

# Nitrogen and Phosphorus Fertilizer Effects on Nodulation, Yield, and Quality of Newly Seeded Alfalfa



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## INTRODUCTION

Alfalfa (*Medicago sativa*) producers have traditionally used fertilizers that contain only phosphorus (P) such as triple super phosphate (0-45-0). Nitrogen-containing P fertilizers, such as monoammonium phosphate (11-52-0), are now gaining popularity due to their lower cost and greater availability. Some producers are concerned that using P fertilizers that contain nitrogen (N) could delay or reduce rhizobia nodulation, negatively influencing both yield and quality. This is the third year of a four-year study to quantify the effect of N-containing P fertilizer on:

- Nodulation of rhizobia
- Dry biomass yield
- Relative feed quality of alfalfa

## MATERIALS AND METHODS

- The experiment was conducted with a randomized complete block design with 9 treatments and 5 replications.
- Soil type was a Ririe silt loam.
- Soil samples were taken in the spring of 2012-14 to determine initial fertility levels.
- Fertilizer was applied pre-plant. 9 treatments consisted of a control, 1 P only, 2 N only, and 5 P+N combination treatments.
- Nodule counts were obtained by removing plant roots from a 30-cm row and attempted at 3, 4, 5, 6, 8, 10, and 15 weeks after emergence, depending on weather and harvesting.
- Alfalfa was harvested at pre-bloom stage by cutting a 1.6 x 6.5 m section, avoiding nodule sampling areas.
- Forage quality was determined using a near infrared reflectance (NIR) spectrometer.
- Statistical analyses were performed using IBM SPSS Statistics 21.0.

## RESULTS AND DISCUSSION

- In week 4 of 2012 and week 3 of 2013, statistical differences were seen only in nodulation, with highest counts in P only treatments (see Fig. 1; 2013 data not shown).
- In 2012, week 15 nodule counts were higher for the P only and for two P+N treatments, suggesting N fertilizer may have a longer lasting effect on nodulation (see Fig. 2).
- In 2014, there was no statistical difference between treatments for nodulation during any of the four measured weeks (see Fig. 3).
- During every year of the study, no statistical differences have been observed for dry biomass yield (data not shown) or relative feed quality (data not shown, 2014 range: 153-183).
- In 2014, nodules per weight for week 8 were related to soil nitrate concentration, but only weakly (see Fig. 4).
- The research plots in 2014 had significant residue from the previous wheat crop. The poor correlation between applied N and soil nitrate concentration suggests immobilization may have been a factor (data not shown), possibly influencing alfalfa nodulation, especially early in the growing season.

