Pewhe 2 summer harvest update

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Summary

Perennial wheat yield data is acceptable, averaging 2166 kg ha.

Winter wheat yield data is not acceptable due to bird damage and should be discarded.

Thousand kernal weight data for both perennial wheat and winter wheat is not acceptable, ranging from 5 - 19 grams per 1000 seeds when we expect 25 - 50.

Conversions

Quadrat dimensions were 20" x 20" for estimating yield. However, row spacing was 12", meaning a 20" x 20" quadrat only measured a single row for a length of 20". As a result, when computing yield on an area basis, use 12" x 20" as the area basis for yield.

Quality assurance and quality control of data

Summer harvest (12Jul2023) occurred after winter wheat checks reached maturity and before perennial wheat checks were in soft dough. Bird damage already occurred to winter wheat when it ripened in early July and we did not want to risk bird damage to the perennial wheat as it began to ripen in mid-July.

Table 1: Expected yield values of winter wheat and perennial wheat. Winter wheat estimates from University of Minnesota winter wheat variety trials (Wiersma and Anderson 2024). Perennial wheat estimates from Snapp (2014) and Clark et al. (2019). All estimates are approximate.

	quadrat (bu/a)	quadrat (kg/ha)
winter wheat	50 - 80	3362 - 5380
perennial wheat	25 - 40	700 - 2017

Table 2: Expected thousand kernel weight (TKW) values for winter wheat and perennial wheat (Wang et al. 2023; Clark et al. 2019).

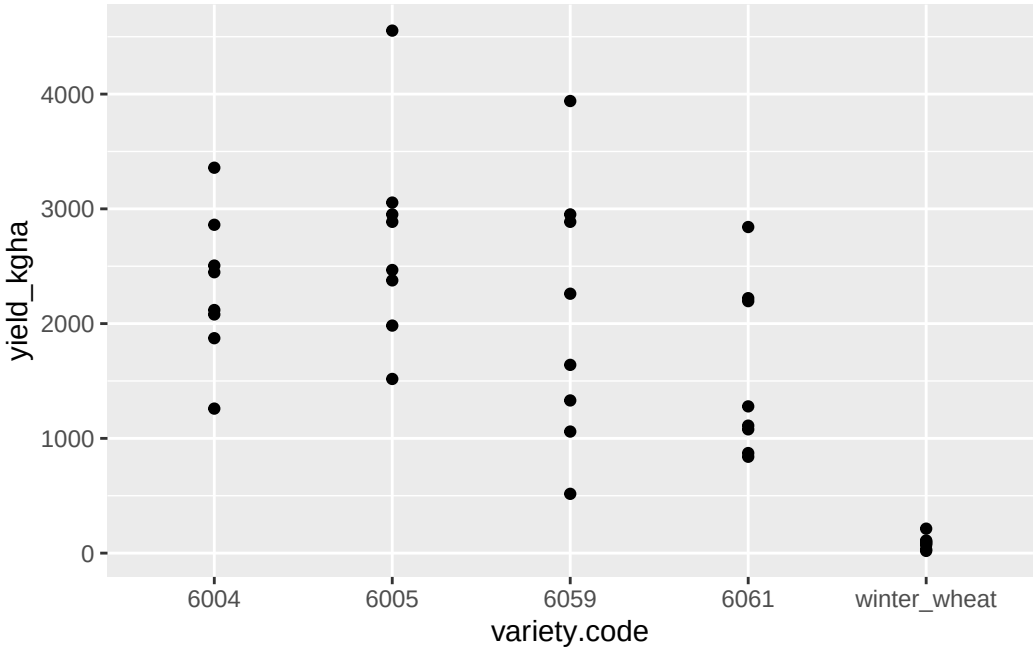
	Thousand kernal weight (grams per 1000 seeds)
winter wheat	30 - 50
perennial wheat	25 - 50

Are yield estimates reasonable? Yes for perennial wheat, no for winter wheat

Perennial wheat yields range from 1000 - 2000 kg ha. These are values we expect and are somewhat surprising since they come from the summer harvest (12Jul2023) when it was unclear if seeds had fully left the milk stage. There was concern that this harvest was too early and the seeds had not yet achieved maximum dry matter content, yet these yield estimates suggest the seeds may not have been harvested too early.

