

Nitrogen Impact on Yield and Quality of Export Timothy Hay

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BACKGROUND

- The potential rewards of producing timothy hay are found through quality (Figure 1)
- values of hay to the producer may range from \$60 to \$200/t based on grade
- grade is based about 63% by the amount of brown leaf caused by natural senescence and/or disease and 19% by green colour
- retention of this quality over an extended harvest period is important as quality naturally deteriorates with time
- the following nitrogen (N) fertility study is part of a larger effort to identify practices to produce consistently high quality over a long harvest window.

Figure 1. Unloading mid-size bales of export timothy.



MATERIALS AND METHOD

- Several N management principles were applied to established timothy fields in Swan River, Russell and Teulon from 1999-2001.
- N rate studies: rates ranging from 0 to 200 lb N/ac
- N timing: early spring vs. delayed 2 or 4 weeks
- N splits: half applied early spring with remainder at either 2, 4, 6 or 8 weeks later
- N was applied as ammonium nitrate (34-0-0)

YIELD AND QUALITY MEASUREMENTS

- Yield was determined with a Swift Current mechanical harvester
- visual assessments were made to determine grade and % brown leaf (Figure 2)
- a computer image analysis system was used to determine grade or Hayscan (Figure 3). This system has been developed by the Canadian Grain Commission and Canadian Hay Association

Figure 2. Brown leaf in timothy (on left).



Figure 3. Determination of grade using Truegrade Hayscan (the higher the number, the better the grade).



ANALYSIS

- All plots were a RCB design, replicated 4 times, and data was analysed using ANOVA.
- The same quality analysis was not necessarily collected each year. Grade was assessed in 2001 only.
- Quality was assessed at 2-3 sampling dates and was analysed in a 2 factor ANOVA

NITROGEN RATE

- At 7 of 9 sites the maximum yield was achieved at 80-90 lb N/ac (Table 1), similar to Manitoba guidelines for forage grasses.
- Increasing N rates increased % brown leaf (%BL) significantly in 4/5 trials (Figure 4) and reduced Hayscan values.
- at one site grades were reduced with increasing N rate (Figure 5).

Table 1. Influence of N rate on timothy yield (t/ac).

N rate lb/ac	T99	SR99	R99	T00	SR00	R00	T01	SR01	R01
0	1.33	2.49	2.12	1.82	0.84	1.53	1.75	0.41	1.52
30		3.65	2.37		1.32		2.01	0.39	1.74
40	1.87			2.60		1.65			
60	1.93	2.72	2.93	2.14	1.88	1.78	2.57	0.90	1.88
80	2.50			2.76	2.23	1.94			
90		2.9	2.23				2.63	1.23	2.06
100				1.93	1.83	1.76			
120	2.26	2.11	2.22	2.32					
150	2.13	2.53	1.95	2.14					
200	2.13								
LSD 5%	0.31	Sign at 10%	ns	0.47	0.41	ns	0.34	0.52	0.29

T= Teulon, SR = Swan River, R = Russell, 99 = 1999, 00 = 2000, 01 = 2001. Maximum yield is marked in red. SR01 yields were very low due to drought.

Figure 4. Effect of N rate on Brown leaf.

