COOKING TIME OF COMMON BEANS CARIOCA TYPE EVALUATED IN DIFFERENT ENVIRONMENTS

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Brazil is the world largest producer and consumer of common beans. Among the many types cropped, carioca stands out as the most consumed, sharing more than 70% of the market (Del Peloso & Melo,2005) and corresponding to near two million tons per year (FEIJÃO, 2011). Given the great importance of the bean crop, breeding programs are conducted by agricultural research institutions to supply the market with new improved cultivars. These cultivars bring together suitable characteristics, such as disease resistance, modern plant architecture, besides high yielding potential, contributing to increase crop yields from 729 kg/ha in 1997 to 1160 kg/ha in 2009 (FEIJÃO, 2001). In addition to those important agronomic traits, new enhanced lines should also provide good culinary characteristics such as short cooking time. This may contribute to increase bean consumption, mainly by reducing the time spent in bean meal preparation, since this activity has led Brazilians to seek ready to eat foods. Cooking time is affected by various environmental factors and by the genotype. Considering that the final evaluation of carioca lines is performed in several environments, there is the possibility of measuring the cooking time of these lines, and also, to verify the existence of genotypes x environments interaction for that characteristic.

Trials were conducted in eleven environments, each one consisting of 17 genotypes of carioca common bean type (Table 1). The experimental design was a randomized complete block with two replications, and plots with four rows four meters long. Samples to perform the cooking time tests were drawn from the central rows and stored at room temperature from 30 to 90 days. Tests were performed using a method similar to that proposed by Proctor and Watts (1978) described by Torga et al. (2010) with two replicates for each sample. Data were submitted to the analysis of variance, using the Scott Knott test at 10% for mean comparison.

The coefficient of variation of the joint analysis was 15.7%, suggesting a good experimental precision. Significant differences ($P<0.01$) were detected among genotypes, environments, and for the interaction genotype x environment. The average cooking time (CT) was 28 minutes, varying from 25 min. for line CNFC 11945 to 33 min. for cultivar BRS 9435-Cometa (Table 1). This variability among genotypes allows selection of those with reduced cooking time. There was variability from 20.9 to 41.2 min. among environments. Data presented in Table 1 demonstrate that environment was more important than genotype in affecting cooking time of beans. The large variability in the environment means is related to differences in the environmental conditions during experiment conduction and harvest as well as to differences in the storage period. The environment showing the largest cooking time was Santo Antônio de Goiás, in the wet season 2009. The shortest were also observed for that same location but in different seasons, in the 2009 winter season and 2010 dry season. This fact emphasizes the importance of the environment to determine cooking time, once the shortest and longest cooking times were observed in the same location, but in different cropping seasons.

Among the controls, BRS Estilo showed the shortest cooking time (27.3 min.); Perola and IPR Juriti were grouped in the second group, while BRS 9435 Cometa remained in the third group (Table 1). None of the lines showed CT lower than the best control. Torga et al. (2010) found a line superior to the control, when working with black beans; however eight lines showed cooking time similar to cultivar BRS Estilo, with cooking time shorter than cultivar Perola (30 min), the main cultivar cropped in Brazil. Seven other genotypes showed CT similar to Perola, which could be considered satisfactory. The short cycle cultivar BRS 9435 Cometa showed the largest CT. Results indicated that CT presented by the evaluated lines were within standards adopted in Brazil.

Table 1. Average cooking time (CT) (minutes) of 17 genotypes of common beans carioca type, and of 11 environments evaluated in Brazil, 2009/2010.

Genotype	CT	Environment	CT
CNFC 11945	**25,0 a**	Sto. Ant. Goiás/GO/Winter 2009	**20,9 a**
CNFC 10429	**25,8 a**	Sto. Antônio Goiás/GO/Dry 2010	**21,4 a**
CNFC 11951	**25,8 a**	Sem. Canedo/GO/Winter 2009	23,9 b
CNFC 11944	**25,8 a**	Porangatu/GO/Winter 2009	24,0 b
CNFC 11962	**26,0 a**	Arco Verde/PE/Wet 2010	25,3 b
BRS Estilo	**27,3 a**	Coronel João Sá/BA/Wet 2010	25,7 b
CNFC 11946	**27,3 a**	Brasília/DF/Winter 2010	28,5 c
CNFC 11966	**27,4 a**	Rio Verde/GO/Wet 2009	31,7 d
CNFC 11952	**28,0 a**	Inhumas/GO/Dry 2009	33,9 e
IPR Juriti	29,2 b	Carira/SE/Wet 2010	34,4 e
CNFC 11953	29,7 b	Sto. Ant. Goiás/GO/Wet 2009	42,1 f
CNFC 11954	29,9 b		
CNFC 11959	30,0 b		
Pérola	30,0 b		
CNFC 11956	30,4 b		
CNFC 11948	31,0 b		
BRS9435 Cometa	33,4 c		

[1]Means followed by the same letter do not differ by the Scott Knott test at 10% probability.

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