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Natural Areas for Soybean Cultivar Recommendations in Alabama

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NATURAL AREAS FOR SOYBEAN CULTIVAR RECOMMENDATIONS IN ALABAMA

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CROP CULTIVAR performance tests are normally conducted at several locations within a state. Soybean [*Glycine max* (L.) Merr.] cultivar performance tests are currently being conducted at nine locations throughout Alabama.[1] As many as 11 locations have been used in some years. Multiple locations are used because of the presence of cultivar x location interactions.[2]

Although a particular cultivar may yield extremely well at one location, the same cultivar may do poorly at another location, even when averaged over a period of several years. Thus, a farmer who lives near one of the testing locations can use the results of that test location as a guideline for selecting a soybean cultivar. However, many soybean farmers in Alabama either do not live near a test location, or live approximately equidistant from two or more locations. A farmer in this situation may have difficulty in deciding which location to use as a guideline, especially if those locations give conflicting results.

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[1]Granade, G.V., and D.B. Weaver. 1983. Performance of Soybean Varieties in Alabama, 1982. Ala. Agr. Exp. Sta., Agronomy and Soils Dept. Series 81.

[2]Weaver, D.B., D.L. Thurlow, and R.M. Patterson. 1983. Stability Parameters of Soybean Cultivars in Maturity Groups VI, VII, and VIII. Crop Sci. 23:569-571.

Some locations, however, may be similar in predicting yield potential within a given area of the State. For example, two locations may be different in inherent yield potential, but relative ranking of cultivars for yield may be the same at both locations, indicating no cultivar x location interaction would exist between the two locations. A farmer living within the area of the two locations could rely on cultivar test data from both locations, and thus have more available data on the cultivars he is considering for planting. The Alabama Cooperative Extension Service currently recommends soybean cultivars on a regional basis within the State, dividing Alabama into northern, central, and southern areas.

Extensive research has been conducted to examine the nature and effect of cultivar x location interactions. Few experiments have been conducted for the purpose of dividing states or regions into natural areas for making cultivar recommendations. Horner and Frey examined cultivar x location interaction effects for making oat cultivar recommendations in Iowa.[3] The purposes of the present experiment were to: (1) examine cultivar x location interaction effects for soybean variety test locations in Alabama, (2) determine if natural areas for cultivar recommendations exist within the State, and (3) determine if current Alabama Cooperative Extension Service recommendations based on northern, central, and southern regions are valid.

Data from the Alabama soybean variety test from 1977 to 1981 were analyzed. Standard cultural practices were followed, and experimental procedures are described in the published Alabama Soybean Variety Test reports.[1] In the statistical analyses, years, replications, and cultivars were considered random factors, and locations were considered a fixed factor. Only cultivars common to the locations involved were included in the analyses. In determining the significance of the cultivar x location interaction, the year x cultivar x location interaction mean square was used as the denominator in the F-test.

Pair-wise comparisons between locations were used as a starting point for defining areas of similarity, see table. Cultivar

[3]Horner, T.W., and K.J. Frey. 1957. Methods of Determining Natural Areas for Oat Varietal Recommendations. Agron. J. 49:313-315.

CULTIVAR x LOCATION INTERACTION MEAN SQUARES FOR PAIR-WISE COMBINATIONS OF VARIETY TEST LOCATIONS IN ALABAMA[1]

	Fairhope	Brewton	Headland	Monroeville	Prattville	Winfield	Marion Junction	Camden	Shorter	Belle Mina	Crossville
Fairhope [2]	—	1384 (0.01)	—	—	—	—	—	—	—	96 (0.01)	—
Brewton	—	—	—	—	125 (.01)	81 (.01)	167 (.01)	1159 (.03)	—	257 (.01)	114 (.03)
Headland	—	—	—	—	116 (.01)	104 (.04)	111 (.04)	1608 (.02)	—	245 (.01)	149 (.08)
Monroeville	—	—	—	—	89 (.04)	75 (.05)	121 (.01)	1121 (.01)	38 (.01)	181 (.01)	112 (.04)
Prattville	—	—	—	—	—	—	1426 (.01)	—	—	—	—
Winfield	—	—	—	—	—	—	—	—	—	—	64 (.08)
Marion Junction	—	—	—	—	—	—	—	—	—	211 (.01)	153 (.01)
Camden	—	—	—	—	—	—	—	—	58 (.01)	—	48 (.04)
Shorter	—	—	—	—	—	—	—	—	—	—	—
Belle Mina	—	—	—	—	—	—	—	—	—	—	—
Crossville	—	—	—	—	—	—	—	—	—	—	—

[1]Significance levels are in parenthesis. Only mean squares significant at the 0.10 or lower probability level are reported.

[2]Only 2 years' data are available for comparison of Shorter with all locations except Monroeville and Camden, which have 1 year's data.

x location interactions for every possible combination of two locations were examined. Only those interaction mean squares significant at the 0.10 or lower probability level are reported. If the cultivar x location interaction for any location pair is not significant, this indicates that relative ranking of cultivars at the two locations is the same. If there is a significant cultivar x location mean square, the relative rankings are different, or cultivars likely to perform well at one location may not be the best cultivars at the other location. In general, locations in proximity (Belle Mina and Crossville, for example) tended to have nonsignificant cultivar x location interactions, and locations far apart (such as Belle Mina and Headland) tended to have highly significant interaction effects. Some locations do not fit this pattern. Soybean yields at Fairhope showed a nonsignificant cultivar x location interaction with all locations except Belle Mina and Brewton. This demonstrates the unusual nature of Fairhope as a test location. Not only does it have a significant cultivar x location effect with a nearby location (Brewton), but it has a nonsignificant interaction with several

other locations that are not proximate. Results from Shorter are inconclusive because only 1 or 2 years' data (depending on location) are available for analysis.

