

IMPACTS OF SULFUR FERTILIZATION ON YIELD, GRAIN QUALITY, AND N USE EFFICIENCY OF WHEAT

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OBJECTIVES AND MATERIALS AND METHODS

A field study was grown in the harvest years 2021 and 2022 at Spindletop Farm (LEX) and the West Kentucky Research and Education Center (PRN). The overarching objective was to determine whether applications of sulfur fertilizer (S) in combination with various levels of N fertilizer would increase yield and N use efficiency. We used a group of varieties that were known to differ to some extent in protein quality and quantity, thinking that might have an impact on the sulfur effect. In the field study grown at LEX and PRN, the following varieties were used: Pembroke 2014 (early maturity, strong gluten), Pembroke 2021 (early maturity, intermediate gluten strength), Vision 45, (mid-late maturity, strong gluten, HRW), Pioneer 26R10 (mid maturity, unknown gluten strength), and Agrimax 454 (mid - late maturity, unknown gluten strength). There were three N levels (0, 90 and 120 lb/a) and these were combined with two S levels (0 and 30 lb/a).

RESULTS AND DISCUSSION

As we often see, the years of the study provided differing results. In 2021 the extra N at heading increased grain yield, though this was not the case in 2022. Normally we would not expect a heading application of N to increase yield but rather increase grain protein. This can vary though when conditions are favorable for initiating tillers and producing more kernels; typically this means cool nights and plenty of solar radiation. In both years of the study, the addition of sulfur plus extra N provided the highest yields.

In Table 2 we see that there are some varietal differences in response to combinations of N and S. Interestingly, Vision 45, the hard red winter wheat shows the highest percentage response to the addition of S when compared to the N only and the N extra treatment. Pembroke 2021 produced the highest yield of all varieties when treated with extra N at heading plus sulfur.

We also baked small loaves of bread in the lab of Chef Bob Perry, thinking that this study might provide insight on the possibility of a value added product. We looked at loaf volume as a function of fertilizer treatment as shown in Table 3. While loaf volume was highest in the extra N plus S treatment, the difference was not statistically significant.

In Table 4 it is apparent that loaf volume varies among varieties, with the HRW Vision 45 producing the largest volumes and thus the strongest gluten. Pembroke 2014, known to be a strong gluten SRW wheat, had the next highest volume followed by the other 3 SRW wheats.

The results of the study show that when averaged over years and locations, there was a yield increase of approximately 7.5 bushels when sulfur was added to the standard amount of N (90 lb/a) applied at growth stages 3 and 5. The data indicate that under certain conditions an extra application of N at heading can increase yield, and further, this response can be amplified by the addition of sulfur. One caveat about this study is that residual N from the previous corn crop at LEX resulted in extensive lodging in 2022, so we did not get as clean an estimate of yield as we were hoping for that year. The soil test data (not shown) tell us that Princeton sites usually have more sulfate present in the subsoil and that could be an important source of S for the wheat. In Table 5, after removing the zero N treatment and the S only treatment, the impact of S application on grain yield was assessed in the four environments: LEX 21, LEX22, PRN21 and PRN22. We do not see a significant effect at PRN either year of the study, but there was a significant yield response to S at Lexington in both years of the study.

We have not assessed economic value of the fertilizer treatment yet but that will be done in the final report that will be available on the KSGGA website.

ACKNOWLEDGEMENTS

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Table 1. Mean yield for fertilizer treatments averaged over five wheat varieties and two locations 2021-2022.

