

# Effect of split nitrogen application on baking quality and yield of wheat-a meta-analysis

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## Introduction

Split nitrogen (N) application (splitting of the same N rate distributed in several applications at different growth stages) is useful for improving the baking quality of wheat. However, the key stage of split N application was varied in existing studies. According to previous studies, there may be a key growth stage of split N application to improve baking quality, and the effect is not significant earlier or later than this key stage (Xue et al., 2016a,b; 2019). In addition, the effects of split N application on the relationship between grain yield and baking quality were inconsistent under different N application levels. The main purpose of this research is to develop a global meta-analysis to explore the key stage for late N application in improving wheat baking quality and yield and to clarify the relationship between wheat grain yield and baking quality under different N levels.

## Materials and Methods

Peer-reviewed publications on the effect of split N application on wheat quality and yield were searched using the Web of Science and China National Knowledge Infrastructure. The search terms combine fertilizer management measure (e.g. nitrogen fertilization, nitrogen application), baking quality parameters (e.g. loaf volume, specific volume, protein, wet gluten, stability time, sedimentation, glutenin and gliadin) and wheat in the topic field. After intensive reading and screening, a total of 93 publications was eligible for the meta-analysis and raw data were from tables and figures of the publications. Standardize literature results by calculating effect size. The effect size is a value reflecting the size of the treatment effect compared with the reference treatment. A mixed-effects model was used to calculate the grouped effect size using the nlme package of R4.0.2 (Hou, Velthof et al. 2015).

