

Examination of heterosis in yellow mustard to determine
the feasibility of developing hybrid cultivars.

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ABSTRACT

Yellow mustard (*Sinapis alba* L.) has shown the potential of being an alternative crop in rotation with small grain cereals in the Pacific Northwest of the U.S.A. Other related *Brassicaceae* species have shown moderate heterosis, and hybrid cultivars have been developed with increased yield. However, no yellow mustard hybrid cultivars exist due primarily to the lack of research examining whether or not hybrid yellow mustard offers any commercial advantages compared to open pollinated cultivars.

The purpose of this study was to examine heterosis in yellow mustard, to determine which pre-harvest morphological traits and yield components were responsible for the manifestation of heterosis, to investigate inbreeding depression, and to examine techniques of developing double haploid lines used for hybrid development.

Six inbred parental lines were hand-pollinated in a full diallel design to obtain 30 F₁ hybrids and 6 selfed lines. These hybrids and selfed lines, along with two open pollinated lines ('AC. Pennant' and 'IdaGold'), were used in field evaluation trials at two locations in 1999 and 2000.

Compared with other *Brassica* species studied, yellow mustard exhibited much greater heterosis for seed yield. Positive high parent heterosis for yield was found in over 77% of all hybrids examined. The highest heterosis among the hybrids was almost 90%, higher than that of most productive parents. The yield of the best hybrid was 7% and 14% higher than the commercial cultivars, IdaGold and AC. Pennant, respectively. The oil content of hybrids was lower than their parents, showing negative heterosis. Heterosis was absent for thousand seed weight.

A high proportion of observed variation for yield was genetic in nature, and narrow sense heritability was 53%. General combining ability and special combining ability were significant at 0.001 and 0.01 level, respectively. Additive genetic variance was greater than dominant genetic variance for most characters examined. For yield, additive variation accounted for 51% of the total genetic variance, while dominant variation accounted for 34% of the total genetic variance. Based on multiple regression analysis, hybrids produced higher yield than parental lines because of increased plant height, earlier flowering, and earlier maturity. Reciprocal effects were found in all characters, and parental choice will be important in hybrid cultivar development.

Yield and oil content of Yellow mustard were severely depressed by successive rounds of self-pollination. These results might have been expected given the results obtained for heterosis, which many believe to be directly related to inbreeding depression in crop species. Yellow mustard has strong self-incompatibility and this trait could be used in developing cost-effective hybrid seed production systems.