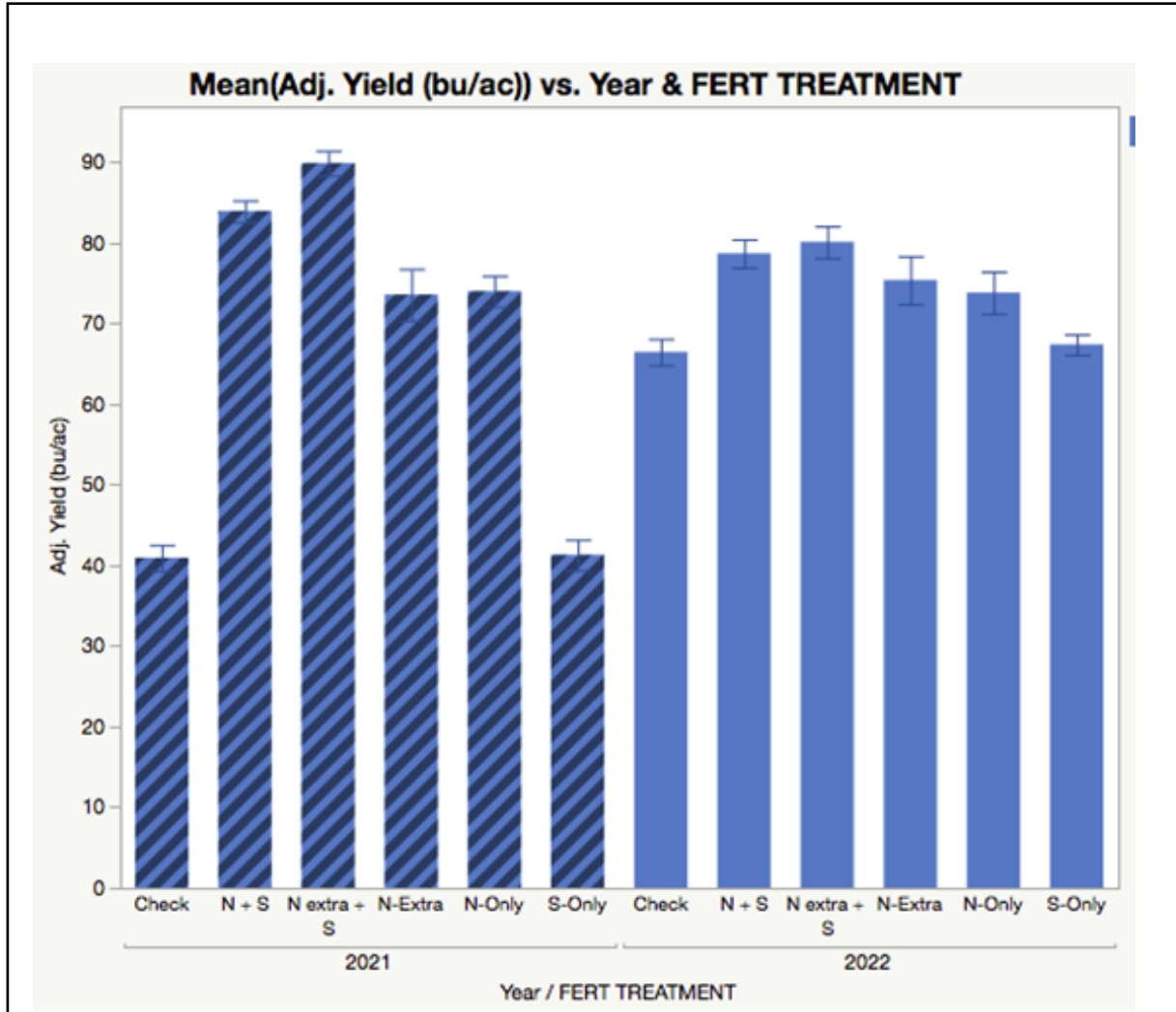


Table 2. Wheat variety response to various levels of N and S averaged over two locations and years, 2021-2022.