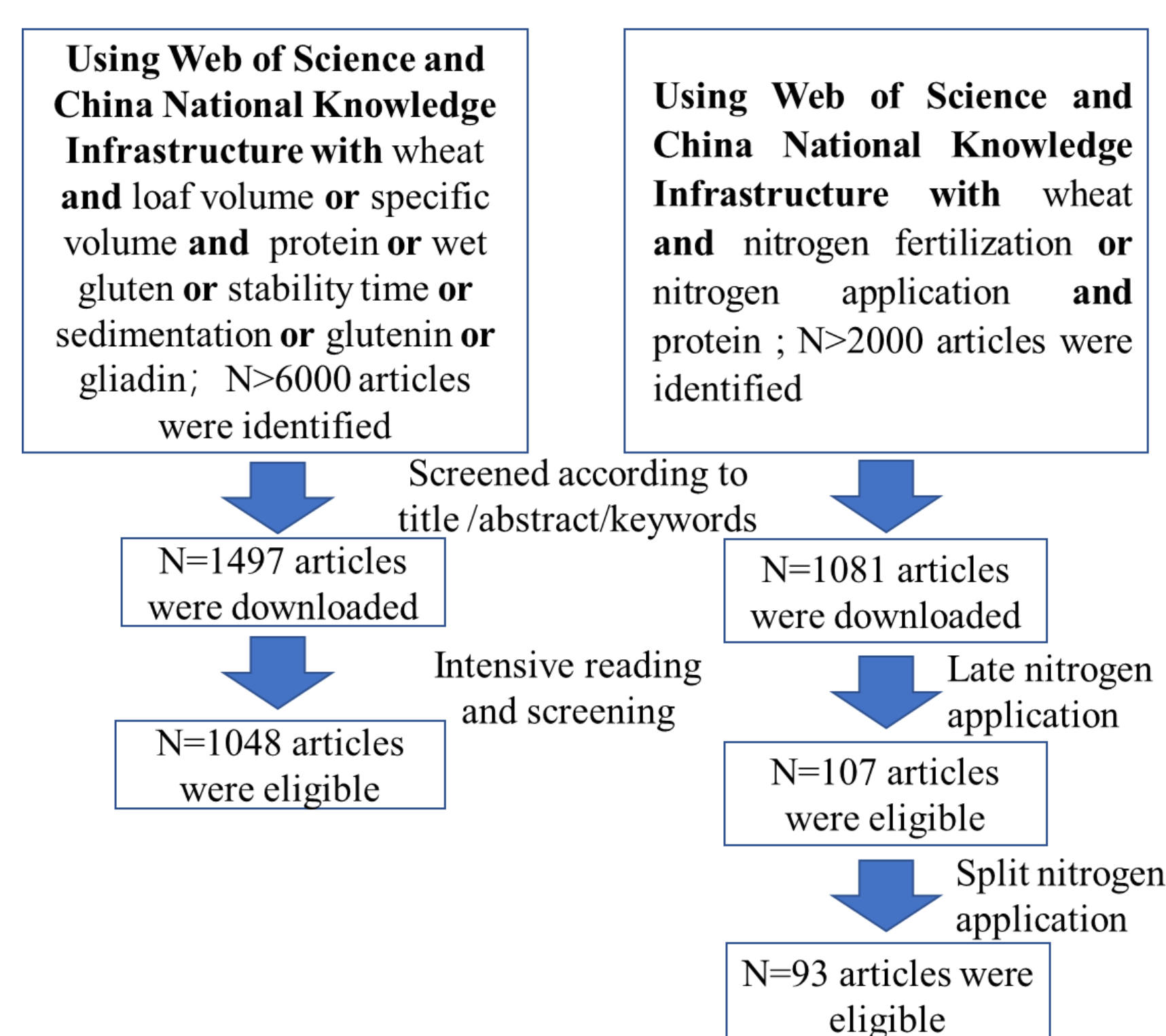


Figure 1 : Flowchart of the process of building the database and conducting the meta-analysis.