## FIGURES AND TABLES

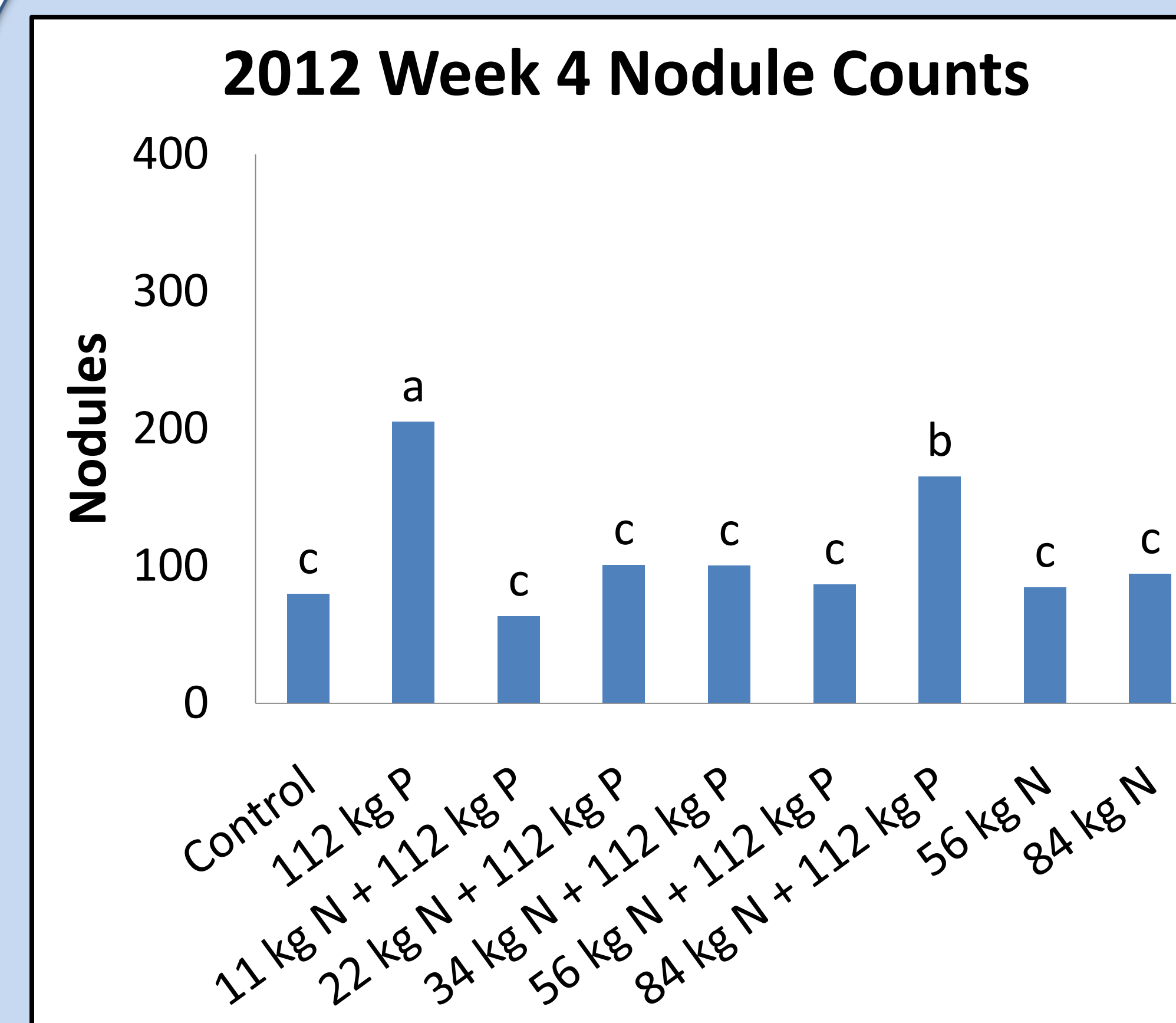


Figure 1. 2012 week 4 nodule counts.

