

Effects of Alternative Management Practices on the Abundance and Diversity of Arthropods in a Mixed-crop Agroecosystem

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Figure 1: Summer fallow plot before grazing.



Figure 2: Summer fallow plot after grazing.



Introduction

Traditionally, insect pest management in small grains, pulse crops, and alfalfa primarily involved the use of insecticides that are not only costly but potentially detrimental to the environment. The current trend is to minimize the reliance on pesticides by incorporating other means of pest management such as cultural, mechanical, and biological controls. Thus, our research goal is to further investigate the potential for using sheep grazing to reduce both pest numbers and insecticide use.

Objective

In an agricultural system involving four crops (pea/hay barley, alfalfa, and wheat) under three weed management schemes (graze fallow, mechanical fallow, and chemical fallow) with a three-year rotation, our primary objective was to measure the relative densities of common and agriculturally-important insects (as well as spiders and mites).

Methods

Sweep nets were used to sample insects within foliage along transects through the center of each plot. Sweep samples were taken in each of the 45 plots 9 times in the summer of 2010 and 7 times in 2011 (50 sweeps/sample). All arthropods collected were counted and identified to the lowest possible taxonomic category and then grouped into three ecologically-functional and economically-relevant categories (pests, pollinators, and natural enemies).

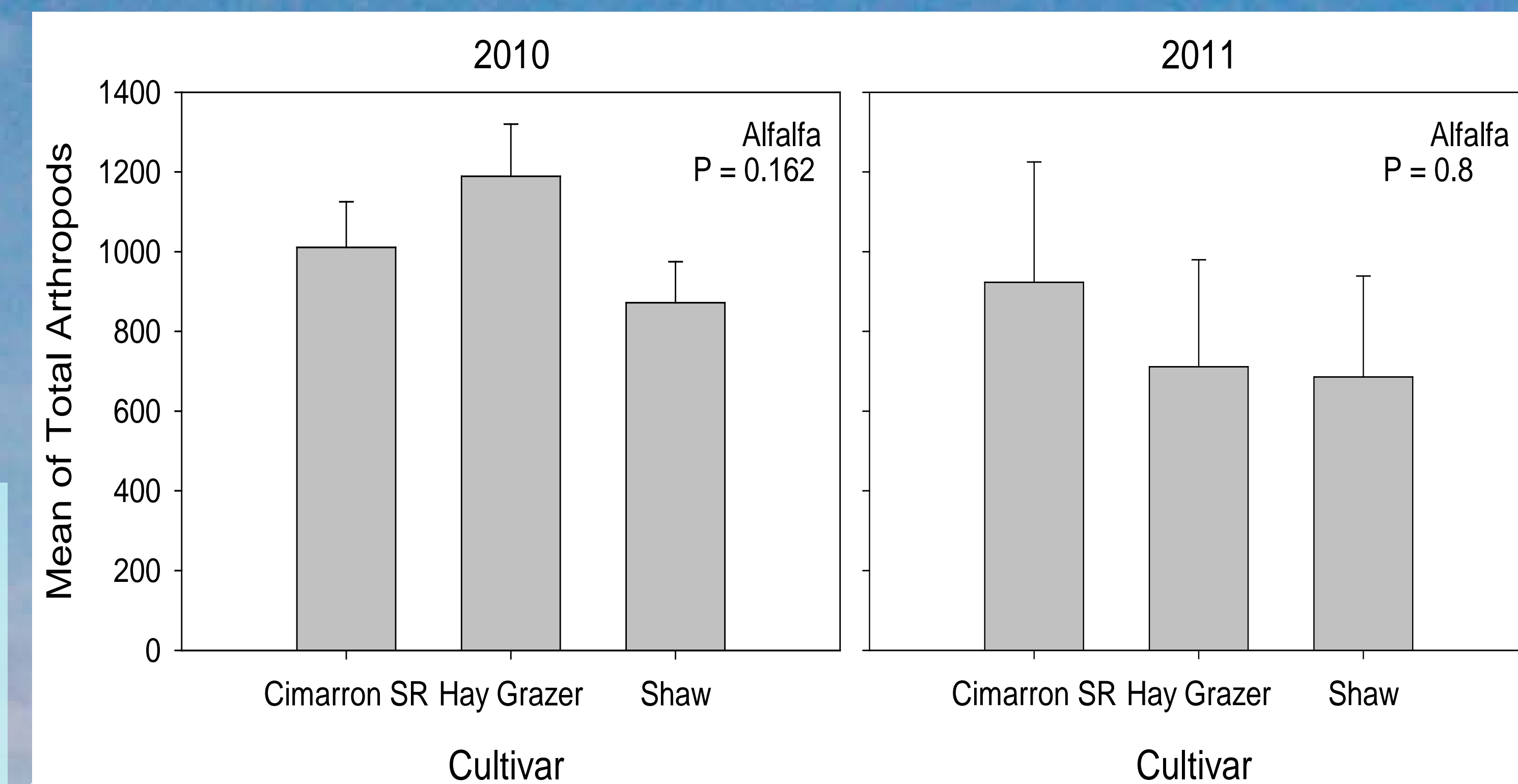


Figure 3: Mean of arthropod abundance in the three alfalfa cultivars for 2010 and 2011.