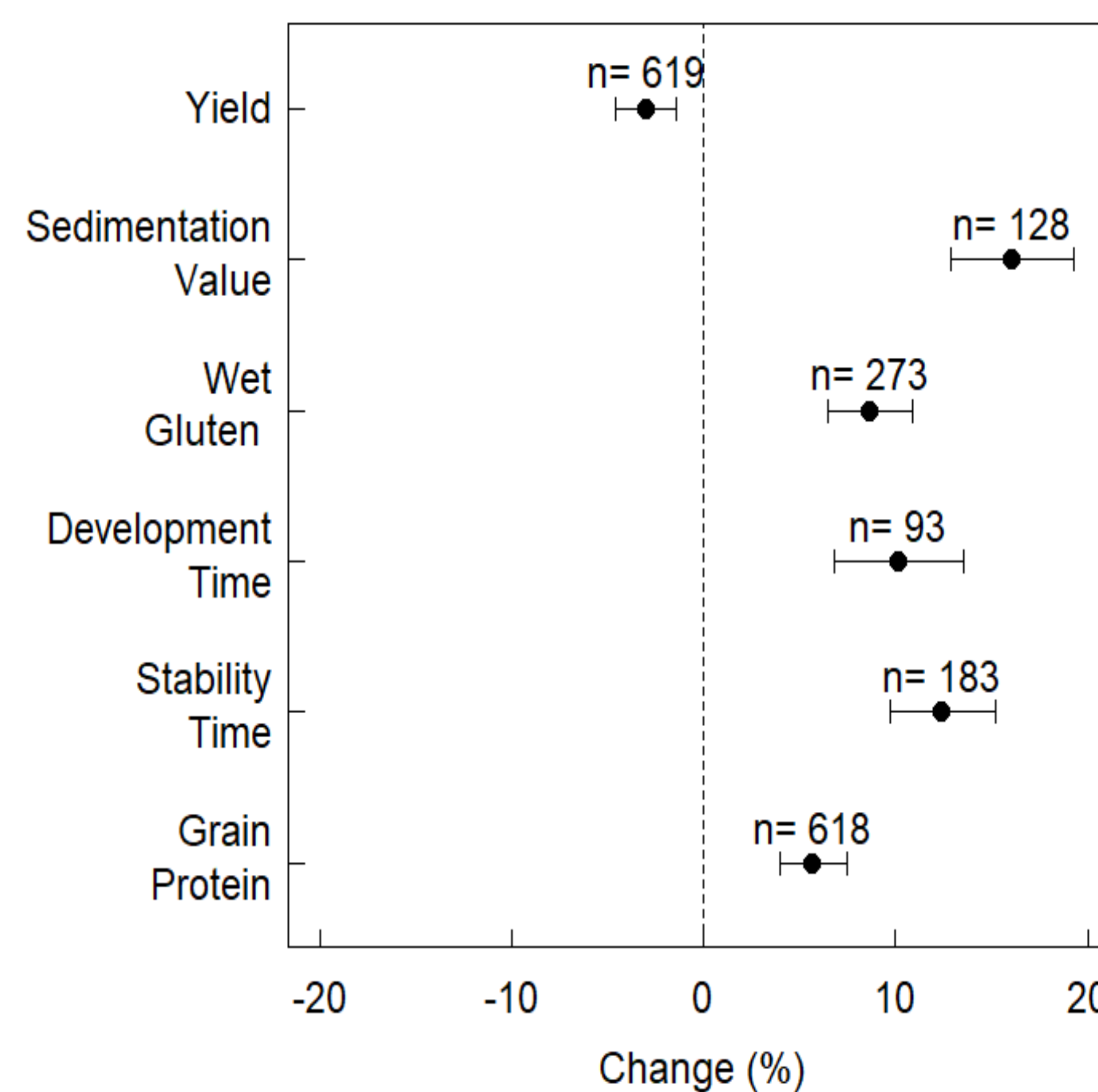


Figure 2: Comprehensive effects of split nitrogen application on wheat grain yield and baking quality. (Unpublished)

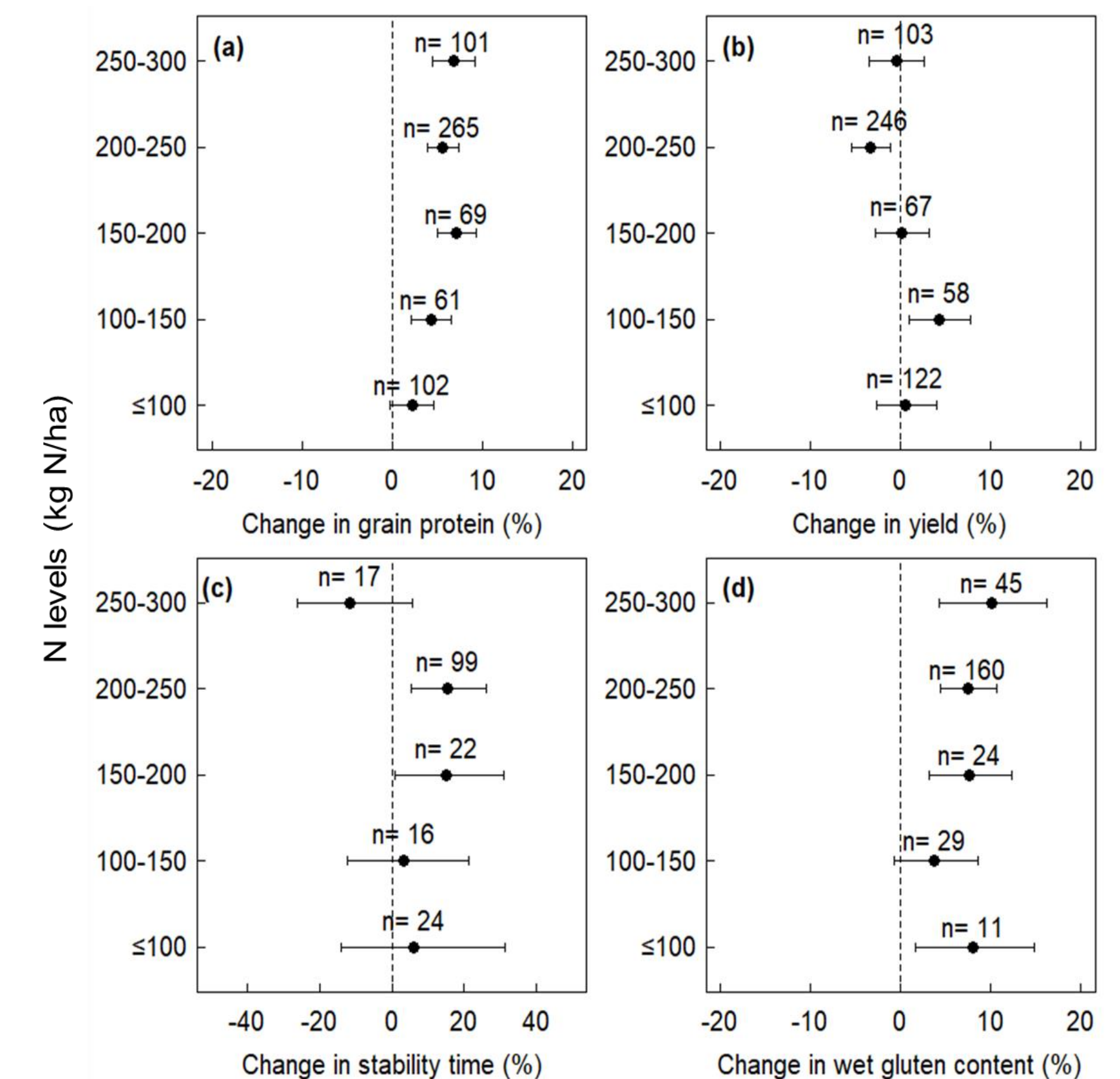


Figure 4: The effect of split nitrogen application on yield and quality under different N levels. (Unpublished)