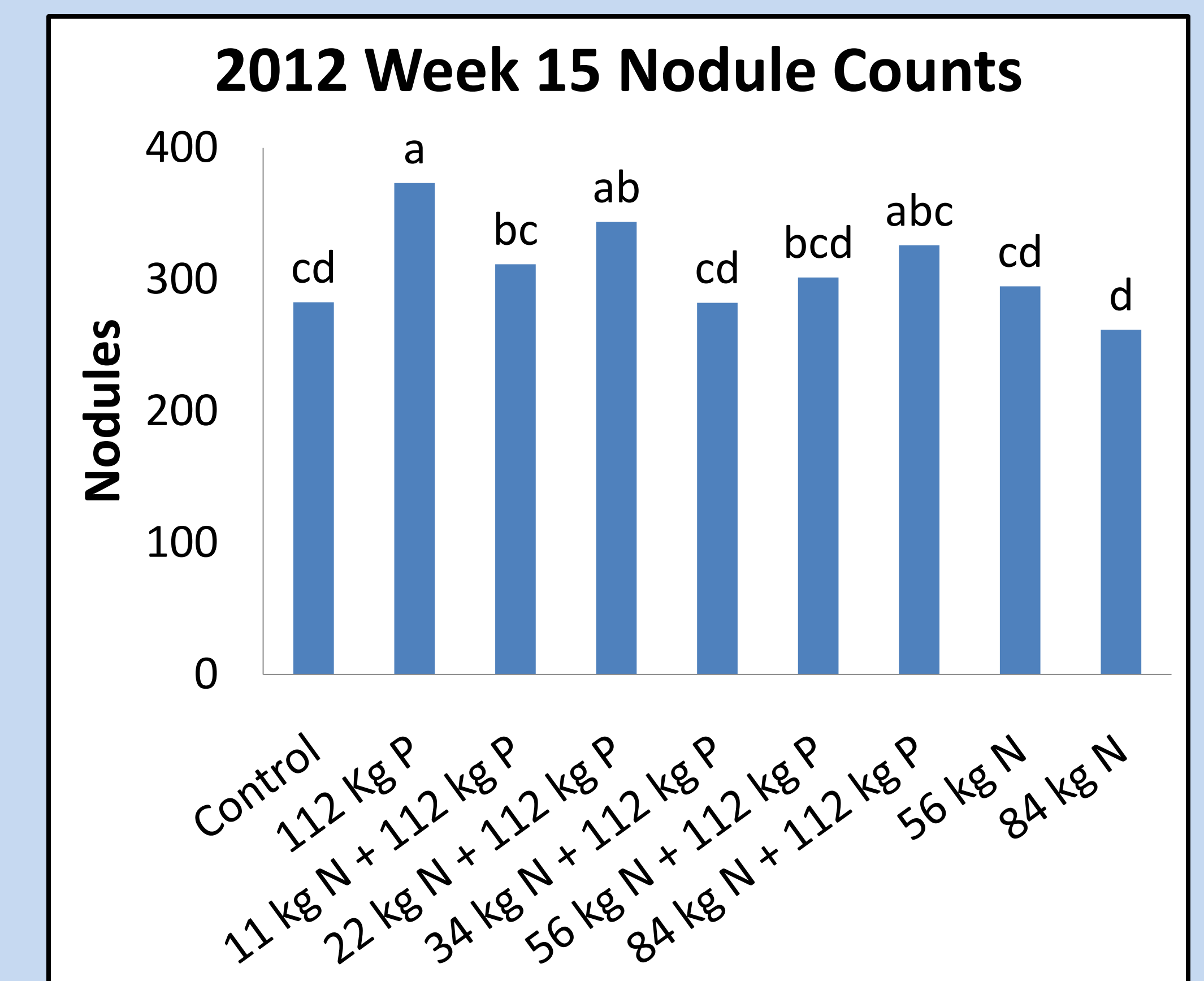


Figure 2. 2012 week 15 nodule counts.

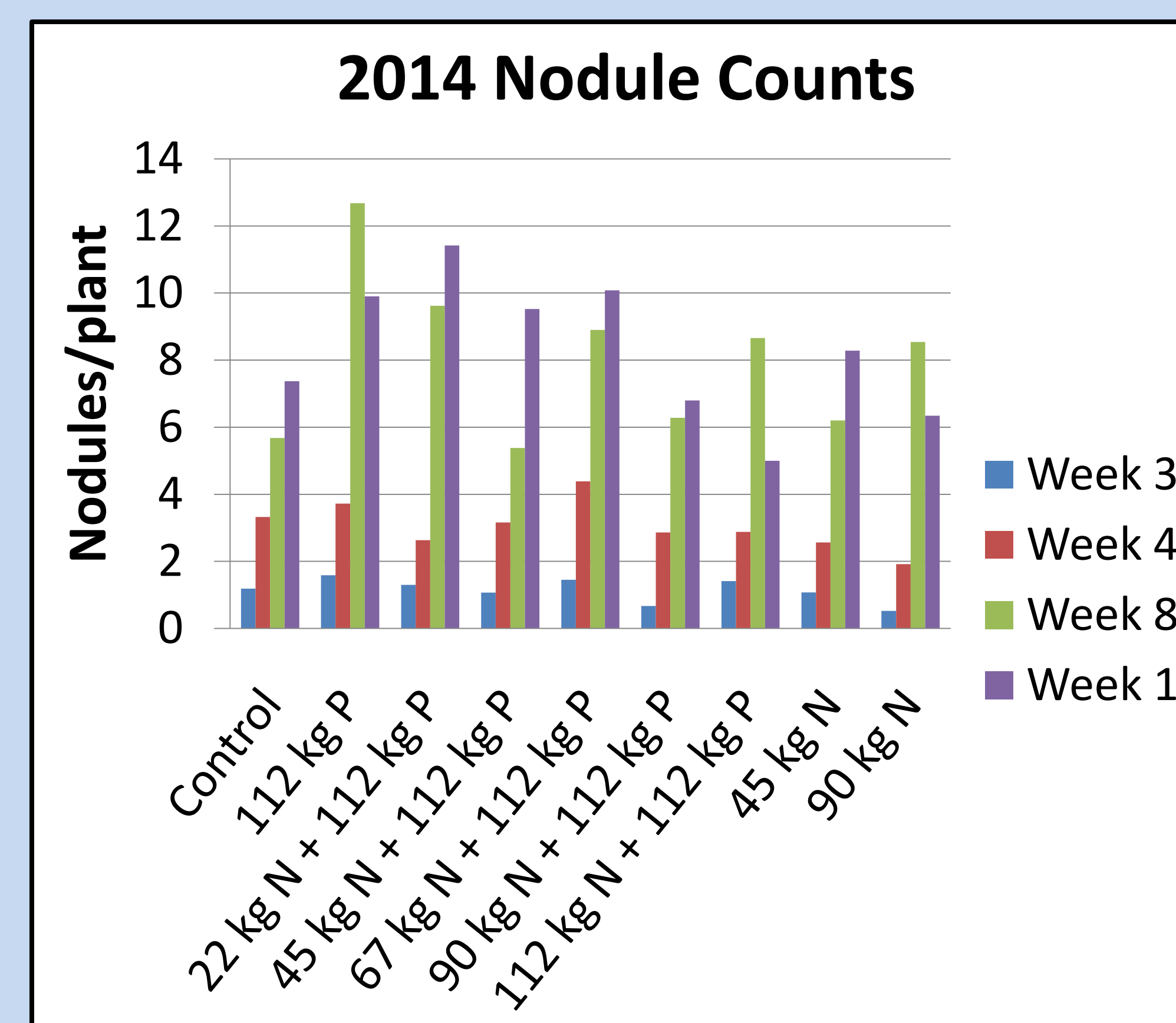


Figure 3. Nodules per plant for each of nine treatments, obtained at weeks 3, 4, 8, and 10.