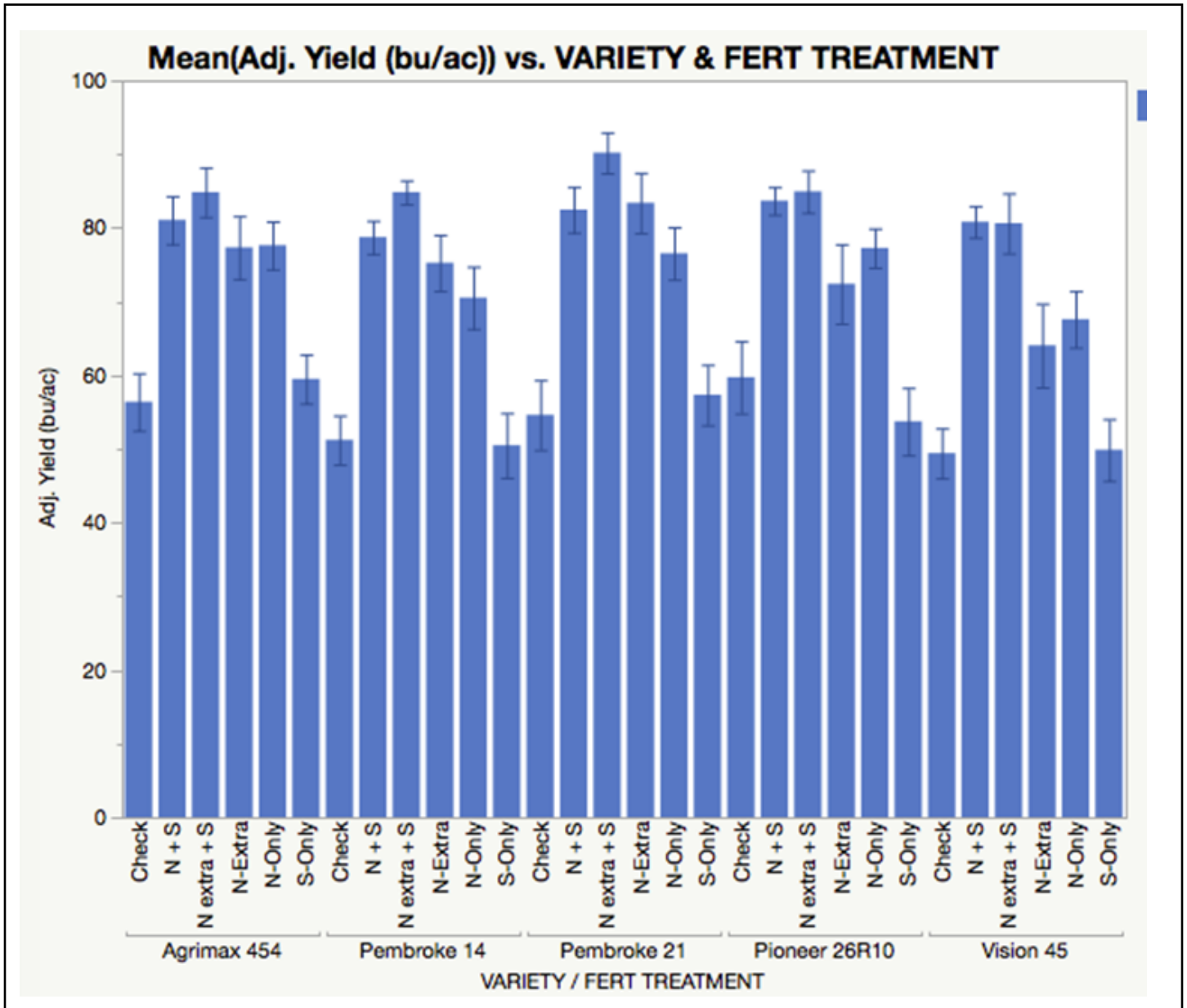


Table 3. Effect of fertilizer treatment on loaf volume in bread baked from 5 wheat varietal flours produced at two locations, 2021-2022.