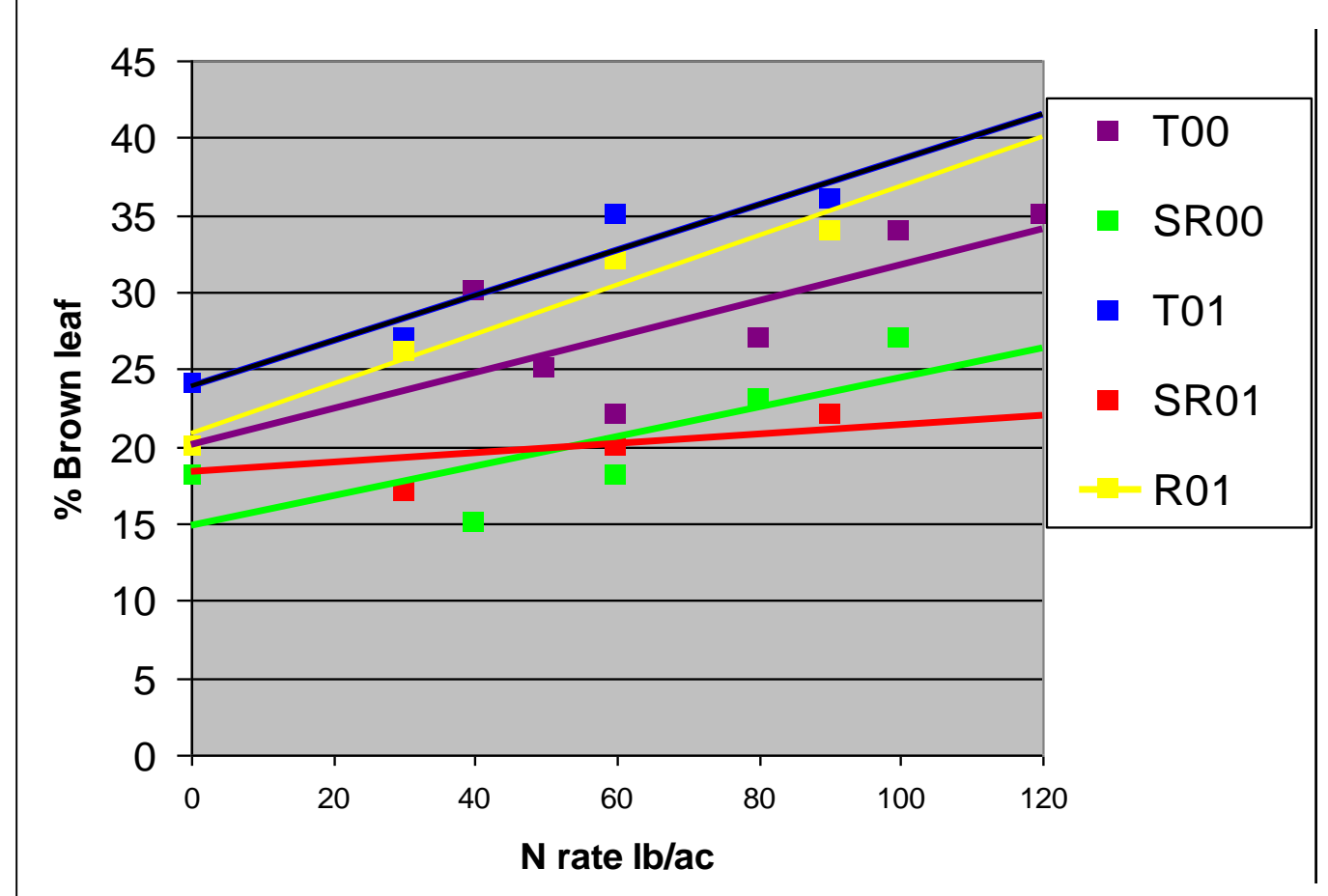
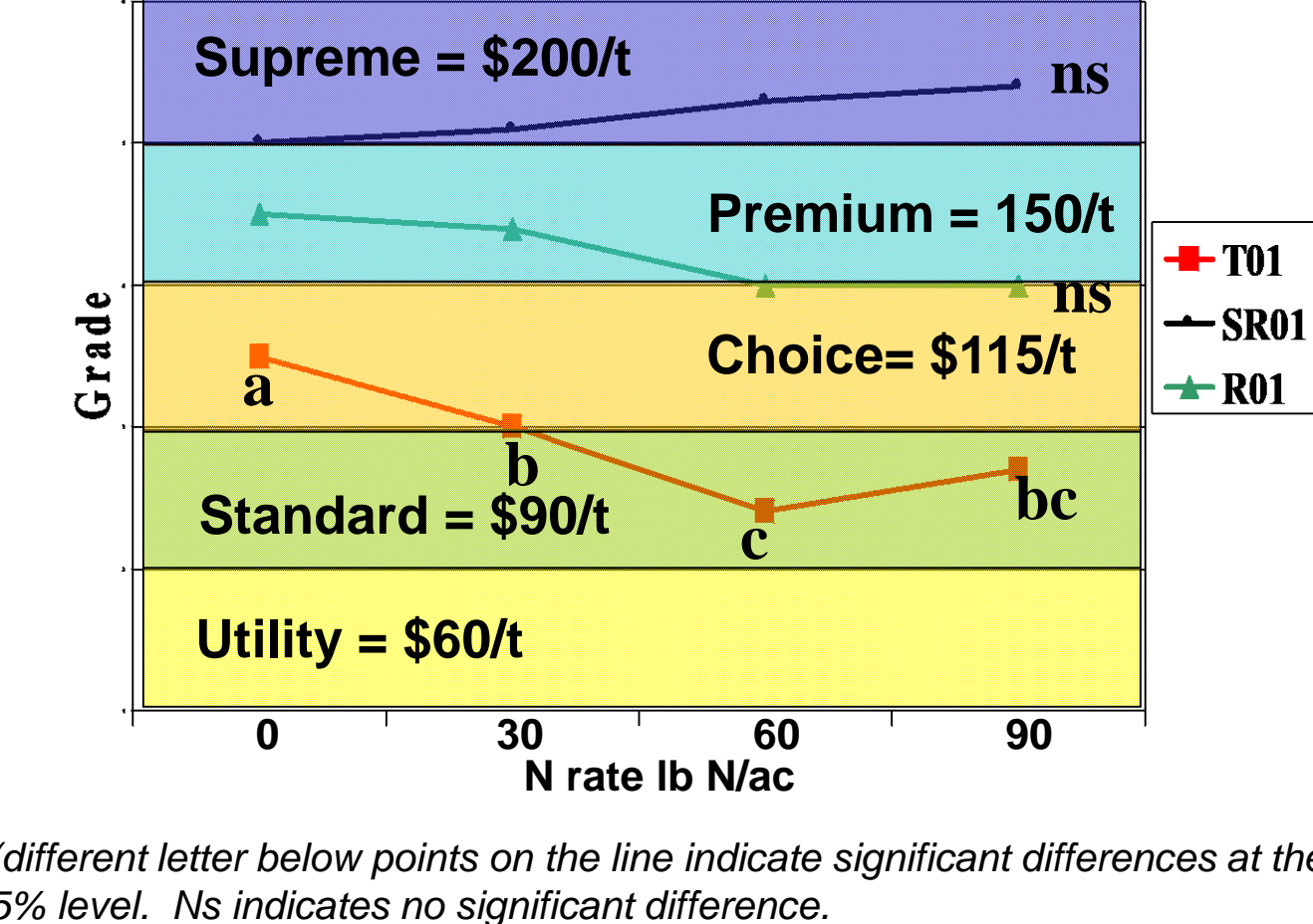


