YIELD RESPONSE OF DRY BEAN CULTIVARS FROM DIFFERENT RACES UNDER DROUGHT STRESS

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Intermittent water stress is the single most important abiotic factor reducing yield of dry beans in the Mexican highlands. In other areas of Latin America, terminal drought and heat stresses can cause severe yield losses. The objective of this reseach was to identify mechanisms/traits and sources of resistance to temporal moisture deficits in dry bean germplasm from different gene pools.

A field experiment including 20 dry bean genotypes chosen on the basis of contrasting response to moisture deficits and belonging to different races (Table 1), was conducted in the summer of 1996 under two moisture conditions at Texcoco, Mexico and Pabellón, Aguascalientes (highlands), and during the fall-winter of 1996-97 at Cotaxtla, Veracruz, Mochis, Sinaloa (lowlands) and Zacatepec, Morelos (mid-altitude). In all sites a rectangular lattice design (4x5) was used with three replicates for each moisture treatment: irrigated and water stressed at the beginning (summer) or second half of reproductive phase (fall-winter). At the summer sites, rainfall was avoided on the stressed treatment with the aid of transparent plastic mounted on metallic frames; while in the winter sites, irrigation was witheld when early genotypes initiated the reproductive phase. We report on the results of three sites, in the other two sites the crop has not yet been harvested.

Averaged over locations and genotypes, drought treatment yielded 51% of control; the yield reduction was of 40, 59 and 52% for Pabellón, Texcoco and Cotaxtla, respectively. There was a significant genotype x site interaction for the geometric mean (GM) and the drought susceptibility index (DSI) , indicating that different genotypes were outstanding for those indices in the different sites. Changes in the ranking of genotypes by those indices illustrate the importance of specific adaptation.

On the basis of the GM, with the exception of G4523, a type I growth habit genotype from race Nueva Granada, genotypes from Durango race resulted outstanding in the highland sites, i.e. Bayo Zacatecas II and Bayo Victoria in Pabellón; Bayo Zacatecas II and Bayo Criollo del Llano in Texcoco. The best mesoamerican genotypes in the highland sites were V8025, Negro Tacaná and Negro INIFAP. In Cotaxtla, as expected, the best genotypes were from the Mesoamerican race: Sequía 12, BAT 477, V8025 and Negro Veracruz.

On the basis of the DSI, Bayo Victoria and Bayo Baranda (Durango), and Manzano (Jalisco) resulted outstanding in Pabellón; other genotypes with low DSI were those non-adapted with relatively low yields, Sequía 12 and Negro Veracruz (Mesoamerican) and Bayomex (Nueva Granada). In Texcoco Bayo Criollo de El Llano and Pinto Villa (Durango) along with G4523 showed the lowest DSI. At Cotaxtla, Satevo (Durango) and BAT 477 (Mesoamerican) showed low DSI.

Although the number of genotypes studied was small, it give us an idea on where to search for sources of drought resistance. G4523 seems to be the most promising genotype for widening the genetic basis of the Durango race and for the combination of different factors for drought resistance. Other promising genotypes are Sequía 12 and V8025. Whereas Bayo Victoria, Bayo Criollo de El Llano, Pinto Villa and G4523 might be used to improve the drought resistance of the Mesoamerican race.

Table 1. Geometric mean and Drought Susceptibility Index of 20 dry bean genotypes grown under two moisture levels at three locations in Mexico.

		Aguascalientes		Texcoco		Cotaxtla	
Genotype	Race	GM[1]	DSI[2]	GM	DSI	GM	DSI
Bayo Cr. El Llano	Durango	168	0.7	188	0.5	72	0.8
Satevó	Durango	214	1.1	122	1.1	78	0.4
Bayo Zac. II	Durango	246	1.1	206	1.0	82	1.1
Bayo Madero	Durango	193	1.0	120	1.1	77	1.0
Pinto Villa	Durango	192	1.8	123	0.5	80	0.9
PT 91082	Durango	237	0.8	132	0.9	90	0.9
Bayo Baranda	Durango	233	0.6	164	1.2	82	0.9
Bayo Victoria	Durango	272	0.2	142	0.9	66	0.8
G4523	Granada	261	1.0	129	0.6	68	1.4
Bayomex	Granada	180	0.5	79	0.9	72	1.2
Bayo Mecentral	Jalisco	158	1.0	105	1.4	65	1.3
Manzano	Jalisco	138	0.6	---	---	88	1.1
Flor de Mayo M38	Jalisco	221	1.4	171	1.3	90	1.3
Negro Tacaná	Mesoam.	200	0.9	---	---	82	1.1
Negro Cotaxtla 91	Mesoam.	127	1.1	136	1.0	87	1.0
Negro INIFAP	Mesoam.	155	1.5	128	1.3	75	1.3
V8025	Mesoam.	204	1.4	---	---	94	1.1
Negro Veracruz	Mesoam.	146	0.5	138	0.9	92	1.1
Sequía 12	Mesoam.	157	0.2	105	0.8	114	1.2
BAT 477	Mesoam.	144	1.2	---	---	105	0.6
Mean		194	0.92	109.4	1.01	82.8	1.05

1. Geometric Mean of irrigated and water stressed yields.
2. Drought Susceptibility Index (Fisher and Maurer, 1978).

REFERENCES

Fisher, R.A. and R. Maurer. 1978. Aust. J. Agric. Res. 29:277-317