



## ***Genetic diversity and performance of oat variety blends***

**Abstract:** *Iowa farmers who typically use a two-crop (corn/soybean) rotation could benefit from adding a third crop to reduce weed and pathogen problems, while improving soil quality. Oat is one of the most common alternative crops in Iowa, but has been hindered by unreliable yields. The potential performance increase in oat variety blends over pure-line varieties was investigated.*

### **Background**

Adding a third crop, such as oats, to the traditional corn/soybean rotation could result in significant economic and environmental benefits for Iowa farmers. Wider adoption of oats in Iowa cropping systems is hindered by unreliable yields of oat. Farmers who presently grow oats use stands of pure-line varieties. But a blend of two or three varieties of oats (known as a varietal blend) has the potential to produce more consistent yields than a pure-line variety. The genetically different plants in a varietal blend compensate for each other's weaknesses in different environments and require no additional inputs from farmers.

Previous research on oat and other crops has provided varying results about the benefits of blends vs. pure-line varieties. A confounding factor may have been the level of genetic diversity represented by the blend. The project tested this theory by estimating genetic similarity of the varieties in different blends via pedigree analysis and phenotypic traits, and measuring the correlation between genetic diversity and blend superiority. A positive correlation between increased genetic diversity and blend superiority would offer a predictive method for choosing approximate combinations of oat varieties from which to develop blends.

The objectives of this project were to:

- Determine if varietal blends have higher mean yields and better yield stability over varying environments than their component cultivars,
- Identify the best blend combinations of current varieties, and
- Test the hypothesis that varietal blend superiority increases as the genetic diversity of the component varieties increases.

### **Approach and methods**

To simplify mechanical harvesting of plots, blends were developed by mixing cultivars of the same maturity class. Ten midseason maturing oat varieties were grown in all possible two-way combinations, and five early-maturing oat varieties were grown in all possible two- and three-way combinations. The cultivars chosen were varieties currently being grown, and when paired represented a wide range of pedigree similarity.

Each experiment was planted over two years (1998 and 1999) at four Iowa locations (ISU research farms at Ames, Nashua, Crawfordsville, and Lewis). Yield and test weights were measured. Stability was calculated as the variance of a variety or blend yield over all eight environments.

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\$8,000 for one year

## Results and discussion

Blend yields in the early maturity experiment were significantly greater than pure-line yields; however, blend and pure-line yields in the midseason maturity experiment were not different. Although average blend yields were not always greater than pure-line yields in these experiments, they were never significantly lower. This indicates that blending cultivars offers a relatively low-risk opportunity for higher grain yields.

Blend test weights were greater than pure-line test weights in the early-maturity experiment, but not in the midseason maturity tests. In both experiments, the blend with the highest test weight included the best pure-line, indicating that blend performance may be largely determined by pure-line performance. Because the highest ranked test weights in both experiments were produced by pure-line cultivars, and because grain uniformity may be important to farmers who market their grain for milling for human consumption, blending for increased test weight has less potential than blending for increased yield. At the very least, farmers should grow cultivar blends that will produce sufficient grain uniformity to satisfy their marketing needs.

## Conclusions

We found no correlation between genetic diversity and blend performance in either experiment. Closely related cultivars (with similar pedigrees) were no more stable or high-yielding than distantly related cultivars. Additionally, cultivar pairs with similar heights and

heading dates were no less stable or high-yielding than more diverse pairs, and a genotypic diversity had no impact on test weight. Thus, pedigree relationships or phenotypic traits are not good predictors of blend yield, test weight, or stability. A possible reason for the lack of any correlation is that, no matter how diverse their pedigrees, spring oat varieties are not phenotypically dissimilar enough to exploit different ecological niches.

## Impact of results

Increasing and stabilizing oat yields would encourage Iowa's farmers to include oats in their crop rotation. Adding this crop would help reduce erosion and chemical use while diversifying farm income. The project showed that although blending results in only a slight improvement in performance on average, blending can increase yield and stability significantly for some cultivar pairs. However, we have not, however, developed a reliable method to predict which cultivar pairs will show a large increase in yield. Though each small increase in oat yield and stability encourages farmers to grow more oats, further investigation of physiological traits in relation to competition and blend performance would help us choose the best combination of varieties to include in blends.

## Education and outreach

Two papers on cultivar blend response are in progress. Information on the project will be included in the variety trial bulletin for 2001.

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