



## IAC Formoso: new carioca common bean cultivar

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**ABSTRACT** - The MAPA/RNC registered the cultivar IAC Formoso with carioca grain of the Instituto Agronômico – IAC, in view of the high mean yield in 24 environments (approximately 2816 kg ha<sup>-1</sup>), resistance to anthracnose (*Colletotrichum lindemuthianum*) and *Fusarium solani*, high grain quality and a cycle of 85 days from emergence to harvest.

**Key words:** *Phaseolus vulgaris* L., grain yield, plant breeding.

### INTRODUCTION

Common bean (*Phaseolus vulgaris*) is one of the most important constituents of the Brazilian diet for being an excellent protein source. In recent years, Brazil has globally ranked first in common bean production and consumption (FAO 2009). Common bean is an agricultural product of great economic and social importance, due to the large areas where the crop is grown and the labor employed during the crop cycle. In the IAC common bean breeding program (Center for Analysis and Technological Research of Agribusiness of grains and fibers of the IAC) has provided high-yielding Carioca bean cultivars, resistant to the pathogen anthracnose (*Colletotrichum lindemuthianum*) and with excellent cooking quality (Carbonell et al. 2008, Chiorato et al. 2008).

### Genetic origin and development

IAC Formoso was derived from the cross of Gen 96A28P4-1-1-1-1 x CNFC9484, performed at the Agronomic

Institute in Campinas (IAC), São Paulo, in 2004. The line Gen 96A28P4-1-1-1-1 was obtained in the winter harvest of 2000, from multiple crosses (Vax1 x IAC - Carioca Aruã) x [(IAC - Carioca Akytã x IAPAR 14) x A686] initiated in 1996. After plant selections by the pedigree method in the dry season of 2006, line F<sub>6</sub> with carioca grain, named Gen C2-1-3, was selected. From the winter season of 2006, this line was evaluated in preliminary tests, where it stood out with high grain yield, yield stability and disease resistance. In the rainy season of 2007, the cultivar was integrated in trials of Value for Cultivation and Use (VCU) 2007/2008/2009 of the state of São Paulo. Due to its plant characteristics, grain color, broth quality evaluated at cooking, disease resistance, and yield and yield stability, line Gen 1-3 was named IAC Formoso and the production of genetic seeds initiated in the rainy season of 2009.

### Yield potential

The yield potential of IAC Formoso is 4025 kg ha<sup>-1</sup>, observed in one environment of the 24 trials conducted in

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the VCU 2007/2008/2009 containing 22 genotypes, demonstrating the capacity of this cultivar in favorable environments. The mean yield of IAC Formoso in the rainy, dry and winter season with eight trials each was 2805 kg ha<sup>-1</sup>, 2483 kg ha<sup>-1</sup> and 3161 kg ha<sup>-1</sup>, respectively (Table 1).

The LSD (least significant difference – 5 % Dunnett) of the mean grain yield of IAC Formoso, for the best standard cultivar (IAC Alvorada or Pérola), was significant in the dry season and in the combined analysis of seasons. In the other rainy and winter seasons, the yield was statistically similar to the standard cultivars with high consumer acceptance.

### Other traits

The IAC Formoso has a semi-upright plant growth (type II), with anthracnose resistance (*C. lindemuthianum*), 1000 seed weight of 280 grams, and carioca grain with light brown stripes. The cycle lasts 85 days, from emergence to maturity, and pods are yellow/straw-colored. In the VCU

field trials, IAC Formoso was found to be tolerant to golden mosaic virus and *Fusarium solani*.

The mean cooking time of IAC Formoso measured in the Matson cooker (Proctor and Watts 1987) was shorter (32.33 min.) than of Pérola (33.49 min.) and IAC Alvorada (34.06 min.) and grains were light-colored and whole at the end of cooking. IAC Formoso has a mean grain content of 22.86 % crude protein, but variations were observed with changes in the growth environment (Table 2).

### Technical recommendations and seed production

Sowing should be performed according to the ecological zones in the state of São Paulo, for the three growing seasons. It is recommended to use a row spacing of 50 cm and 10 - 12 plants m<sup>-1</sup> meter, with a total of 200,000 - 240,000 plants ha<sup>-1</sup>. Seed production was initiated in the rainy season of 2009 and the patent of the RNC (National Register of Plant Varieties) and protection by SNPC (National Plant Variety Protection) were requested from MAP in March 2010.