No obvious outliers. Homogeneity of variance. Normally distributed.

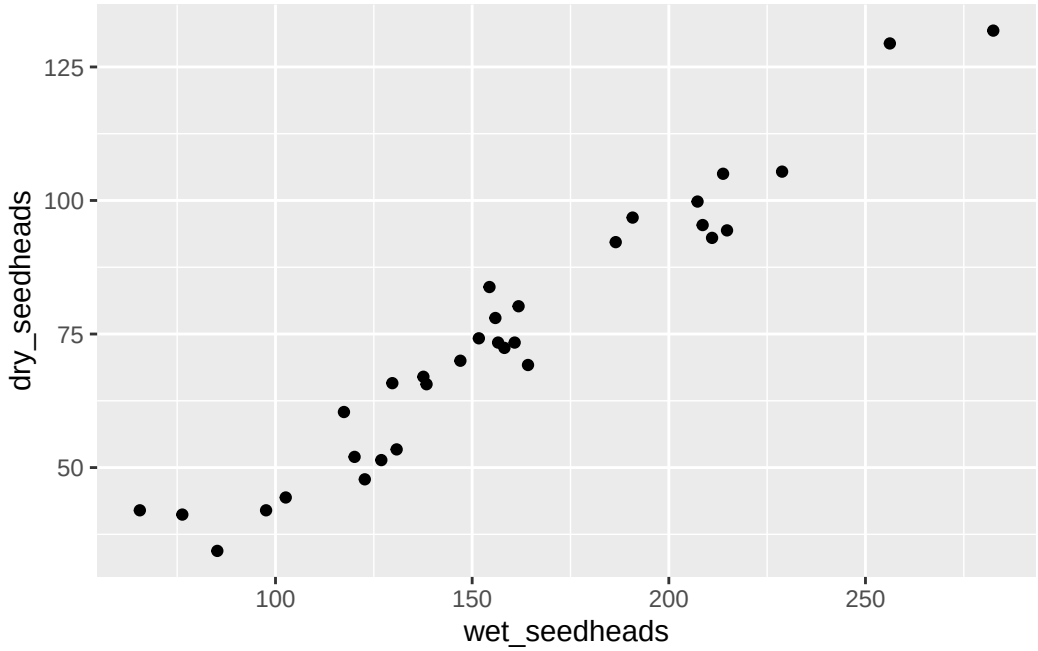
Winter wheat yields average around 90 kg ha because birds damaged the plots and removed seed prior to harvest. This data should be discarded.