Figure 5. Effect of N rate on Grade.



N TIMING

- Yield was depressed at 1 of 6 sites by delaying N application 2 and 4 weeks (Figure 6).
- delayed N increased BL at 2 SR sites and decreased BL at T01 (Figure 7).
- Hayscan and grade improved at T01 with delayed N (Figure 8).

Figure 6. Effect of delaying N on yield.

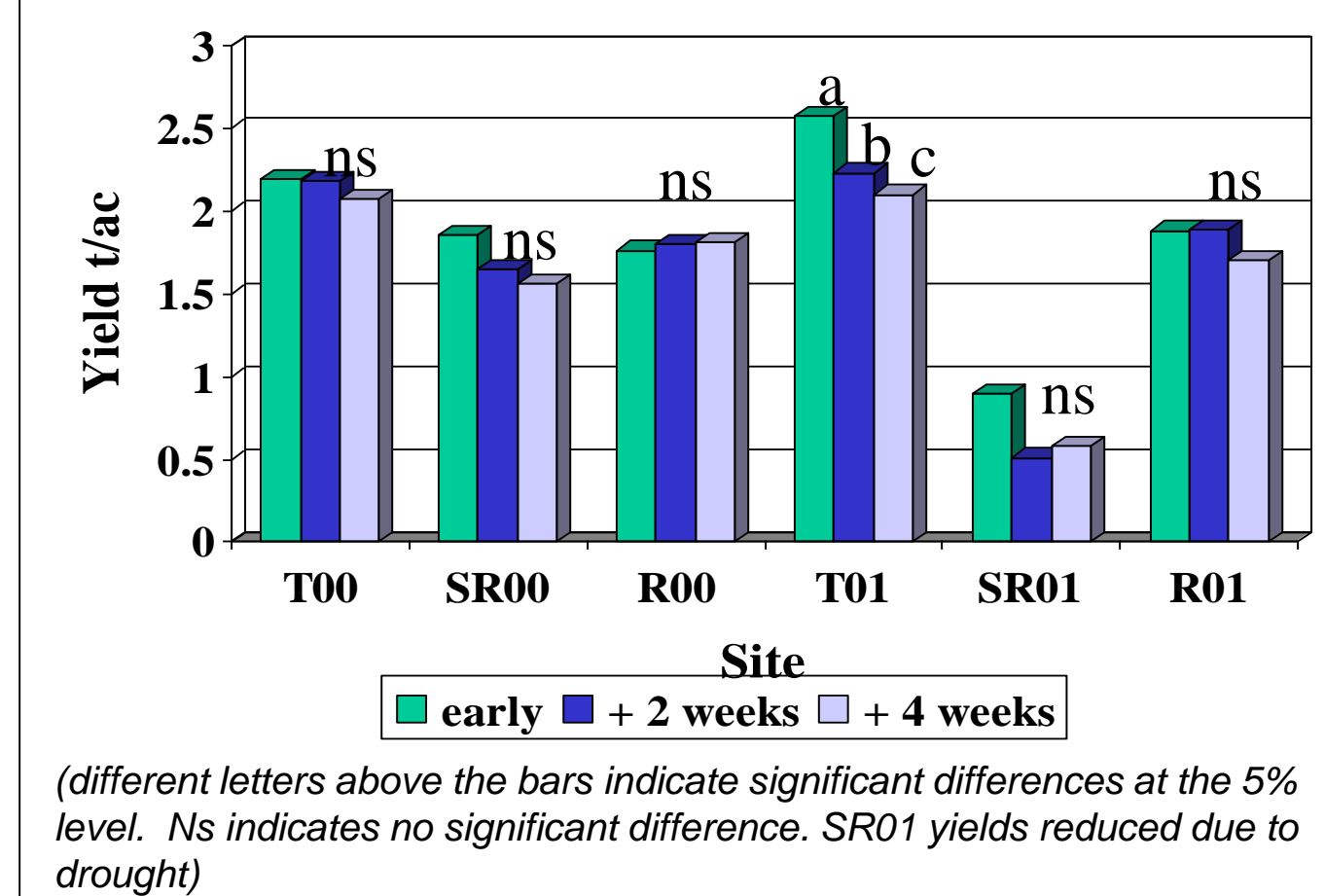


Figure 7. N timing on % Brown leaf.