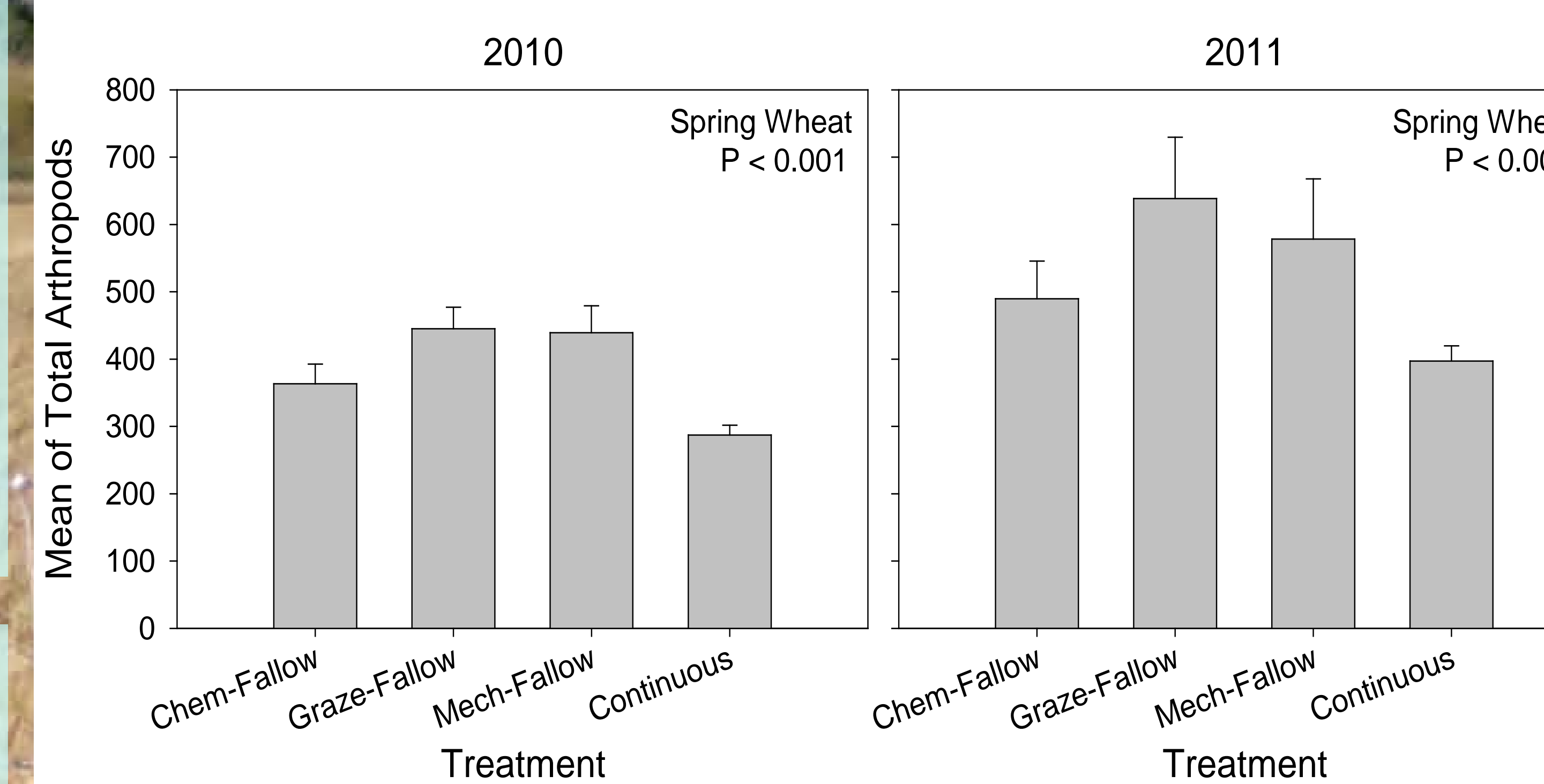


Figure 4: Mean of arthropod abundance in spring wheat for 2010 and 2011.