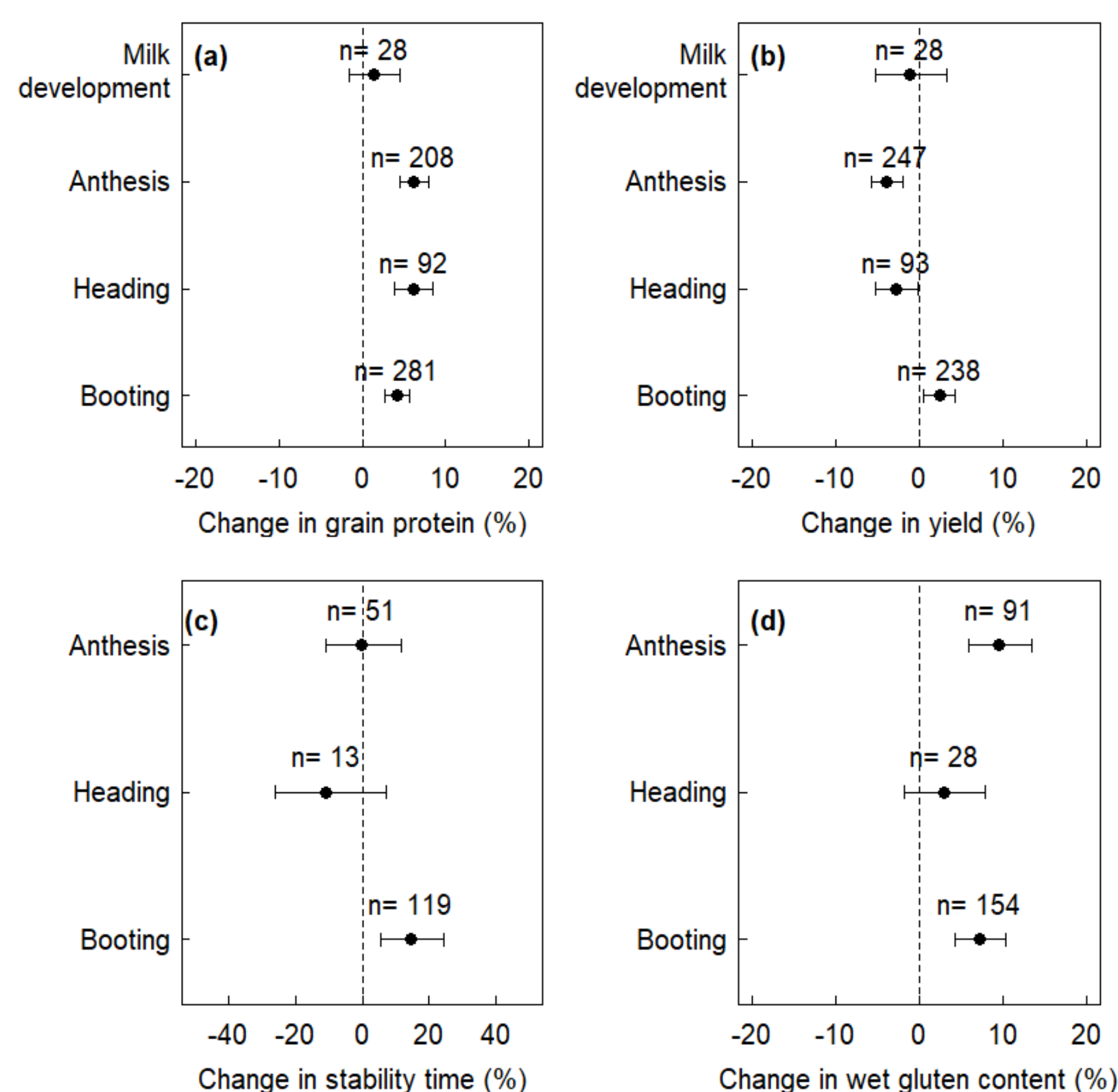


Figure 3: The effect of split nitrogen application in different stages on yield and quality. (Unpublished)