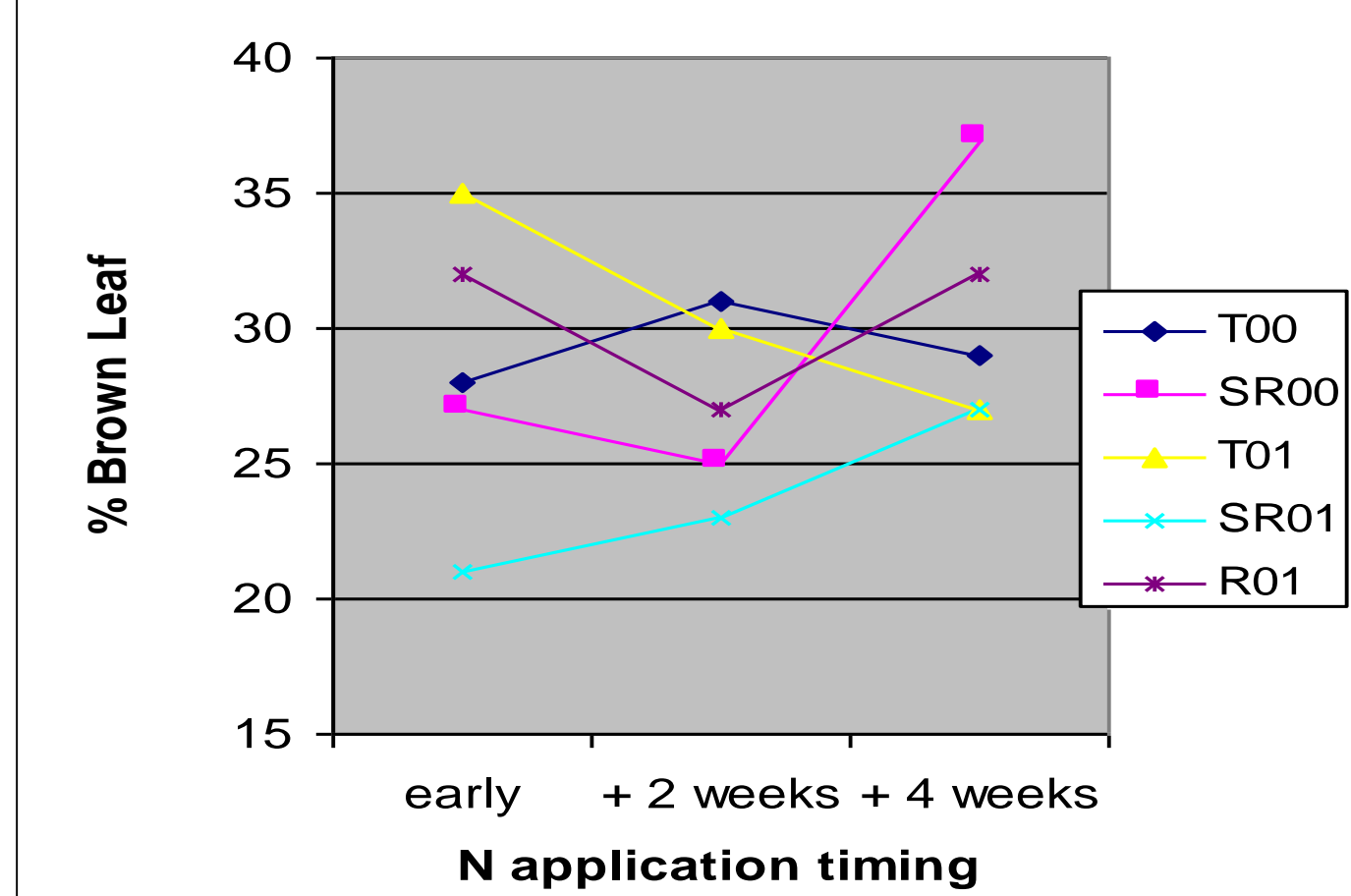
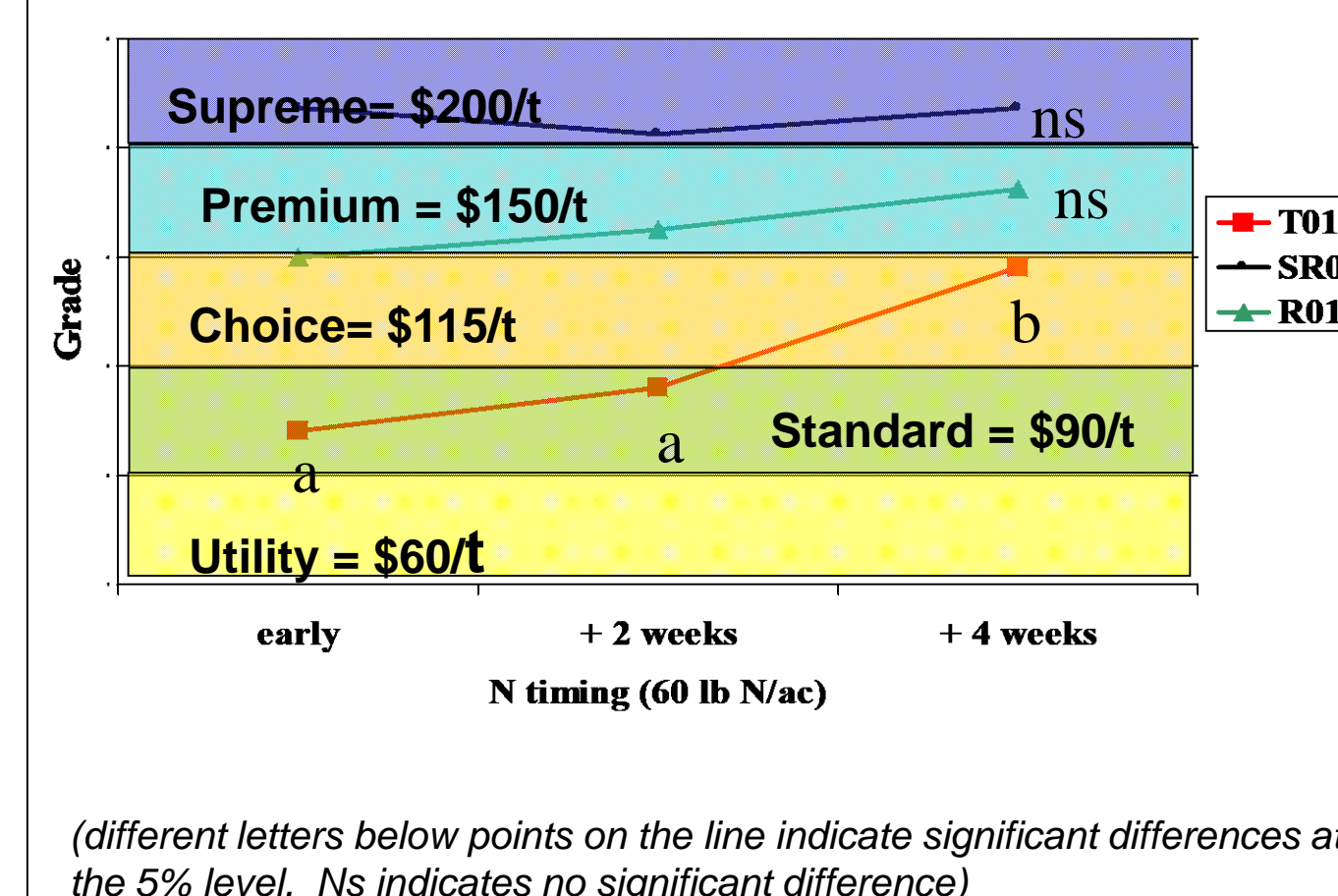


