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INTRODUCTION

Manure Experiment

Alfalfa-corn growers in the U.S. Corn Belt often apply manure when terminating alfalfa to replenish soil P and K after several years of intensive alfalfa cropping. Although this is a common practice, it may result in excessive or insufficient N supply to corn, depending on the C:N ratio. University fertilizer guidelines suggest no or small fertilizer N applications when corn follows a good stand of alfalfa, but there are no published studies on the effects of fall manure application on the fertilizer N requirement of first-year corn. To investigate these effects, we conducted 8 on-farm experiments in 2010 to 2011.

No-till Experiment

No-tillage corn after alfalfa is a new option in many parts of the Midwest, but only 17 site-years of published research have been conducted on the topic. Most Corn Belt states do not alter N credit recommendations for tillage, but a few other states reduce the N credit by one-half for no-till compared to aggressive tillage. We conducted 7 on-farm experiments in 2010 to 2011 to validate whether alfalfa N credits should be adjusted for no-tillage.

MATERIALS AND METHODS

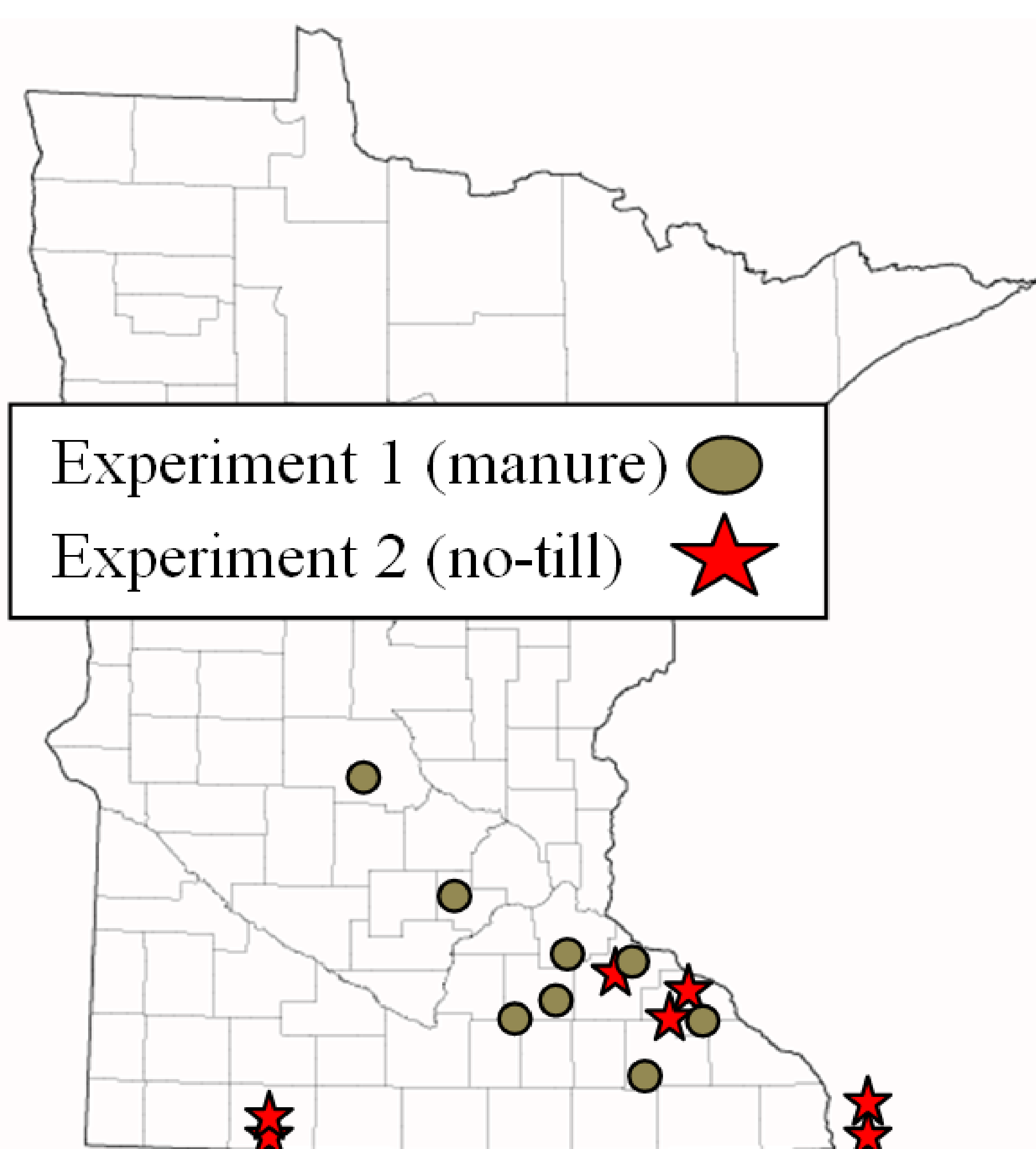


Figure 1. On-farm research locations of two N credit experiments.

Table 1. Manure application characteristics for eight Minnesota farms.

Nearest city	Rate Mg or 1,000 L ha ⁻¹	Type†	Total N‡ kg ha ⁻¹	C:N
Faribault	0.6	SB	11	16
Howard Lake	68.3	LB	245	7
Medford	15.0	LI	73	-
Plainview-2	4.2	SB	88	23
Randolph	36.5	LB	44	12
Red Wing	4.7	SB	105	19
St. Rosa	4.3	SB	63	12
Stewartville	72.9	LB	61	21

† Manure was applied from Oct.-Nov. as broadcast liquid manure (LB), injected liquid manure (LI), or broadcast solid manure (SB). Alfalfa was terminated after manure application with disc-chisel or moldboard plow tillage.



Figure 2. Manure was applied in fall at alfalfa termination in Manure Exp. on 8 farms. In both experiments, fertilizer N was applied as ammonium nitrate 1 to 2 wk after planting. Grain and silage yield and basal stalk samples were collected 1 to 3 wk after corn had reached "black layer."