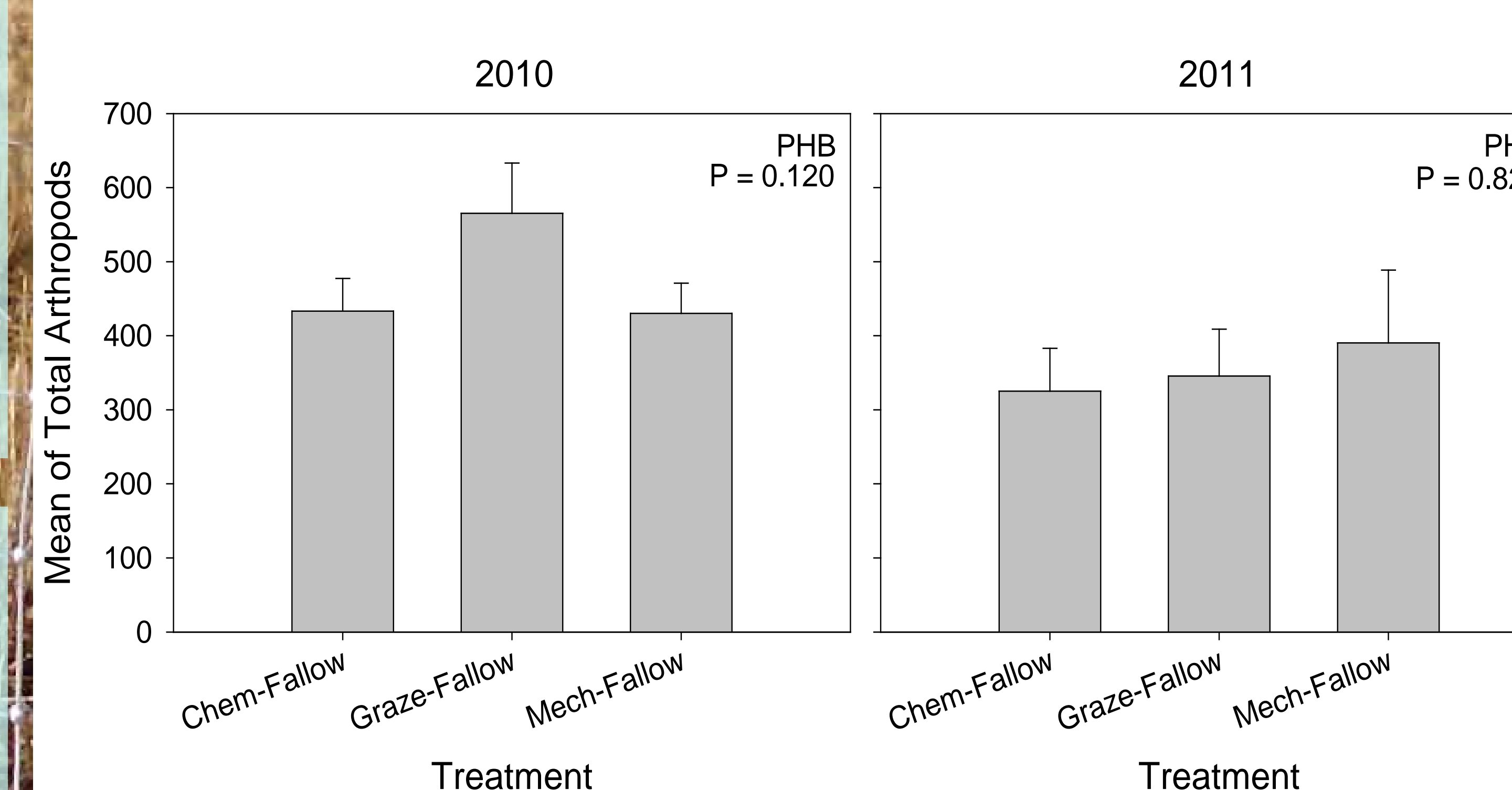


Figure 5: Mean of arthropod abundance in pea hay barley for 2010 and 2011.

