

Evaluation of Hybrid Vigor between Different Alfalfa Varieties

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near Boone, IA) in 2004 and 2005, based on
four harvests each year.

Introduction

Since 1983 there has been no yield increase of alfalfa in the United States and even some decrease in parts of the Midwest. Alfalfa yield could be increased in two different ways. The first way would be to produce hybrid or semihybrid varieties that could outyield current cultivars due to hybrid vigor. To be able to produce hybrids, distinct alfalfa germplasm with different genetic backgrounds are crossed. The second method would be to increase regrowth ability in order to add one more harvest per year. The cultivars that are grown in the southwestern states are genetically distinct from those grown in Iowa and also are known to have the ability to regrow faster. These two features of southern alfalfa varieties make them attractive for cultivar improvement in Iowa. However, because southern cultivars do not have adequate cold resistance to be able to survive in Iowa winters, we have selected winter hardy populations from each cultivar over the past several years.

The aim of this experiment was to test whether we observed hybrid vigor when the adapted southwestern winter-hardy populations (ASW) were crossed to elite midwestern cultivars (EMW).

Materials and Methods

We chose four ASW and four EMW and intercrossed them in all pairwise combinations in the greenhouse during the summer of 2003. We evaluated the performance of all the possible crosses at two locations in Iowa (Northeast Research Farm near Nashua, IA, and

Results and Discussions

We had expected to find that EMW \times ASW crosses would perform better than other groups, but our results showed that they did not perform better at any harvest or in total yield (Table 1). The EMW and their crosses performed best; the ASW and their crosses performed worst. In general, the intergroup crosses performed closer to EMW than ASW. Our analyses also indicated that particular hybrid crosses produced highly significant yield increases compared with current midwestern cultivars (data not shown), suggesting that these particular crosses may be useful in a future semi-hybrid cultivar development program to improve yield.

At the early harvests, EMW had a better performance than ASW, but toward late harvests cold-tolerant southwestern cultivars and their hybrids yielded similarly, with a statistically nonsignificant trend toward a higher yield. A fifth harvest, taken after the critical autumn period, would likely have shown an advantage to EMW \times ASW hybrids. Thus, the intergroup crosses have potential to overcome the yield stagnation problem of the Midwest, both by improving yield per se and by enabling a fifth harvest in autumn.

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Table 1. Average yield of five groups of alfalfa entries in each of harvest and average yearly total yield per plot at the Northeast Research Farm in 2004 and 2005.¹

Group	May	June	July	August	Total
Elite midwestern cultivars (EMW)	732 a ²	653 a	606 a	465	2452 a
Adapted southwestern populations (ASW)	515 c	531 b	531 b	469	2037 b
Crosses between EMW	723 a	638 a	599 a	479	2444 a
Crosses between ASW	592 b	567 b	593 a	486	2246 b
Crosses between EMW × ASW	627 b	609 a,b	624 a	513	2371 a

¹Harvests are taken at the end of each month.

²Mean values with different letters within a column are different at P=0.05.