SEED PHYSICAL TRAITS AND INHERITANCE OF COOKING TIME IN RECOMBINANT BEAN INBRED LINES

Carmen Jacinto H.[1], Susana Azpíroz R.[1]., Jorge A. Acosta G.[1], Humberto Hernández S.[2], Baltazar Baltazar M.[3], Irma Bernal-Lugo[4]
[1] CEVAMEX-INIFAP, [2] DGIA-ENCB-IPN, [3] Monsanto Com., [4] Fac. Química UNAM
[1] Apdo. postal 10. Chapingo, edo. de Méx. C.P. 56230, MEXICO. [4]E-mail irmofel@servidor.unam.mx

INTRODUCTION. A wide diversity of seed color and sizes of common bean (*Phaseolus vulgaris* L.) are consumed in Mexico. Cooking time of beans is an important factor for consumers. There is a significant genetic variability in quality traits among genotypes (2), genotypes that are utilized in the Bean Breeding Program of INIFAP but we do not have information on the inheritance of seed quality related traits. Elia *et al.* (1) reported a narrow sense inheritability of cooking time of 0.90 in *P. vulgaris*, while Nielsen *et al.* (4) detected an inheritability of 0.76 for cooking time in *Vigna unguiculata*. The objective of this work was to study the inheritance of seed cooking time and physical traits through the determination of these traits in a population of recombinant bean inbred lines (RIL's) in the F6 and F7 generations.

MATERIALS AND METHODS. In this trial a population of 88 RILs in the F6 and F7 generation, derived from the cross of Bayo Mecentral (P1) X Bayo Victoria (P2) was evaluated. The parental cultivars showed contrasting cooking times and were bred for rainfed conditions. RIL's were developed following a modified single seed descent method. Eighty-eight RIL's in the F6 and F7 generations were sown at the Valle de Mexico Experimental Station during the 1996 and 1997 growing seasons, respectively. In each growing season, two plants were randomly taken per plot and hand threshed as they matured, seeds were kept at 5 °C until the tests were performed. The percent of water absorption capacity was determined on replicate samples of 25 seeds by differences in seed weight before and after being soaked in distilled water for 18 h at room temperature. Cooking time was determined using a Mattson bean cooker by recording the time when 80% of the pins had penetrated the seeds pins had an average weight of 200 g. Seed weight, shininess of coat color and color of hilium were also determined. Coat color was evaluated using the Color Mate HDS equipment. Data on cooking time from both growing seasons were taken as replicates in a completely randomized-block design. Narrow sense inheritability (h^2) of cooking time was estimated from the mean square of the analysis of variance (3).

RESULTS AND DISCUSSION. Seed traits of the parental cultivars are shown on table 1. The average values of all recorded traits in the RIL's showed significant differences depending on the year of growing (table 2). In both growing seasons, seed weight and cooking time of the RIL's showed a wide range of values and also transgressive segregation was observed. Some inbreds fell beyond the minimum values in seed weight and cooking time of the softest to cook and small seeded parent Bayo Mecentral.

Table 1. Ranges of seed quality and agronomic traits of Bayo Mecentral and Bayo Victoria, parental cultivars during the 1996 and 1997 growing seasons

Seed trait	Bayo Mecentral	Bayo Victoria
Weight 100 seeds (g)	29.6-37.3	44.4-54.5
Cooking time (min)	38-81	142-220
Water absorption (%)	101-111	1-21
Coat color:		
L (lightness)	72.5-74.0	68.7-71.9
a (reddish-greenish)	3.6-3.5	6.6-4.9
b (yellowish-bluish)	18.8-19.9	21.5-20.8
Coat	opaque	shinny
Days to maturity	106-118	107-114
Seeds per plant	176-336	129-218

Table 2. Seed quality and agronomic traits of 88 bean RIL's[&] in the F6 and F7 generations.

Seed trait	Year	Mean*	Minimum	Maximum	Std. Dev.
100 seeds weight (g)	1996	33.23b	20.4	47.2	5.80
	1997	35.60a	19.9	54.3	6.56
Water absorption (%)	1996	112.0b	16.0	127.0	24.52
	1997	69.0a	4.0	121.0	34.35
Cooking time (min)	1996	62.3b	27.0	181.0	25.10
	1997	78.9a	20.0	216.0	37.81
Coat color:					
L (lightness)		69.63	56.1	78.9	4.75
a (reddish-greenish)		4.76	1.07	8.13	1.28
b (yellowish-bluish)		18.7	13.52	22.96	2.23
Days to maturity	1996	115.38a	105	126	5.07
	1997	111.47b	100	125	3.84
Seeds per plant	1996	129.73b	65	295	44.92
	1997	239.66a	64	479	93.94

* Significant differences at P=0.05

[&] RILs were grown in the field under rainfed conditions during 1996 and 1997 growing seasons

Narrow sense inheritability (h^2) of cooking time was 0.62, a value similar to the one estimated for *Vigna unguiculata* (4), and inferior to the one reported by Elia *et al.* for *Phaseolus vulgaris* L. (1). The estimated value is fairly high (5), which suggests that the genetic effect was higher than the environmental effect and therefore it is possible to improve by breeding the cooking quality in rainfed beans.

A coat color similar to Bayo Mecentral was predominant in the RIL's. Correlation coefficients indicated that materials with higher water absorption capacity showed lower cooking time (r=-0.72), while the RILs with shinny coat showed inferior water absorption capacity. (r=-0.60).

Some RILs showed longer time to reach maturity than the parents and in some cases, the number of seeds per plant was beyond the values of the parents.

The results suggest that the contribution of the maternal parent was predominant in cooking time, seed size, coat and hilium color, as well as in the shininess of seed coat of the RIL's. This might had happen because planting of RIL's was done at the same site were that cultivar was developed while the cv Bayo Victoria was developed in the semiarid region at Durango's Experimental Station. The observed narrow sense inheritability (h^2) and genetic variability of cooking time and other physical seed traits supports the aim at breeding of seed quality in common beans.

Acknowledgments.
To Dr. Fdo. Castillo, A. Peña, y E. Espitia, for their suggestions in the statistical analysis.
To Dr. Ramón and M.C.Dagoberto Garza G. for their advise in the field work.
This project is supported by Alianza para el Campo edo. México, INIFAP, IPN and UNAM.

REFERENCES:

(1).Elia,F.M., G.L.Hosfield., J.D.Kelly, and M.A.Uebersax.1997.J.Amer.Soc.Hort.Sci.122(4):512-518.
(2). Jacinto-Hernández C., Acosta-Gallegos J. Ortega-Alcalá J. 1993 Agric. Téc. Méx. 19(2) 167-178
(3).Márquez,S.F.1988.Genotecnia Vegetal.Tomo II. 665 p.
(4).Nielsen,S.S., W.E.Brandt, and B.B.Singh.1993.Crop Sci.33:469-472
(5) Stansfield, W.D. 1992.Genética. 574