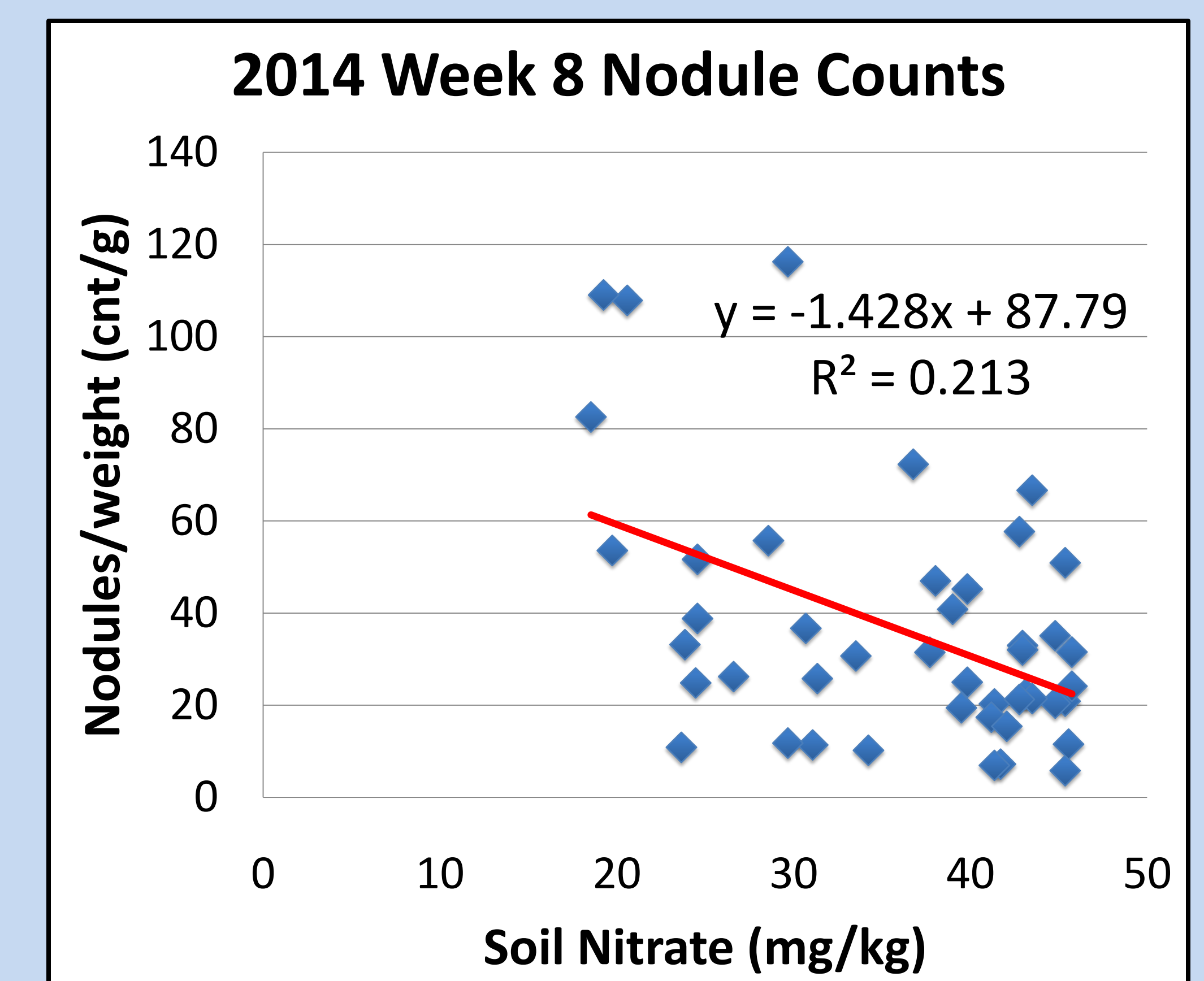


Figure 4. Regression analysis of soil nitrate concentration and week 8 nodule counts.

## CONCLUSION

- Three years of evidence have shown no significant statistical differences in alfalfa nodulation, yield, or relative feed quality when N-containing P fertilizers are used.
- Results show that N-containing P fertilizers may delay nodulation but do not affect yield or relative feed quality of alfalfa.