RESULTS

Manure Experiment

Small chance of grain yield response to N. greater chance for silage corn

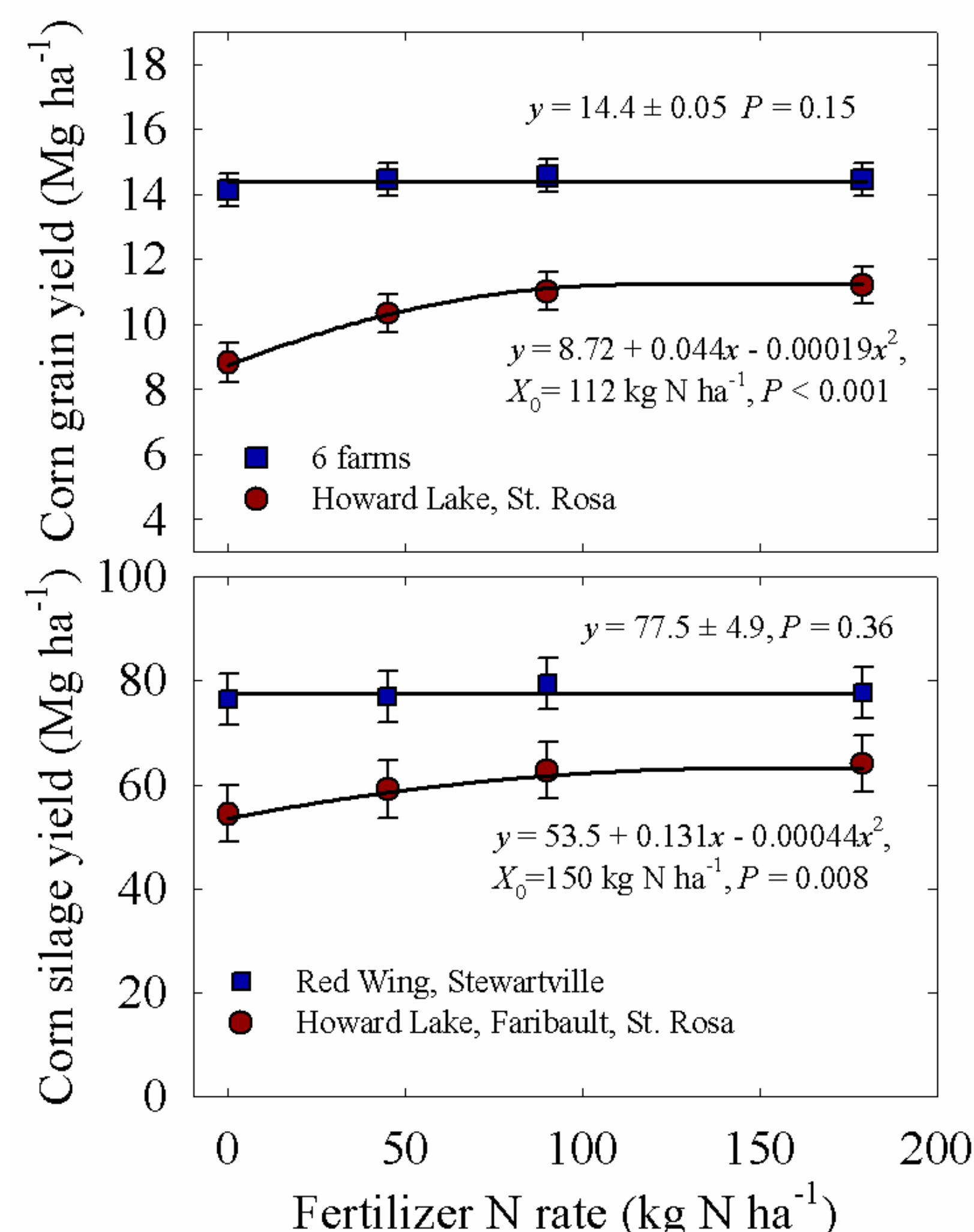


Figure 2. Response of grain (top) and silage yield (bottom) to fertilizer N at planting on 8 farms with manure applied during alfalfa termination.