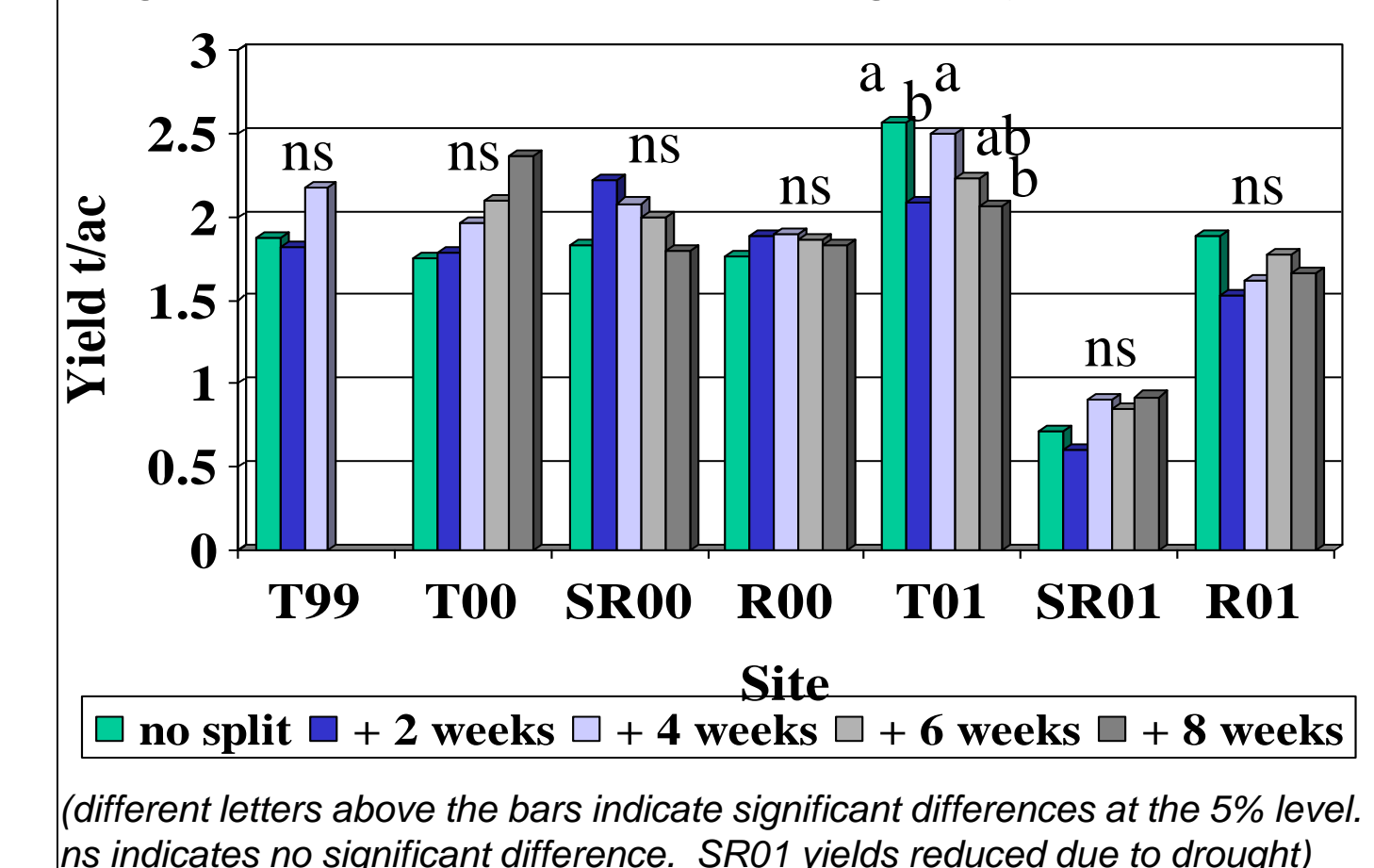
Figure 8. Effect of N timing on Grade.