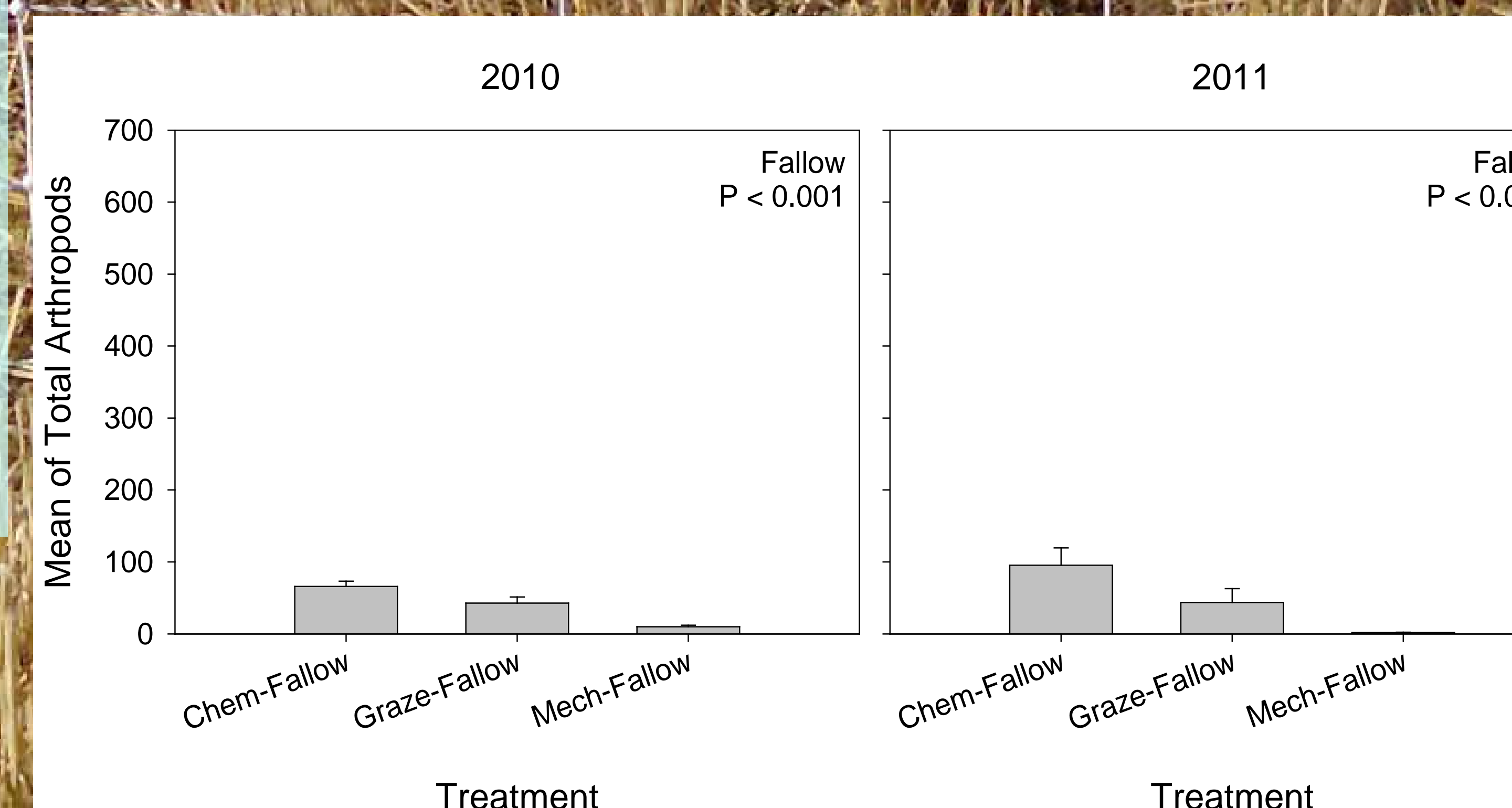


Figure 6: Mean of arthropod abundance in fallow for 2010 and 2011.

Results

Arthropod abundance was not statistically different among the three alfalfa cultivars for 2010 ($P = 0.16$) and 2011 ($P = 0.80$). There was also no difference in arthropod abundance among the pea/hay barley plots with different fallow treatments for 2010 ($P = 0.12$) and 2011 ($P = 0.82$). However, there was a difference in arthropod abundance among the summer fallow plots with different fallow treatments in both 2010 ($P < 0.001$) and 2011 ($P < 0.005$). There was also arthropod abundance difference observed among the spring wheat plots in both 2010 ($P < 0.001$) and 2011 ($P < 0.005$).

Conclusions

In 2011, the most abundant insect species associated with alfalfa was the alfalfa weevil larvae and the results suggest that the three alfalfa cultivars had no difference in tolerance against this common alfalfa pest. Crop rotation is a common practice to reduce insect pests. The preliminary results from our study, however, indicate otherwise for spring wheat, though we still need to analyze the data for individual pest species. In both years, continuous spring wheat plots had lower total arthropod abundance compared to the spring wheat rotated with any of the fallow treatments. As there were no continuous pea/hay barley plots, we were unable to conclude at this time whether crop rotations is a better choice than pea hay barley monoculture. Finally, the results suggest that mechanical control was the best practice to reduce insect numbers on summer fallow plots followed by sheep grazing.

Acknowledgments

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