Grain %N and grain and silage N uptake increased with N at most farms

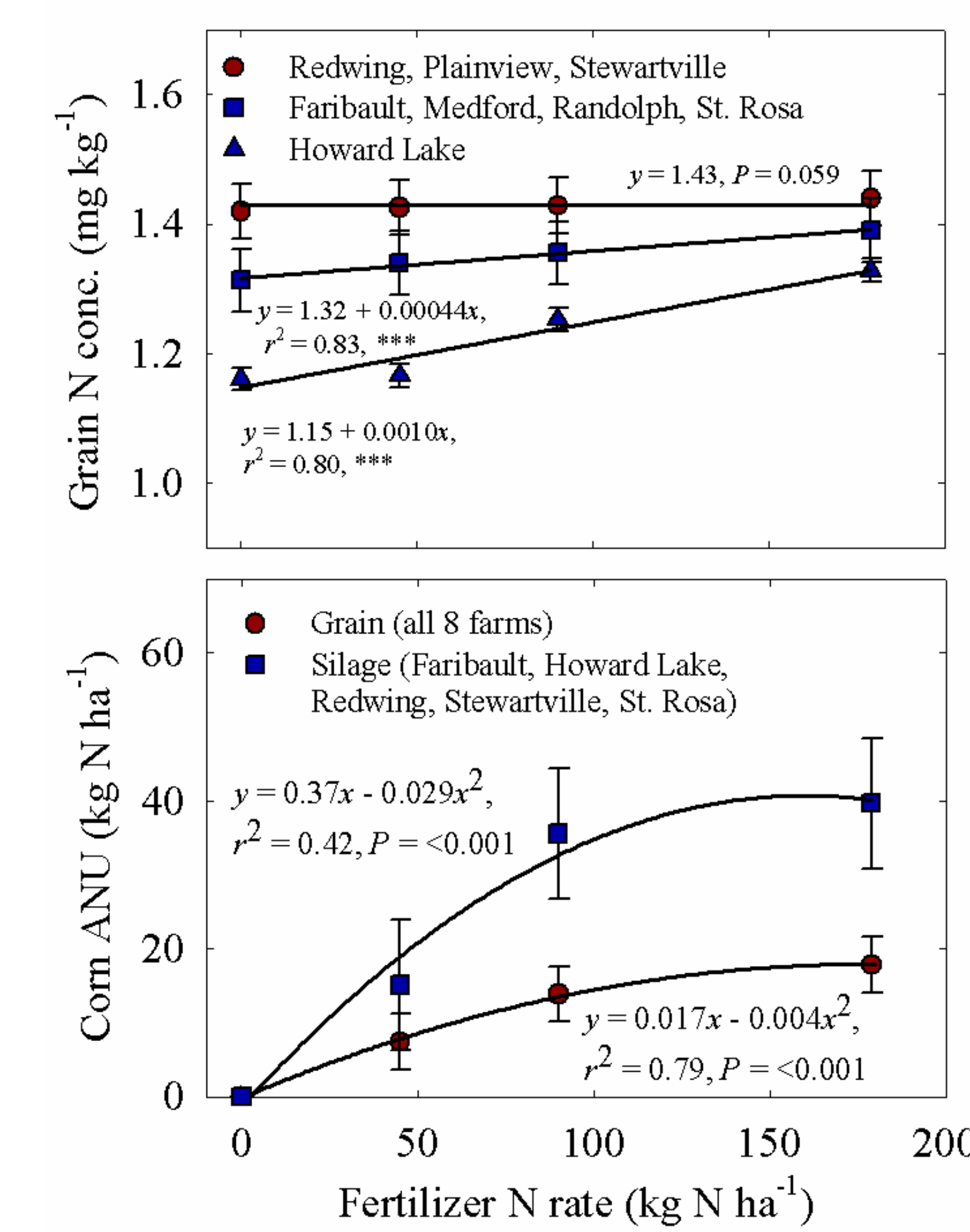
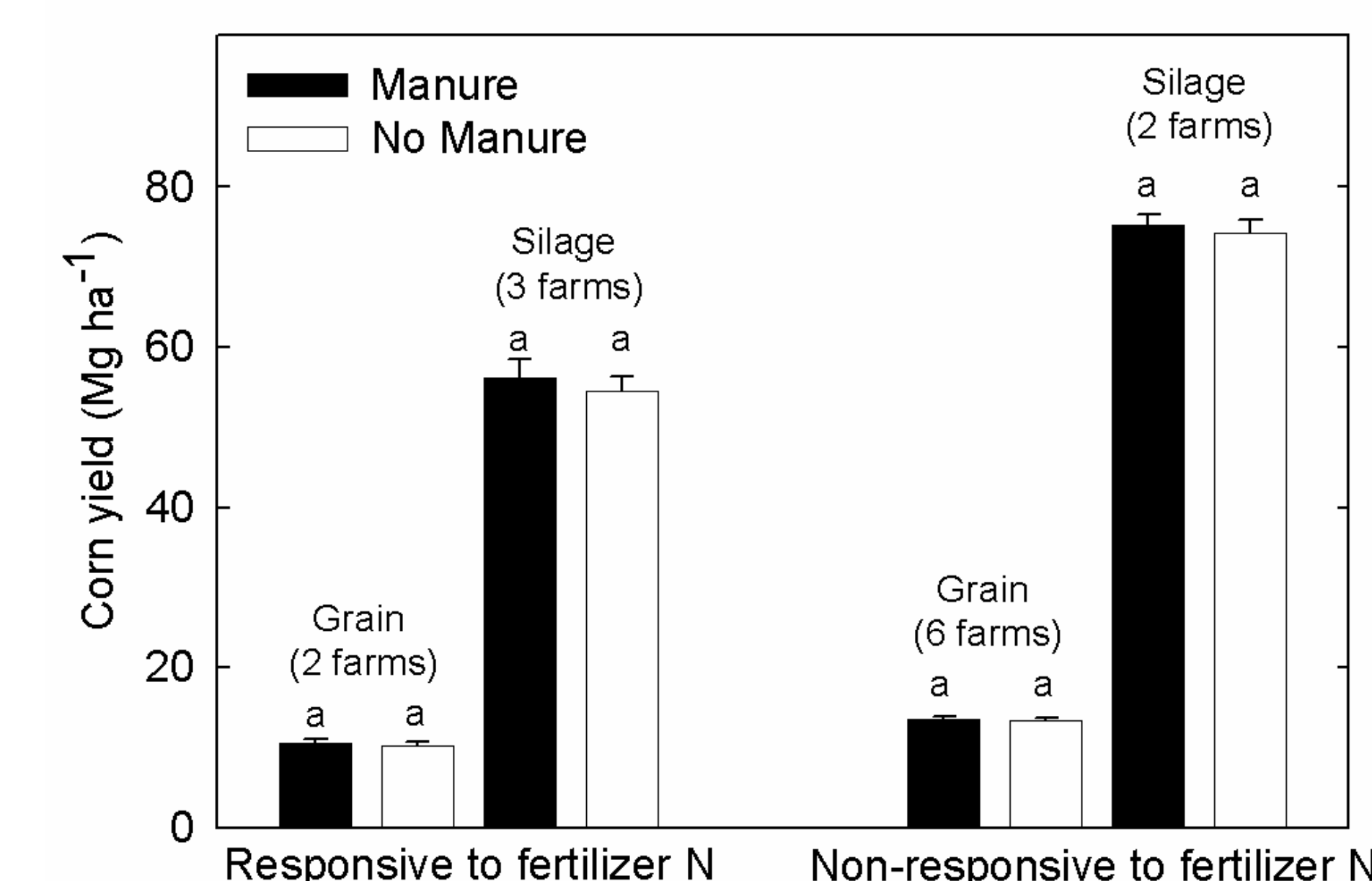