SPLITTING N APPLICATIONS

- Splitting N had minimal affect on yield at most sites (Figure 9)
- At T01, splits at 2, 6 and 8 weeks had lower yields than all N early

Figure 9. Effect of N splitting on yield.



N SPLITTING INFLUENCE OVER EXTENDED HARVEST PERIOD

- N splitting impacted quality at some sites, particularly with the latest harvest date (Figure 10 & 11).
- Later application of N splits tended to retain higher quality at the latest harvest date.

Figure 10. Impact of N splitting on Grade over time at Teulon in 2001.

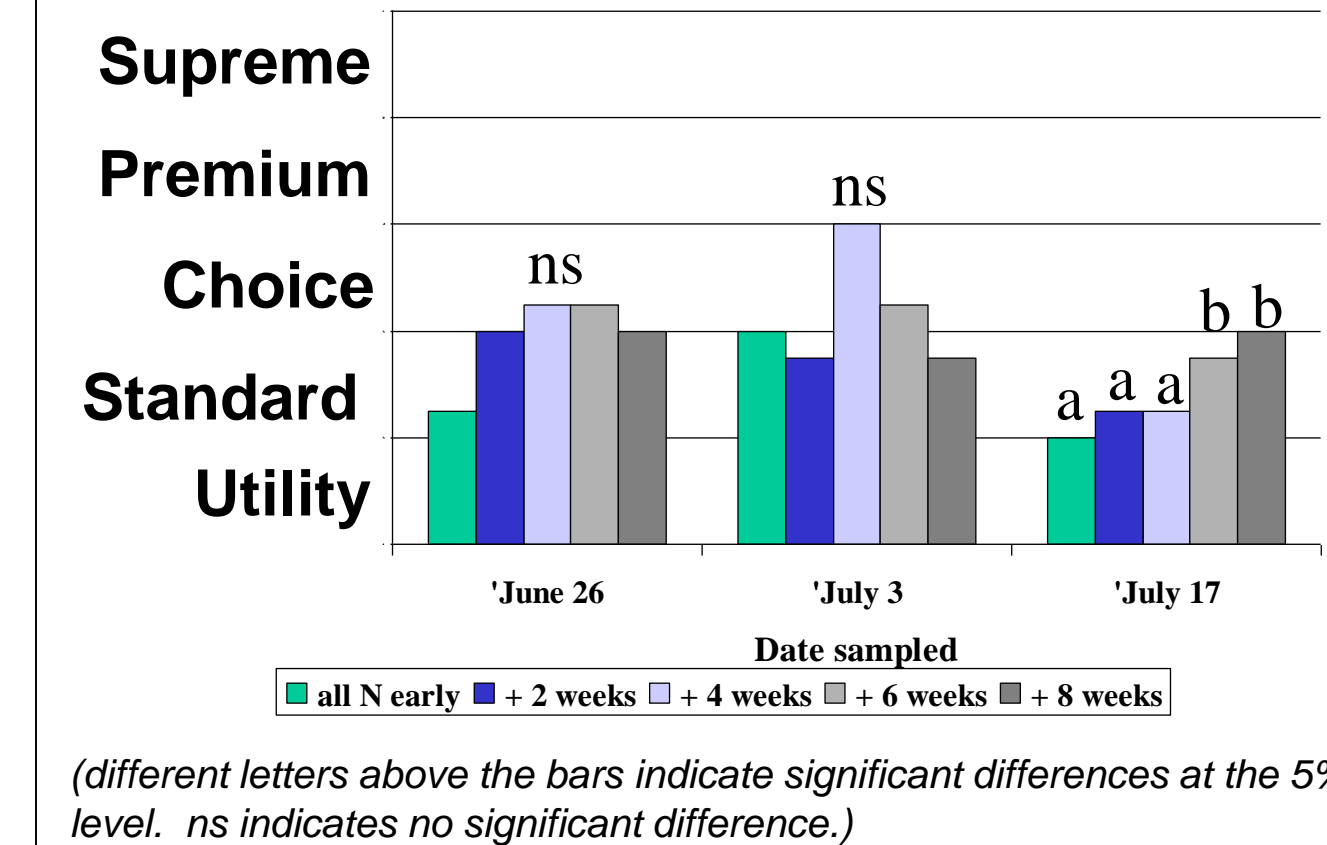
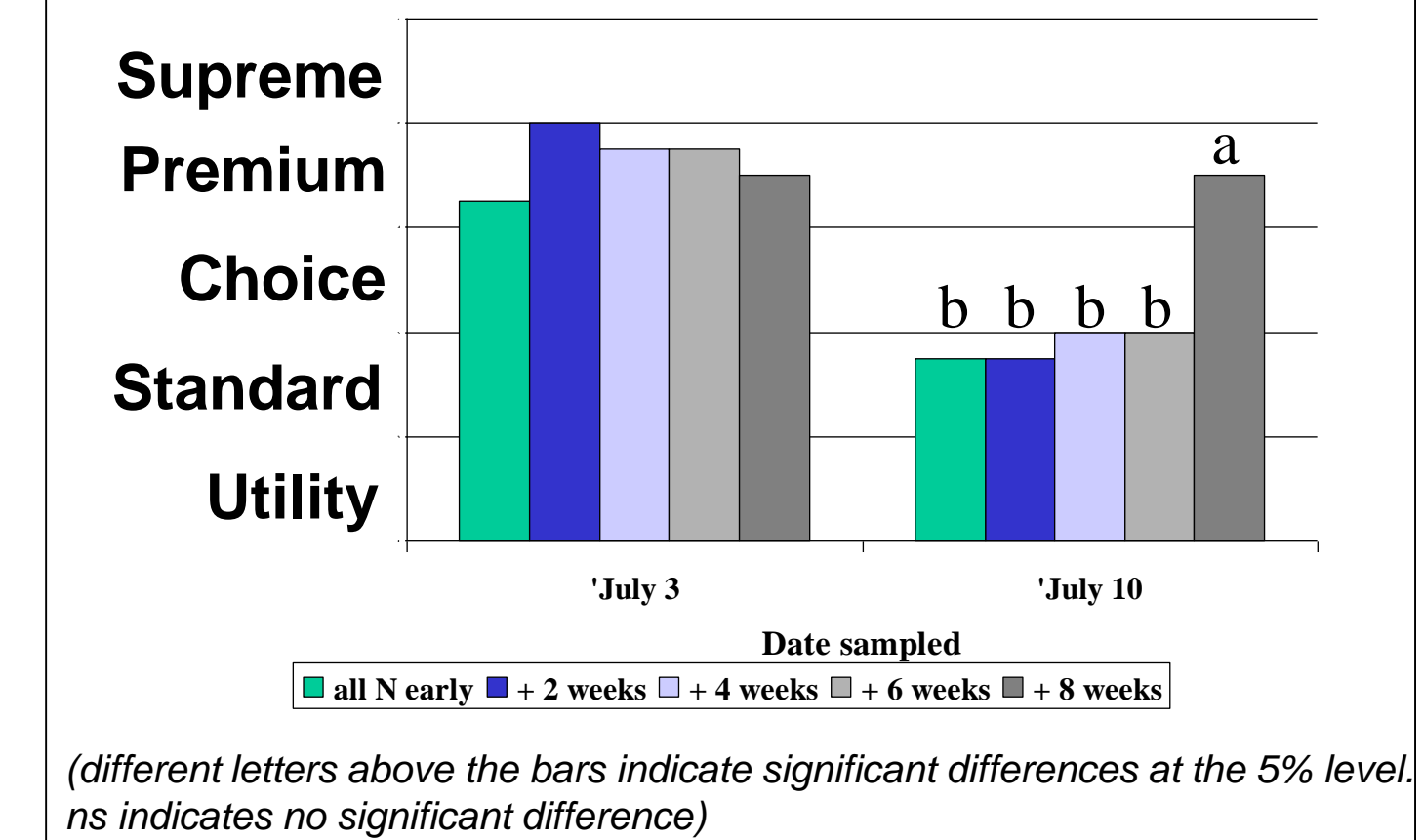


