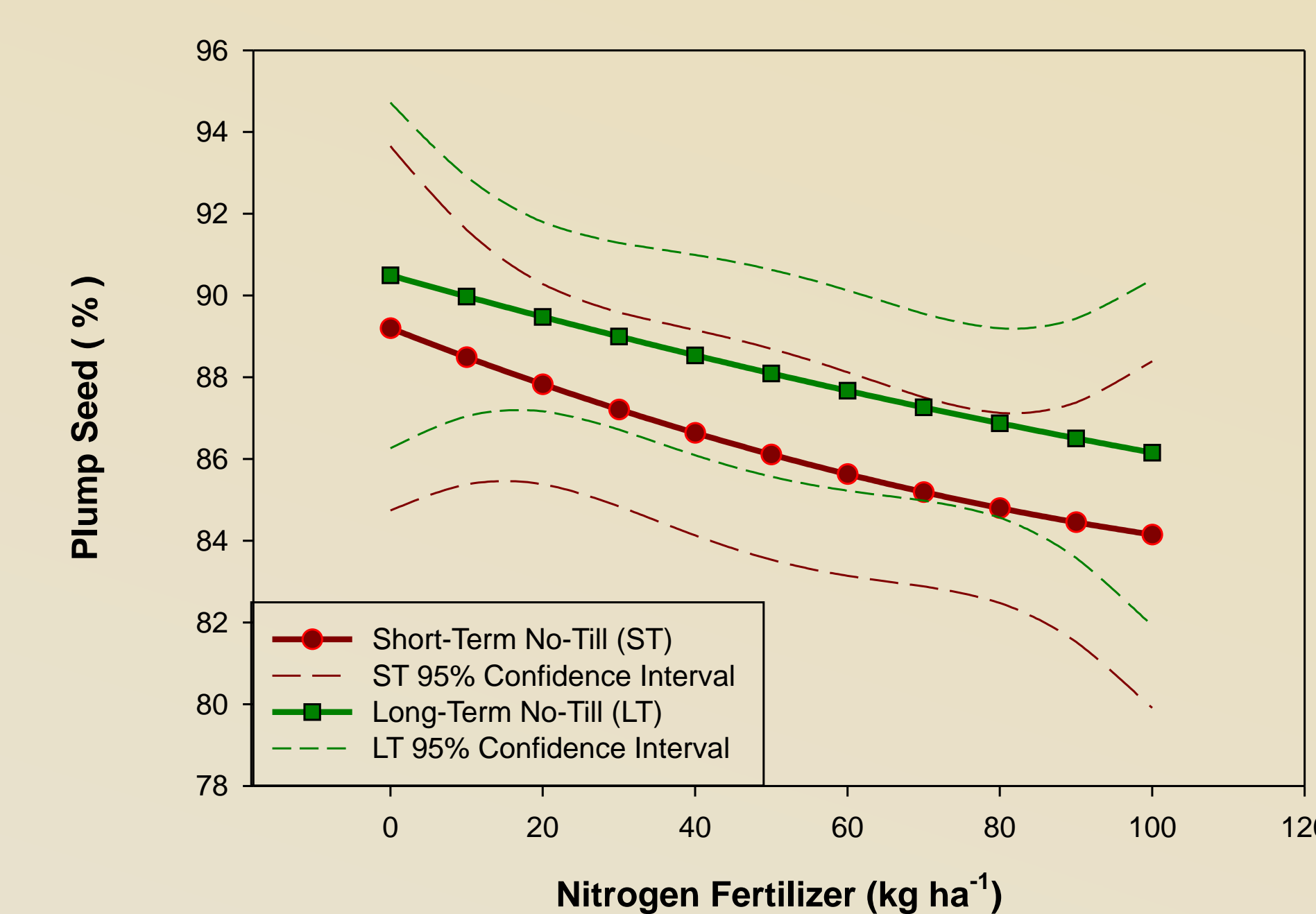


Fig. 3. The effect of previous crop management on the percentage of plump seed in the harvested oat grain.

Groat yield and Thin Seed

- ❖ Both groat yield and thin seed did not differ between the short-term and long-term no-till treatments at any N rate (data not shown).

Conclusions

- ❖ Long-term no-till reduces the amount of N fertilizer required to optimize oat production relative to short-term no-till.
- ❖ Grain quality did not differ between long-term and short-term no-till.
- ❖ Grain yield was more sensitive than grain quality to previous management and cropping history.

References

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