**Table 1.** Yield (kg ha<sup>-1</sup>), coefficient of experimental variation (CV%) and LSD (least significant difference – 5 % Dunnett) per sowing season and combined seasons in comparison with the control cultivars IAC Alvorada and Pérola in the VCU trials of common bean in the state of São Paulo in 2007/2008/2009

Carioca bean cultivars	Sowing season			Mean 2007/2008/2009 (kg ha <sup>-1</sup> )
	Rainy (8 environments)	Dry (8 environments)	Winter (8 environments)	
		(kg ha <sup>-1</sup> )		
IAC Formoso	2.805	2.483*	3.161	2.816*
IAC Alvorada	2.316	1.885	3.041	2.414
Pérola	2.671	2.092	2.812	2.525
Mean <sup>1</sup> (kg ha <sup>-1</sup> )	2.600	2.199	2.910	2.570
C.V. (%)	18,00	19,73	15,26	17,48
LSD (kg ha <sup>-1</sup> )	398	368	375	219

<sup>1</sup> Experimental mean containing 22 cultivars and lines and with coefficient of variation lower than 25%.

\* Dunnett Test (5%) compared to the corresponding best standard control cultivar.

**Table 2.** Technological and nutritional quality: mean cooking season, in minutes, in the Mattson cooker and gross protein content (%) in bean grains of the VCU trials, in 18 environments of the state of São Paulo, in 2007/2008/2009

Season	Location	Cultivar: IAC Formoso		Control: Pérola		Control: IAC Alvorada	
		Cooking season (min)	Protein content (%)	Cooking season (min)	Protein content (%)	Cooking season (min)	Protein content (%)
Rainy/2007	Araras	39.29	22.53	42.74	19.53	40.27	25.53
Rainy/2007	Capão Bonito	26.07	21.87	31.77	22.43	33.22	23.40
Rainy/2007	Monte Alegre do Sul	24.09	22.83	20.23	20.76	23.17	24.48
Dry/2008	Avaré	28.30	22.39	27.56	22.42	29.61	20.80
Dry/2008	Monte Alegre do Sul	31.51	23.08	26.26	22.62	32.12	19.54
Dry/2008	Tatuí	35.28	22.71	32.40	21.96	30.14	22.42
Winter/2008	Colina	27.56	20.12	29.21	23.05	37.38	23.61
Winter/2008	Ribeirão Preto	35.50	21.39	45.18	21.22	42.36	24.01
Winter/2008	Votuporanga	39.22	23.11	30.32	23.19	37.01	22.85
Rainy/2008	Avaré	34.19	23.16	38.16	23.79	35.45	25.04
Rainy/2008	Capão Bonito	26.04	22.44	32.17	22.33	33.22	24.47
Rainy/2008	Mococa	35.23	23.30	36.10	19.12	33.14	25.58
Dry/2009	Colina	32.04	24.91	32.41	25.77	31.15	21.58
Dry/2009	Mococa	25.07	21.36	28.18	23.21	26.35	23.63
Dry/2009	Tatuí	32.16	21.36	34.39	23.23	36.13	24.56
Winter/2009	Pindorama	32.04	24.63	35.14	23.23	32.47	22.66
Winter/2009	Ribeirão Preto	34.38	25.97	39.49	24.38	36.18	20.85
Winter/2009	Votuporanga	40.32	24.39	41.12	21.85	40.10	20.29
<b>Rainy mean</b>		<b>31.22</b>	<b>22.69</b>	<b>33.53</b>	<b>21.33</b>	<b>33.08</b>	<b>24.75</b>
<b>Winter mean</b>		<b>35.33</b>	<b>23.27</b>	<b>37.14</b>	<b>22.50</b>	<b>37.58</b>	<b>22.73</b>
<b>Dry mean</b>		<b>31.13</b>	<b>22.64</b>	<b>30.20</b>	<b>23.20</b>	<b>31.32</b>	<b>22.09</b>
<b>General mean</b>		<b>32.33</b>	<b>22.86</b>	<b>33.49</b>	<b>22.45</b>	<b>34.26</b>	<b>23.07</b>

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