Advances in Hairy Vetch Breeding for Cover Crop Use

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Although cover crops can supply forage and provide ecosystems services, few improved varieties exist. The Cover Crop Breeding network has developed new experimental varieties of various cover crop species. Selection has targeted traits of interest to growers and seed companies, including fall vigor, biomass, winter survival, maturity timing, seed traits, and allelopathy. These new experimental varieties are being tested in a nationwide network of 14 evaluation sites. Here we report hairy vetch (*Vicia villosa* Roth) breeding progress.

Among 37 selections environments, we phenotyped 65,825 individual genotypes from 1091 half-sibling families for emergence, fall vigor, spring vigor, winter survival, flowering time, determinacy, disease, pubescence, and seed yield. Of these genotypes, 4408 were also phenotyped for hard seed and pod shatter. Narrow-sense heritabilities calculated using pedigree relationships were moderate to high for some traits, such as flowering time (h^2=0.32), indeterminancy (h^2=0.42), and hard seed (h^2=0.48). We observed slightly negative phenotypic correlations among some traits, such as between indeterminancy and flowering time (r=-0.135 p<0.001). Without strong tradeoffs between traits of interest to growers and seed companies, selection for multiple traits seems possible.

Advanced line trials identified 17NC-Early, a very promising broadly adapted experimental variety (Table 1). 17NC-Early produced more biomass than all commercially available varieties in 34 out of 50 test environments. 17NC-Early also had higher seed yield and fall vigor than all commercially available varieties. Forage testing of experimental varieties indicates that hairy vetch has extremely high quality, but toxic compounds may be present.

Table 1. Performance of 17NC-Early and 18MD experimental lines compared to commercially available checks across 50 environments. Traits include the percent of environments in which the entry performed in the top 20% for biomass yield; biomass yield (% of best check); fall vigor (% of best check); and seed yield (% of best check). The best check variety was Hungvillosa in 2019 and AU Merit in 2020-2021.

Hairy vetch entry	Environments where top ranking for biomass	Biomass	Fall vigor	Seed yield	Release priority
	------ % ------	---------- % of best check ----------			
17NC-Early	**68**	**103**	**101**	**119**	**1**
18MD	32	104	94	123	2
Albert Lea Organic VN	0	84	92	86	Check
AU Early Cover	0	74	89	88	Check
AU Merit	25	100	100	100	Check
Bailey Seed Oregon VNS	--	--	--	100	Check
Hungvillosa	14	96	82	110	Check
Purple Bounty	6	89	81	98	Check
TNT GS3 Quality See	--	--	--	79	Check

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