

Effect of Intercropping Wheat and Rye on Wheat Yield and Protein Content

Muhammad Suhayl Koodoruth

Department of Sustainable Agriculture,
Kwantlen Polytechnic University

Introduction

- Triticeae is a botanical tribe of grasses including wheat, rye, and barley
- Widely used for food, feed and beverages
- Wheat and rye have been intercropped since early medieval times, and harvested in a mixture called maslin
- Intercropping may improve resource use efficiency and reduce risk of crop loss
- Intercropping may increase protein content of wheat

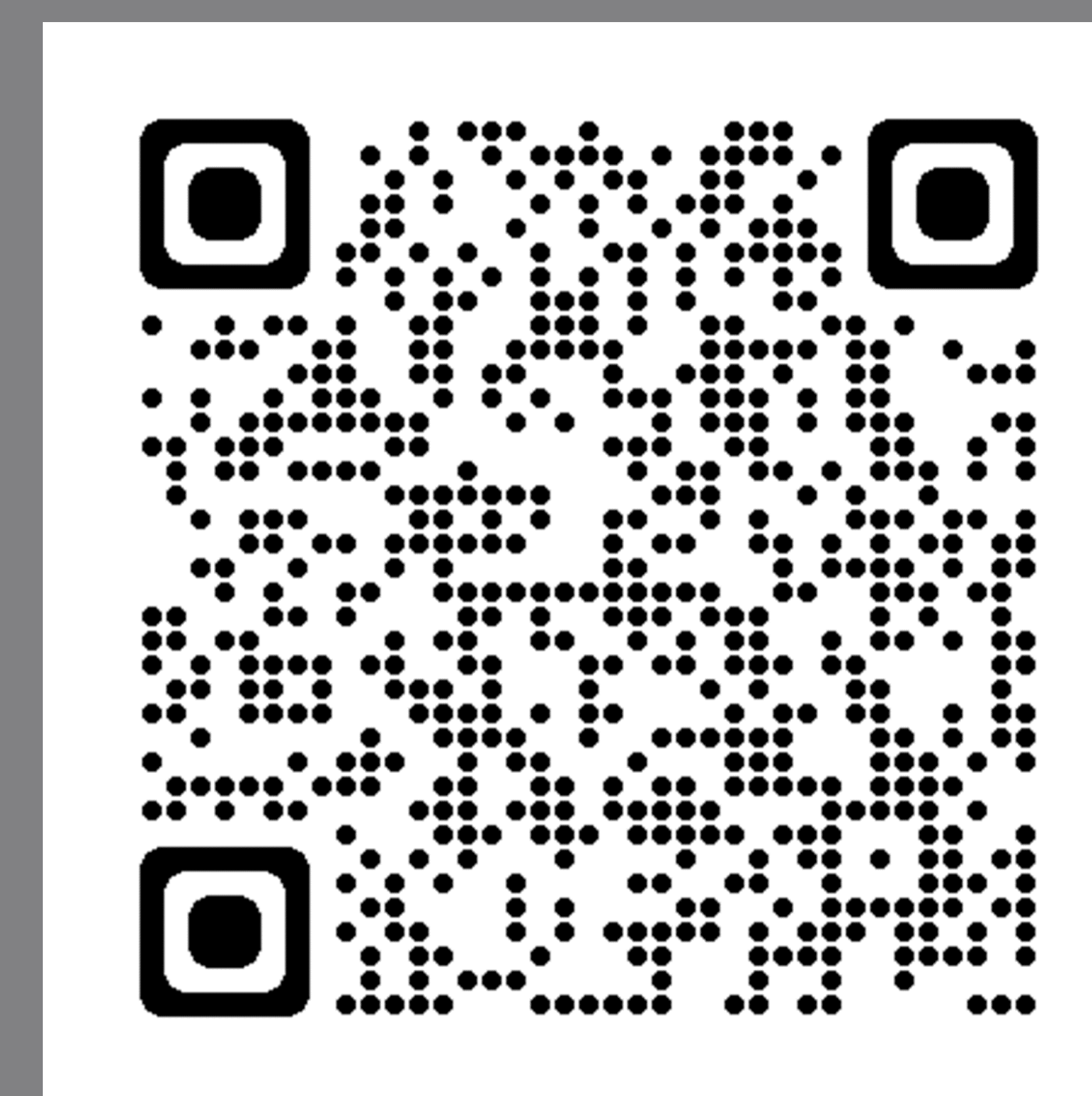
Objective

- Determine intercropping effects on heritage wheat yield and protein content

Methods

- Randomized Complete Block Factorial Design with four replicates, two factors, and four treatments:
 - Wheat variety factor:
 - cv. 'Kamut'
 - cv. 'Red Fife'
 - Intercropping factor:
 - Wheat monoculture (150 seeds/m²)
 - Wheat mixed with rye (cv. 'Gazelle') (75 seeds/m² for each crop)
- Direct-seeded on June 29th, 2023
- Hand weeded 1 and 2 weeks after seeding
- Harvested October 25, 2023 (118 days after seeding)
- Dry weight of wheat recorded after hand harvest, drying, threshing, and winnowing
- Wheat grain samples tested for protein content by protein combustion method (Dumas) AOAC 990.03
- Statistical analysis: ANOVA

Intercropping heritage wheat with rye reduced wheat yield but did not affect protein content.



