

USE OF A MOBILE NURSERY TO MONITOR PATHOGENIC VARIABILITY IN BEAN RUST.

J.R. Steadman, D. O'Keefe, E. Kerr and D. Lindgren.

Departments of Plant Pathology and Horticulture, University of Nebraska-Lincoln

Rust caused by *Uromyces appendiculatus* (Pers.) Unger var *appendiculatus* causes periodic epidemics in the Great Plains dry edible bean production areas. Most pinto and great northern cultivars are susceptible to some if not all of the races/pathotypes of *U. appendiculatus*. The wide pathogenic variability of the rust fungus is well documented with a recent study identifying 373 pathotypes from 2000 cultures collected from East Africa and North and Central America (Mmbaga et al., 1996. J. Phytopathol. 144:533-541). Pinto 'Olathe' released in 1982 with rust resistance gene Ur-6 remained effective in reducing losses due to rust for a number of years. However, 'Olathe' is now susceptible to all rust pathotypes collected from Nebraska and Colorado. Great northern 'Beryl' has also succumbed to the rust boom and bust cycle in this region.

New pinto cultivars such as 'Chase' with resistance to rust derived from the gene Ur-3 are increasing in planted acreage on the Great Plains. Will this gene or others being incorporated in bean germplasm be overcome by the pathogen when it is in widely grown cultivars? To answer this question we are testing a mobile nursery of bean genotypes with different rust resistance genes. This nursery is placed in rusted bean fields and 8-10 days after exposure, data on disease reaction can be used to evaluate the pathogen virulence.

Because leaf development affects uredinium size, all plants in a nursery must be at the same stage of leaf expansion. Thus, seed is pregerminated before planting. Two seeds of a cultivar/line are planted per pot. The plants should be ready to be taken to the field in 5-6 days, when their primary leaves have just begun to expand. Sets of monitor plants are placed in a rust focus in a field for 2-4 h. A dry windy day is ideal.

After the plants have been exposed in the field, they are placed in a 100% RH mist chamber for 15 h at 18-24° C. The plants can be taken to a greenhouse, screenhouse or left outside. Direct sunlight will cause the leaves to bronze, so the plants will need some type of shading. The primary leaves of the nursery lines/cultivars can be rated for rust reactions 8-10 days after exposure.

The mobile bean nursery was used in 1995 and 1996. Rust resistance genes in this nursery were Ur-3 (Aurora), Ur-4 (Early Galatin), Ur-5 (Mex 309), Ur-6 (Olathe) and Ur-11 (PI 181996). The Ur-4 and Ur-6 genes did not provide complete resistance in Nebraska/Colorado. Ur-6 was susceptible in all locations while Ur-4 was resistant in most locations. Resistance genes Ur-3, Ur-5 and Ur-11 were resistant in all collections. Thus, new cultivars and breeding lines with any one of these three genes (or combinations) would be resistant to the rust pathogen population in the region.

The results of the mobile bean nursery were tested for agreement by collecting five bean leaf samples with uredinia from each field where a nursery was exposed. Urediniospores from the samples were then increased in the greenhouse on the host cultivar, and inoculated onto the standard rust differential lines/cultivars. The virulence patterns found in the fall analysis are shown in Table 1. There was complete agreement between the mobile nursery results and the greenhouse assay of collected leaf samples.

Table 1. Similar virulence patterns for *Uromyces appendiculatus* in Nebraska collections made during 1995-1996 from greenhouse tests.

Standard Differentials	VIRULENCE PATTERN GROUPS				
	I	II	III (Race 54)	IV	V (Race 52)
	Rust Grades ¹				
1. U.S. 3	5,6	5,6	5,6	5,6	5,6
2. CSW 643	3,2	3,2	3,4	3,2	3,2
3. P 650	5,6	5,6	5,6	5,6	5,6
4. KW 765	5	5	5	5	5
5. KW 780	2,3	2,3	2,3	2,3	5
6. KW 814	5	5	3,4	3	5,4
7. GGWax	5	5	5	3,4	5,6
8. Early Gallatin	2,3	2,3	2,3	2,3	4,5
9. Red. Pioneer	3,2	5	3	3	5
10. Ecu 299	2	2	2	2	2
11. Mex 235	2	2	2	2	2
12. Mex 309	3,2	3,2	3,2	3,2	3
13. Br. Bty	2,3	2,3	2,3	2,3	4,5
14. Olathe	5,6	5,6	5,6	5,6	5,6
15. A X S 37	2,3	2,3	2,3	2,3	2
16. NEP-2	2	2	2	2	2
17. Aurora	2	2	2	2	2
18. 51051	3,2	3,2	3,2	3,2	2,3
19. CNC	3,4	4,5	3,4	3,4	3
20. PI 181996	1	1	1	1	1

¹ Uniform scale of Stavely et al. 1983. Ann. Rep. BIC 26:iv-vi

The mobile nursery saves time (10-12 days compared to 1-2 months in the greenhouse) and money and allows results to be known during the growing season as opposed to a few months later.

The mobile nursery concept may be very useful in developing countries where greenhouses are rare and for other host-pathogen systems.

Reference: Kelly, J.D., Stavely, J.R. and Miklas, P.N. 1996. Proposed symbols for rust resistance genes. Ann. Rep. Bean Improv. Coop. 39:25-31.