Figure 3. Confirmation of fertilizer N availability in grain N concentration (top) and grain and silage apparent N uptake (ANU) (bottom) to fertilizer N applied near planting.

Manure Experiment

No effect of manure on corn yield at N responsive or non-N-responsive sites



Manure and No-till Experiment

BSNT was successful at separating grain response to N 73% of time, but conc. were highly variable.

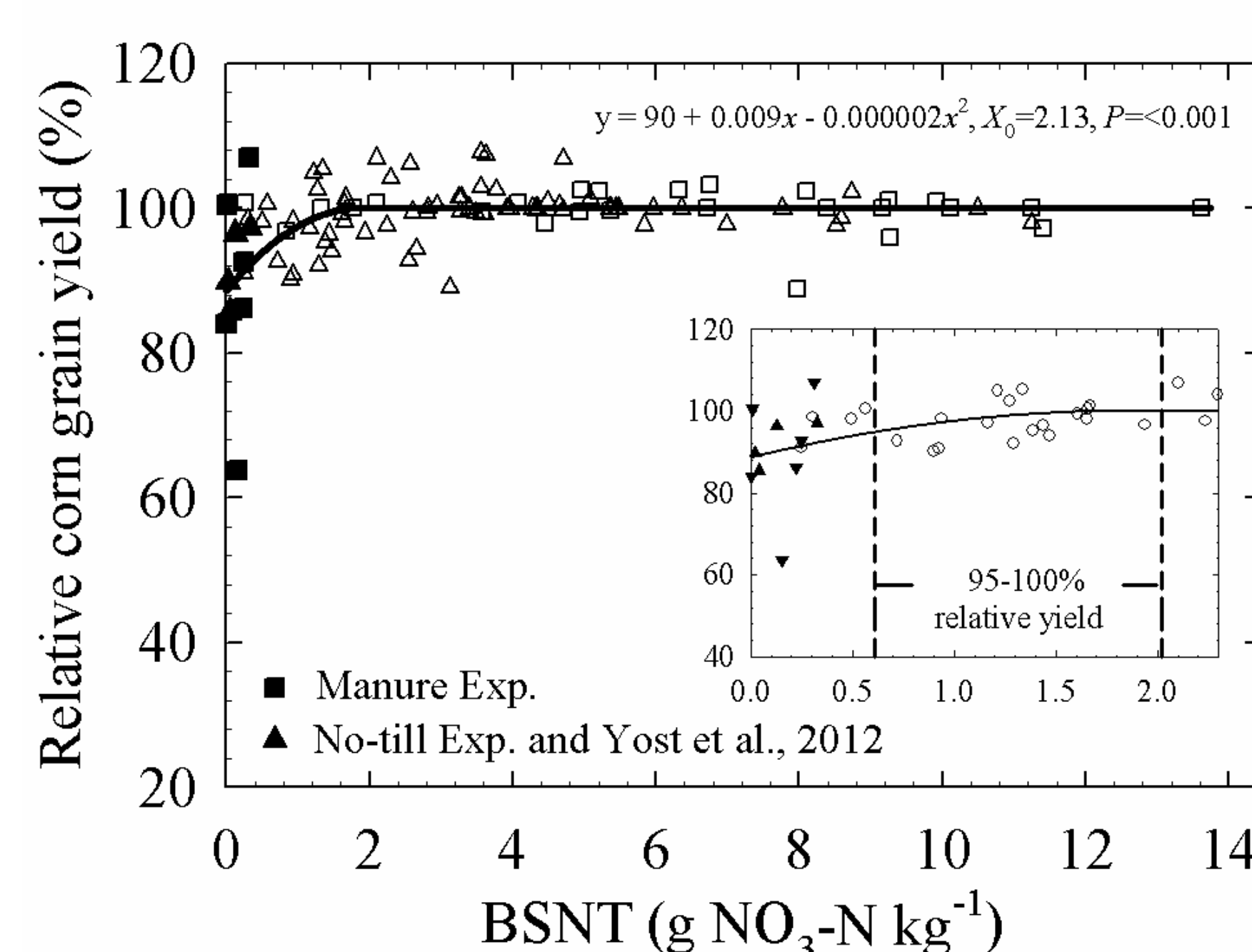


Figure 4. Response of relative corn grain yield to basal stalk NO₃-N test (BSNT) concentration in Manure Exp. (squares) and No-till Exp. + 6 site-years of previous work (triangles). Bold symbols represent response to fertilizer N, open were non-responsive.

At critical conc. of 21 mg kg⁻¹, the PSNT was correct only 55% of the time.