In dividing the State into natural areas based on similarities of test locations within those areas, a logical starting point would be to group locations on the basis of latitude into northern, central, and southern areas, as done by the Alabama Cooperative Extension Service. South Alabama would include Brewton, Monroeville, Headland, and Fairhope. Any pair-wise combination of Brewton, Monroeville, and Headland results in a nonsignificant cultivar x location interaction, see table. Fairhope and Brewton, however, had a highly significant cultivar x location interaction (C x L mean square = 1384). Combining all four locations into one analysis, the cultivar x location interaction is not significant (C x L mean square = 47.35), indicating that all four locations could be combined into one area for cultivar recommendation. The magnitude of the cultivar x location mean square can be reduced, however, by the removal of Fairhope from the group (C x L mean square = 34.14). Removal of Brewton from south Alabama group does not result in any reduction in magnitude of the cultivar x location interaction (C x L mean square = 51.51, a slight increase). Thus Brewton, Monroeville, and Headland form a very homogeneous group of locations, and soybean farmers living within this area could use information from all three locations. Addition of Fairhope to the group results in less homogeneity, and farmers in the Fairhope area (Baldwin and Mobile counties) should view data from other south Alabama locations with caution. Reasons for these observed differences are probably related to the higher incidence of late summer thundershowers in the Fairhope area. Beginning in 1982, Monroeville was discontinued as a testing location because of its consistent similarity in cultivar performance to the Brewton and Headland locations. Soybean farmers in the Monroeville area should look at the results of the Brewton and Headland tests when making cultivar selections.

Central Alabama should include Camden, Winfield, Marion Junction, Prattville, and Shorter. Examination of all pair-wise combinations of these five locations shows that the only significant cultivar x location interaction occurs between Marion Junction and Prattville, see table. Camden and Shorter also

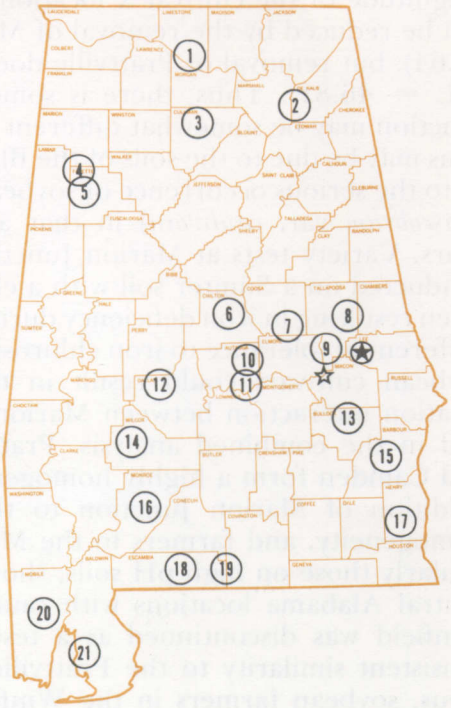
show a significant cultivar x location interaction, but this result is based on data for only 1 year. When all five locations are combined into one analysis, the cultivar x location interaction is not significant (C x L mean square = 44.83). Again, the magnitude of the cultivar x location interaction mean square can be reduced by the removal of Marion Junction (C x L = 33.64), but removal of Prattville does not give a reduction (C x L = 46.81). Thus, there is some indication that Marion Junction may be somewhat different from the other locations. This may be due to the soils of the Black Belt area of Alabama, or to the serious occurrence of soybean stem canker (*Diaportha phaseobrum* var. *caulivora*) in that area for the past several years. Variety tests at Marion Junction have previously been conducted on a Sumter soil with a characteristically high pH, often resulting in iron deficiency during periods of water stress. Differential tolerance to iron chlorosis or stem canker between soybean cultivars could result in the significant cultivar x location interaction between Marion Junction and Prattville, and in the combined analysis. Prattville, Shorter, Winfield, and Camden form a highly homogeneous group of locations. Addition of Marion Junction to the group results in less homogeneity, and farmers in the Marion Junction area, particularly those on high pH soils, should view data from other central Alabama locations with caution. Beginning in 1982, Winfield was discontinued as a test location because of its consistent similarity to the Prattville and Camden locations. Thus, soybean farmers in the Winfield area can depend on results of the Prattville and Camden locations when making cultivar selections.

Belle Mina and Crossville are the two remaining locations, and comprise the area of north Alabama. There was no significant cultivar x location interaction between Belle Mina and Crossville.

Results of these analyses show that the Alabama Cooperative Extension Service's practice of recommending soybean cultivars on the basis of north, central, and south Alabama areas is essentially valid. The Fairhope and Marion Junction locations, however, appear to be somewhat atypical within their particular areas, and cultivar test results from these locations should be viewed critically outside their immediate locales.

Alabama's Agricultural Experiment Station System
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Plant Breeding Unit, Tallassee.
10. Forestry Unit, Autauga County.
11. Prattville Experiment Field, Prattville.
12. Black Belt Substation, Marion Junction.
13. The Turnipseed-Ikenberry Place, Union Springs.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Solon Dixon Forestry Education Center, Covington and Escambia counties.
20. Ornamental Horticulture Substation, Spring Hill.
21. Gulf Coast Substation, Fairhope.