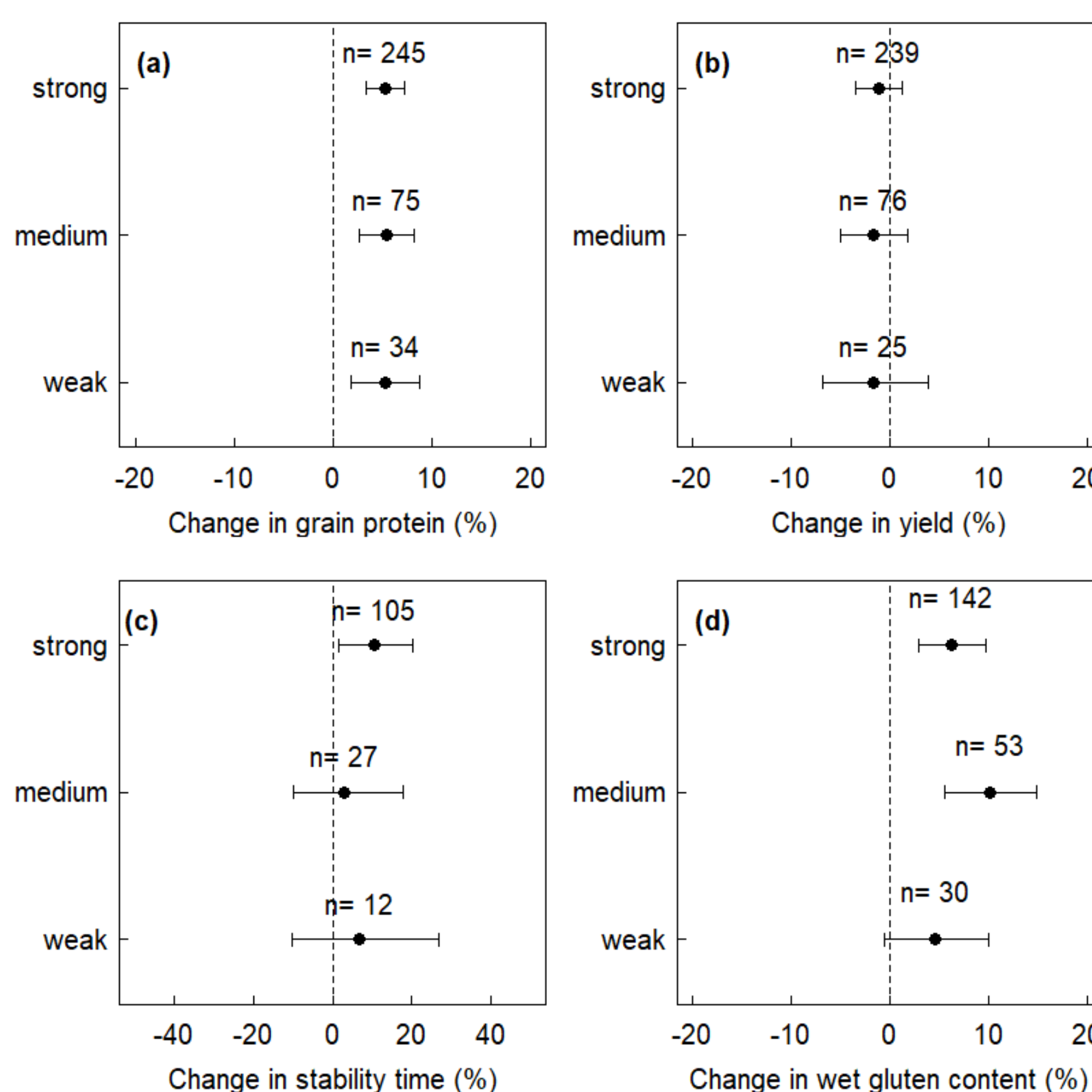


Figure 5: The effect of split nitrogen application for different quality groups on yield and quality. (Unpublished)