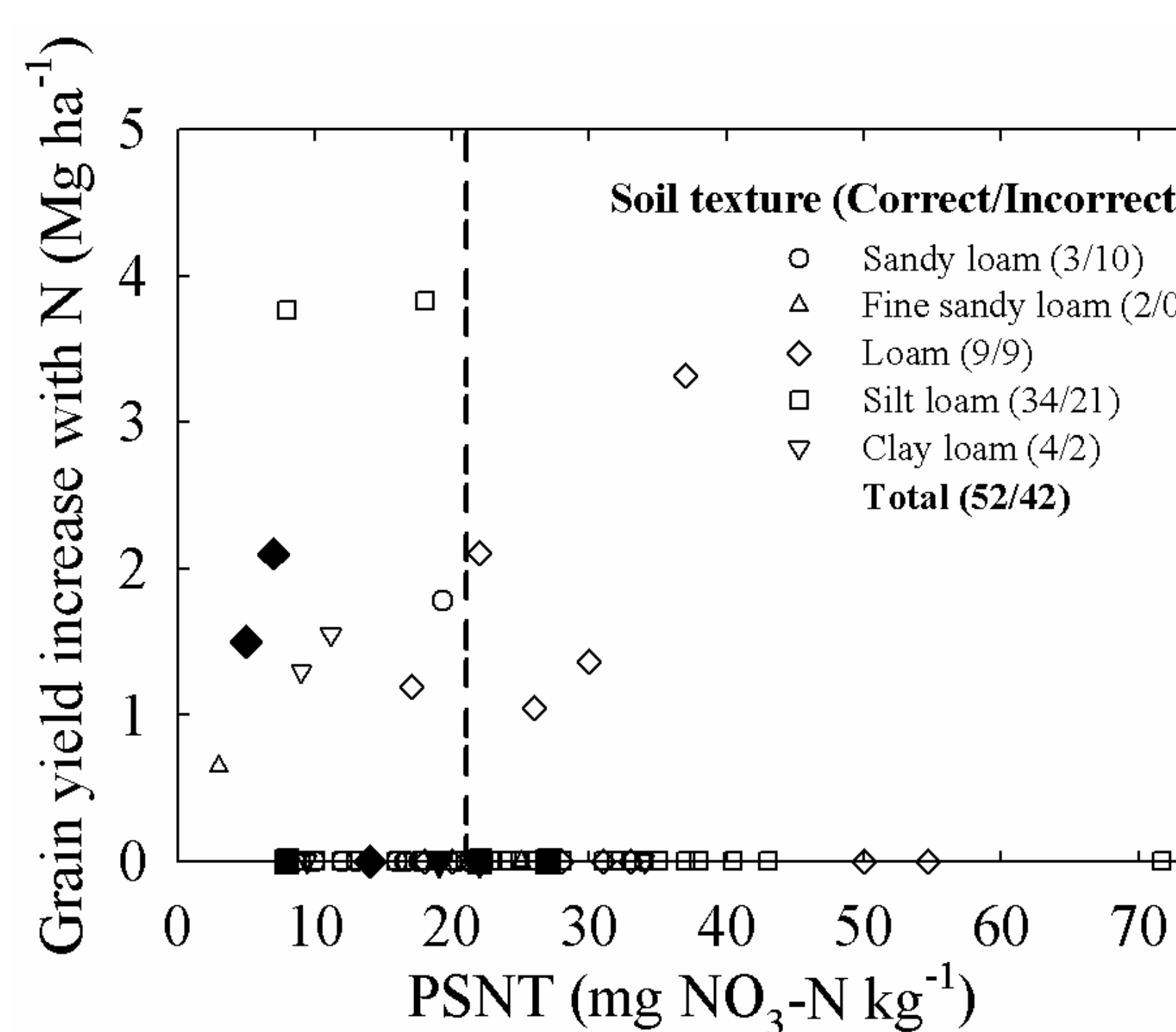
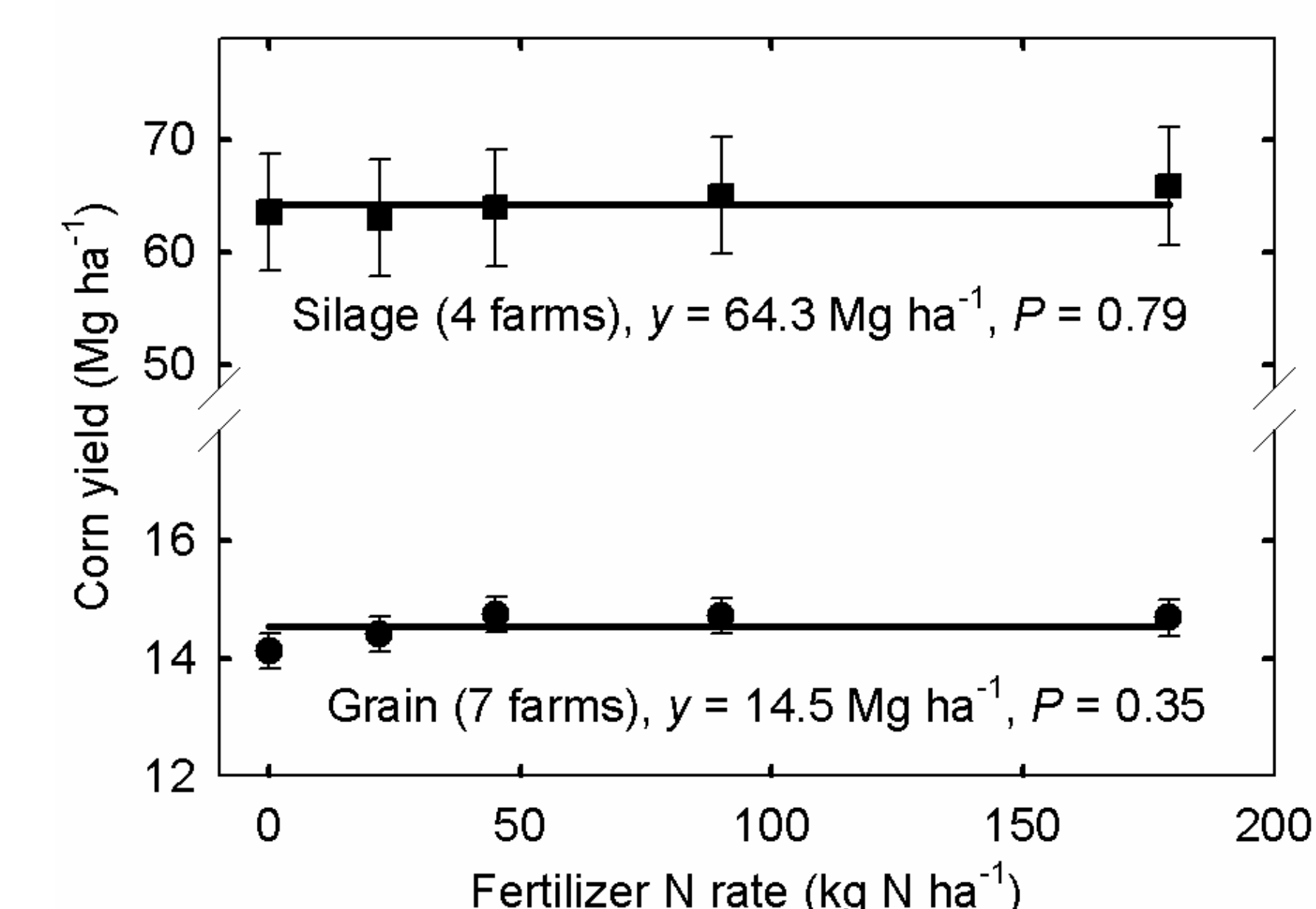


Figure 5. Grain yield response to N and presidedress soil nitrate test (PSNT) concentration. Bold symbols represent 8 farms in Manure Exp., open symbols represent 7 farms in No-till Exp. + 82 site-years of corn following alfalfa in literature.

No-till Experiment

No fertilizer N needed for first-year, no-till corn following alfalfa



CONCLUSIONS

Current alfalfa N credits to first-year corn do not need to change for no-till corn or for manure application during alfalfa termination.

Use caution when using the BSNT and PSNT to guide N application to corn following alfalfa, because in most cases corn needs no fertilizer N and the tests have limited accuracy. If these tests prove reliable for this rotation, critical concentrations may need to be lower.

If growers predict N is needed for first-year corn following alfalfa (extremely wet spring), small N applications (45 kg N ha⁻¹) are usually sufficient.

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