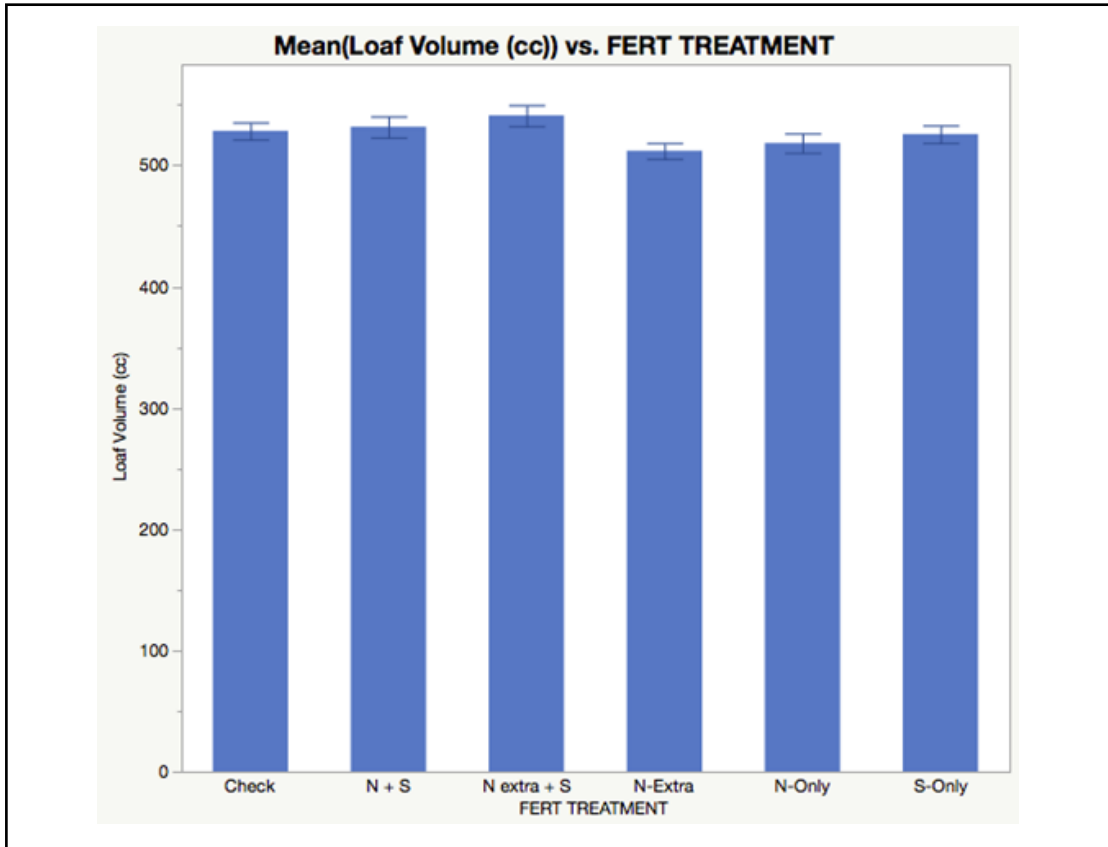


Table 4. Loaf volume of four SRW wheats and one HRW wheat grown at two locations, 2021-2022, averaged over 6 combinations of S and N fertilizer.

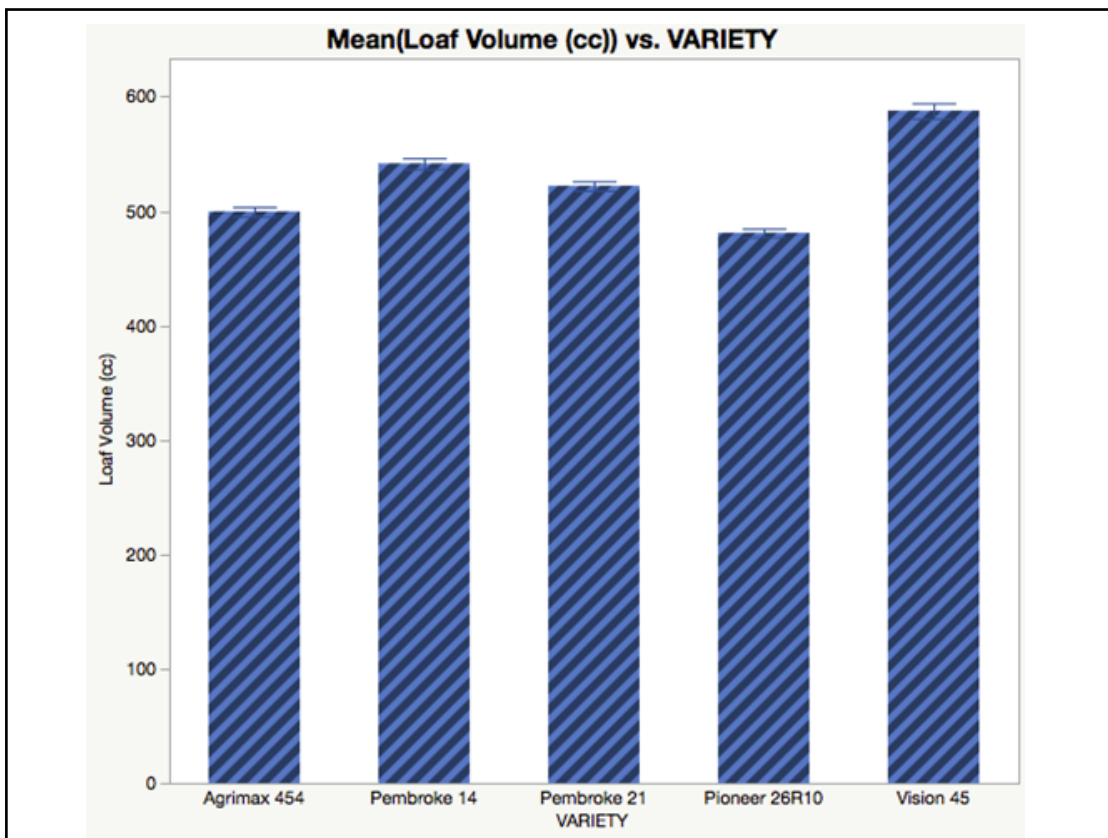


Table 5. Impact of extra sulfur on wheat yield in four environments: Lexington and Princeton over two years, 2021 and 2022. The zero N and S only treatments were excluded from this analysis. Extra S indicated by 1, no extra S by 0.