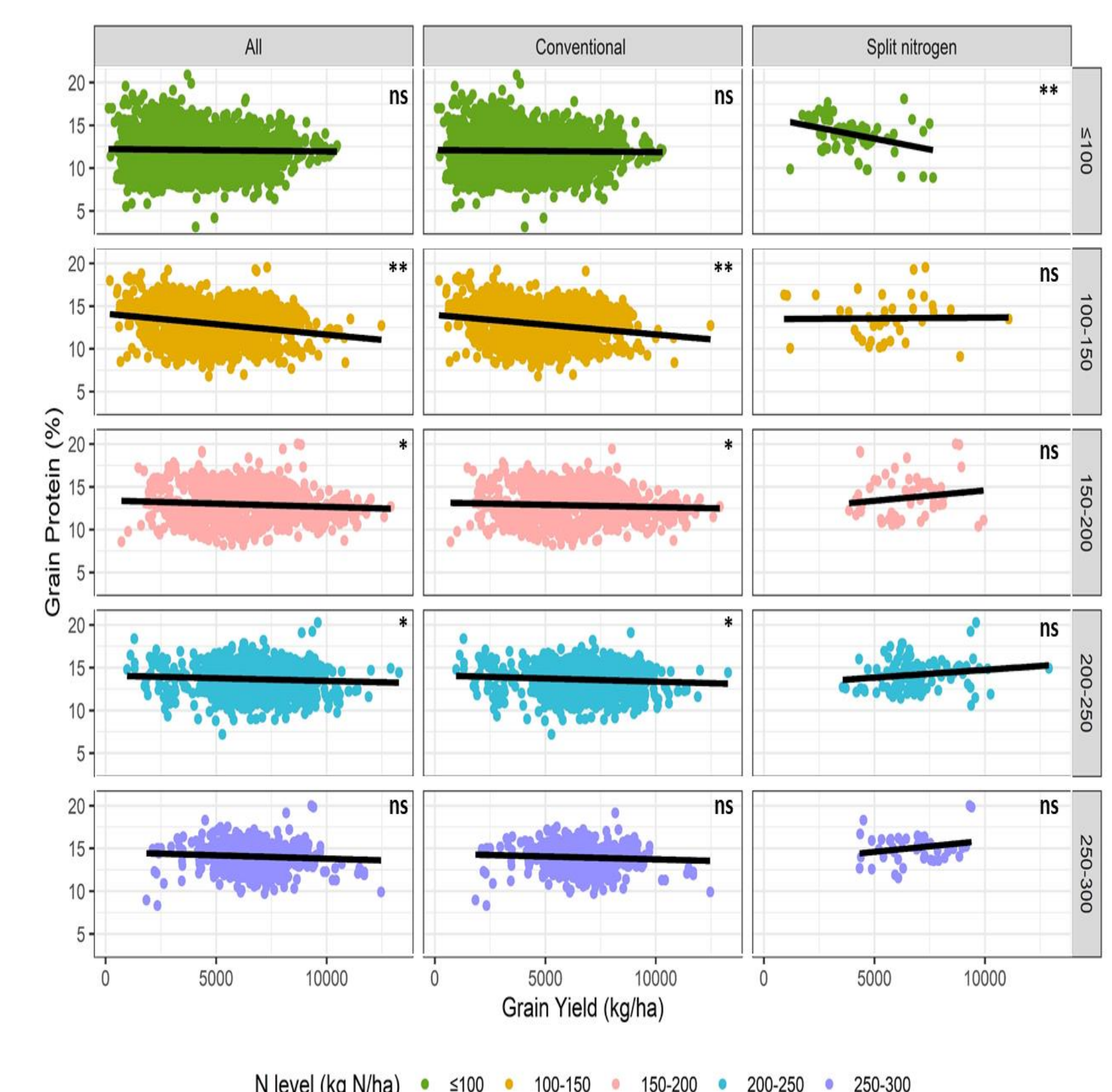


Figure 6: Correlations between grain yield and grain protein under different N levels. (Unpublished)

## Summary

**Booting stage** is the key timing for split N application in improving grain quality of wheat as only at this stage, split N application has a significant positive effect on yield and quality. Under different N level, the respond of split N application is inconsistent. Only in the range of 150-200 kg N/ha, split N application has a significant positive effect on quality and the effect on yield is not significant, while the negative correlation between yield and protein is not significant. So **150-200 kg N/ha** is a more reasonable N fertilizer application rate for split N application to improve quality without reducing yield. The quality of strong gluten varieties can be effectively improved by splitting N application without reducing yield. **Split N application can weaken the negative correlation between yield and quality.**

## References

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