Results

- Rye did not mature and was not harvested
- 'Red Fife' yield was higher than 'Kamut' (Fig. 1)
- Wheat yield was higher in monocultures than mixtures (Fig. 1)
- Protein content averaged $10.8 \pm 0.8\%$ across treatments, and was not correlated with yield

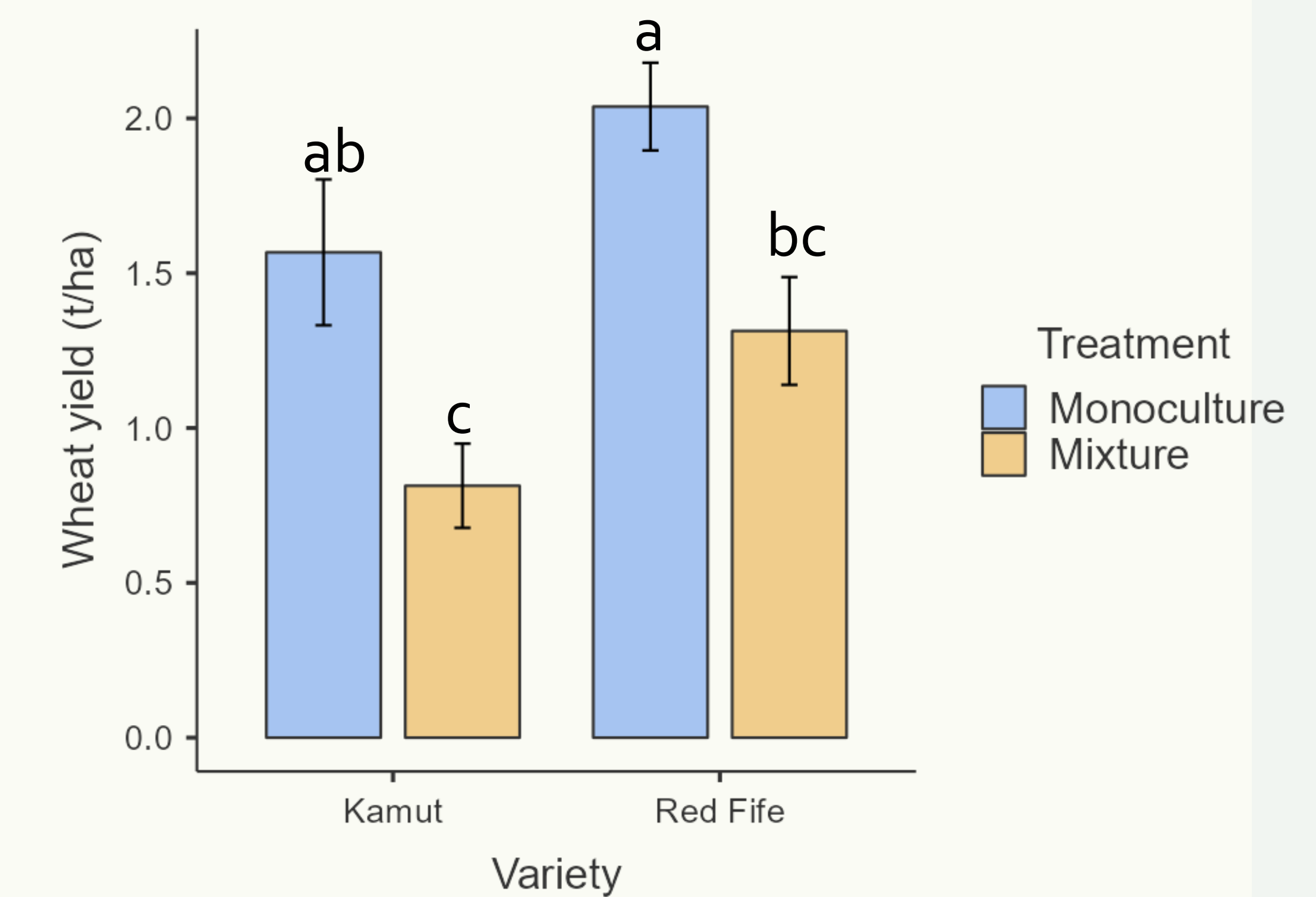


Figure 1. Yield of 'Kamut' and 'Red Fife' wheat varieties in monocultures and 1:1 mixtures with 'Gazelle' rye. Error bars denote standard error. Means labelled with the same letter do not differ significantly (Tukey test, $\alpha = 0.05$)

Conclusion

- Although wheat variety and rye intercrops both influenced wheat yield, no relationship was observed between wheat yield and protein content.
- Millers prefer wheat with a protein content above 10.5%. Other studies have found protein content to be negatively correlated with yield and density, but positively correlated with nitrogen fertilization and weed pressure. Protein content in this study was mostly above 10.5%, but did not vary with the experimental factors tested.
- Both 'Red Fife' and 'Kamut' are heritage varieties of wheat, which tend to have lower yields than modern varieties. The average yield in this study was 1.4 ± 0.1 t/ha, compared to an average Canadian wheat yield of 2.4 – 3.5 t/ha since 2019.

Acknowledgements

- Thank you to the KPU Student Research & Innovation Grant 2023 for funding this research study.
- Thank you to Dr. Mike Bomford, Dr. Rebacca Harbut, Dr. Alex Lyon, Andy Smith, and Sahar Zandieh for their guidance & expertise.