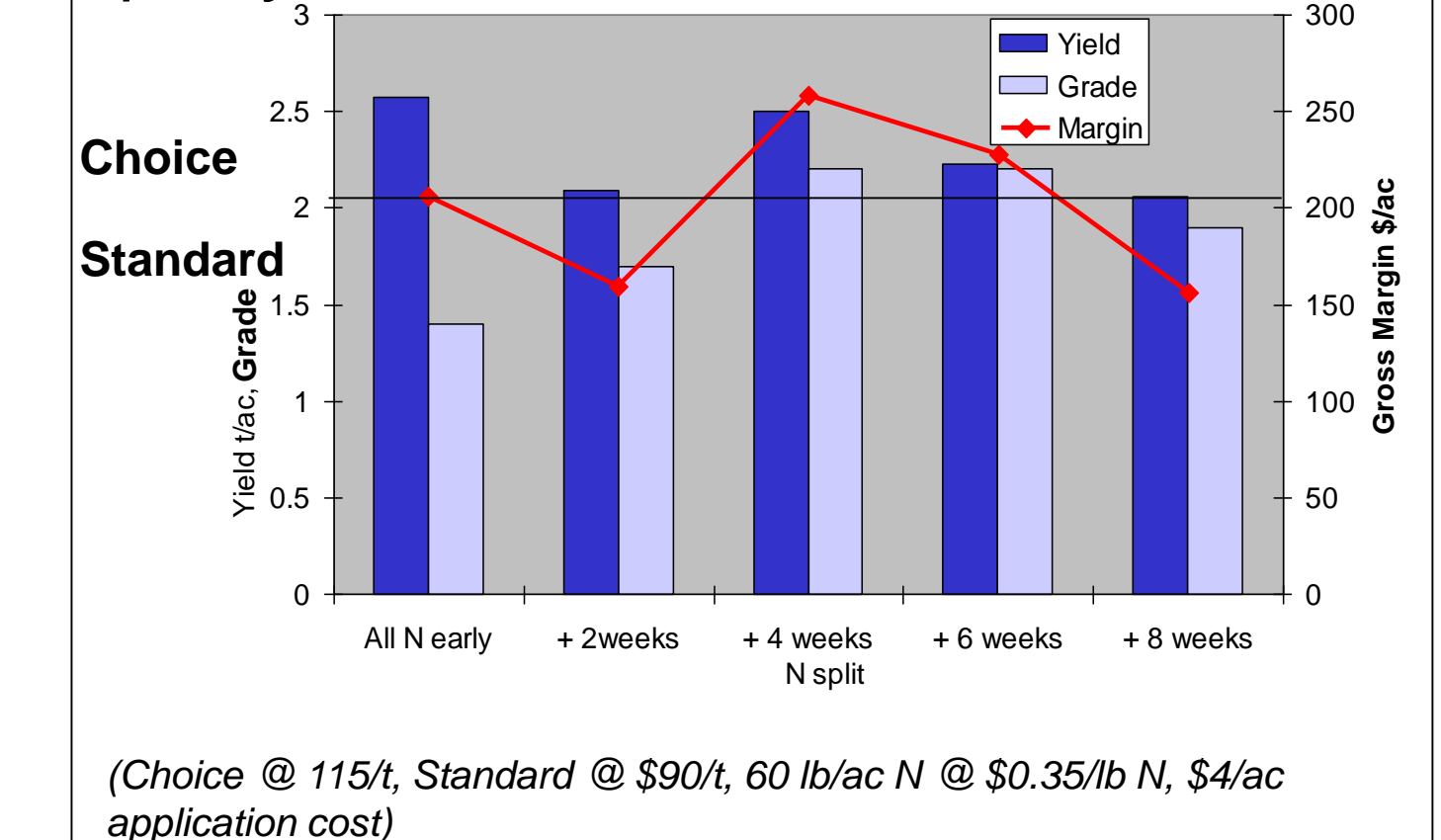
Figure 11. Impact of N splitting on Grade over time at Russell in 2001.



ECONOMICS OF N MANAGEMENT

Economic analysis of the 2001 Teulon site (where split N reduced yield, yet improved grade) illustrates that grade impacts returns more than does yield (Figure 12). The gross margin in Figure 12 is calculated as the gross return per acre (yield X grade X price) less the fertilizer and application cost. The grade is the mean of the three sampling dates.

Figure 12. Economics of splitting N for quality.



SUMMARY

- Although yields were increased with N up to 80-90 lb N/ac, quality declined.
- Yield and quality appear to be inversely related. Delayed N application or splitting N usually benefits quality with only minor effect on yield. However the site with the most marked quality improvement, also had significant yield depression (T01)
- Quality appears to be superior at late harvest dates with later split N applications.
- Although quality improvement with delayed or split N was sometimes insufficient to move to a higher grade class, producers may still be rewarded since price breaks are usually offered within grade classes.
- Greatest returns will result from production of highest quality timothy-through N management and earlier harvesting.

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