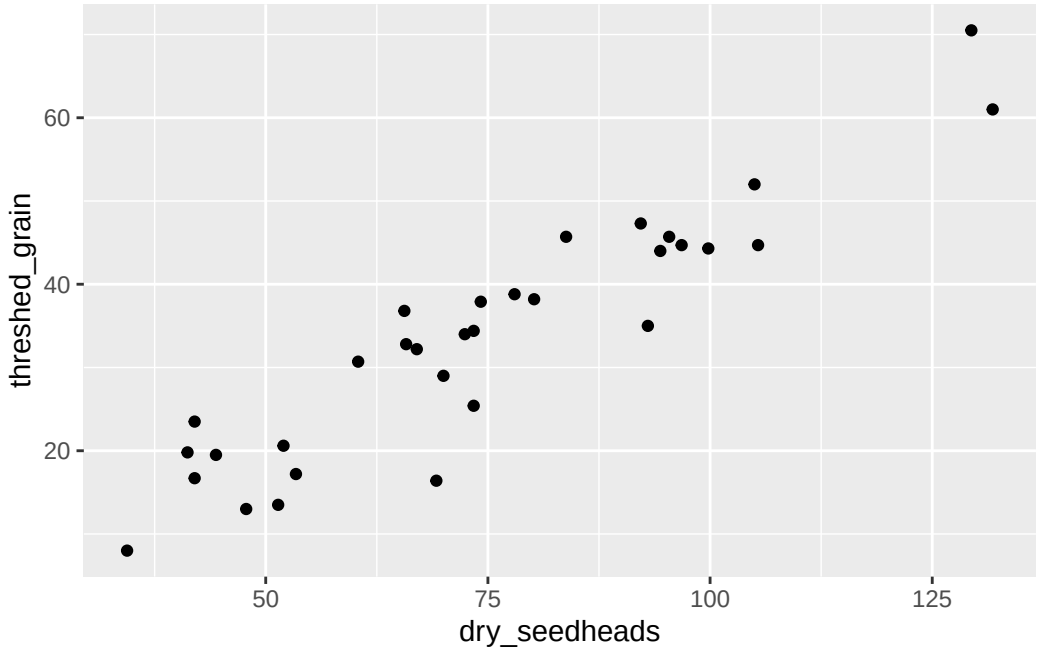


Are weights of wet seedheads, dry seedheads and threshed grain correlated? Yes.

We expect weights of wet seedheads to be correlated with dry seedheads and threshed grain. If there is not a correlation, then we expect an issue with processing or data entry.

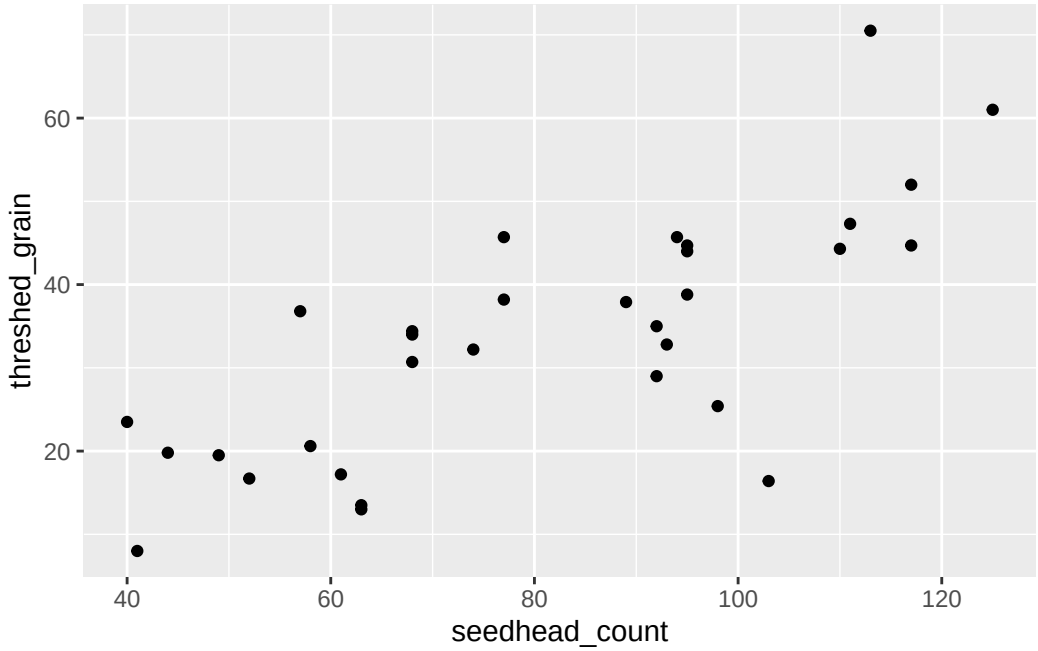
Strong positive correlation is good and provides support for collecting this data during processing. If threshed grain data was lost, we could predict that value based off wet or dry seedhead weight.


125
100
75
50
dry_seedheads
100
150
200
250
wet_seedheads


60
40
20
threshed_grain
50
75
100
125
dry_seedheads

Does seedhead count correlate with threshed grain weight? No.

We also collected seedhead count data prior to threshing. Seedhead count does not correlate strongly with threshed grain weight.

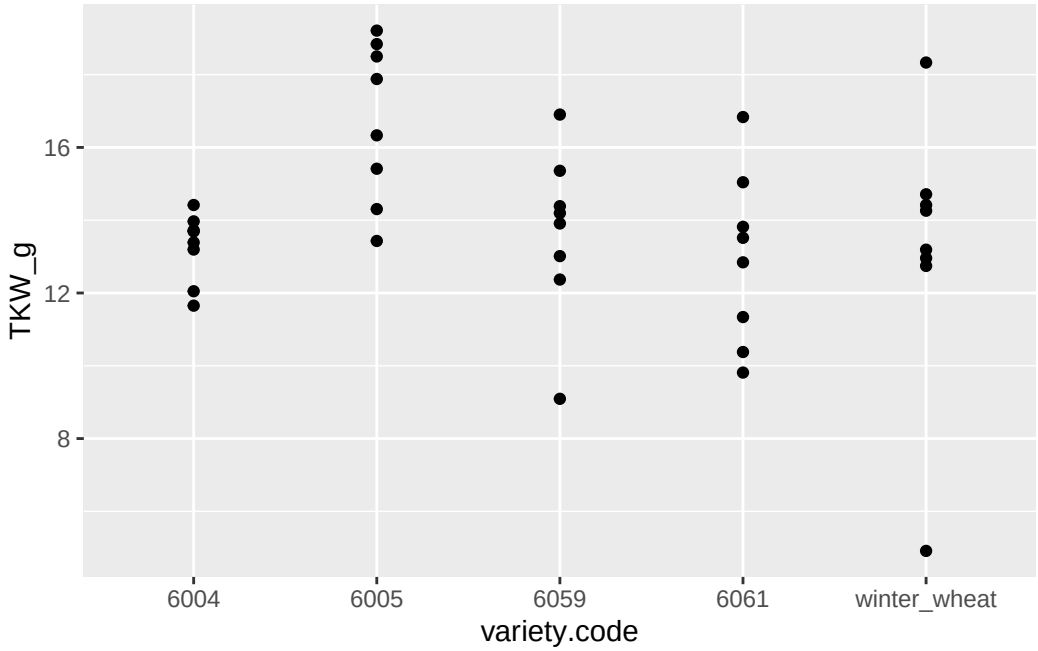


Are thousand kernal weight valuables reasonable? No, they are low.

Thousand kernal weight (TKW) values range from 5 to 19. We expect 25 to 50. This may indicate that the 12Jul harvest was too early, however if this was the case we'd expect the TKW for winter wheat to be in the expected range since it was fully ripe when harvested.

Another explanation is an error with the Marvin. The wheatgrass equation rather than the wheat equation was used for counting seeds and computing thousand kernal weight. If the program had thresholds for smaller seeds from the wheatgrass equation, it may have counted split seeds, resulting in an inflated seed count and thus a lower TKW. However, the seed count values seemed reasonable.

We will try to clean samples more and rescan to see if TKW values become more expected. If this does not solve the problem, we will scan the summer redo samples to see if TKW values become more reasonable.



References

Clark, Ian, Stephen S. Jones, John P. Reganold, Karen A. Sanguinet, and Kevin M. Murphy. 2019. "Agronomic Performance of Perennial Grain Genotypes in the Palouse Region of the Pacific Northwest, USA." *Frontiers in Sustainable Food Systems* 3 (May). https://doi.org/10.3389/fsufs.2019.00039.

Snapp, Sieg. 2014. "Perennial Wheat E3208." https://www.canr.msu.edu/wheat/uploads/files/Perennial_Wheat_(E3208).pdf.

Wang, Keyi, Liping Shi, Bangyou Zheng, and Yong He. 2023. "Responses of Wheat Kernel Weight to Diverse Allelic Combinations Under Projected Climate Change Conditions." *Frontiers in Plant Science* 14. https://doi.org/10.3389/fpls.2023.1138966.

Wiersma, Jochum, and Jim Anderson. 2024. "Winter Wheat Field Crop Variety Trials." https://varietytrials.umn.edu/winter-wheat.