

MAIZE BIOFORTIFICATION IN BRAZIL BIOFORTIFICAÇÃO DE MILHO NO BRASIL

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RESUMO - O programa de melhoramento de milho biofortificado para carotenoides precursores de pró - Vitamina A (Pró-VA) começou em 2006. Baseado em seis linhagens elites para características agronômicas e com maiores concentrações de Pró-VA, foi desenvolvida uma variedade sintética de milho biofortificada, a BRS 4104. Esta variedade foi melhorada por três ciclos de seleção. Esta cultivar é competitiva em produtividade com algumas variedades comerciais. As concentrações totais de pró-VA da BRS 4104 são inferiores às apresentadas pelos híbridos desenvolvidos no CIMMYT. Um grupo destes híbridos foi avaliado em Sete Lagoas, na safra 2014/2015. Para produtividade de grãos não foram identificados híbridos pro-VA competitivos com o BRS 1055, um híbrido simples não biofortificado. Os parentais dos melhores híbridos do CIMMYT poderão ser usados como fontes de pro-VA para melhorar linhagens elites, que poderão gerar versões biofortificadas de híbridos comercializados no Brasil.

Palavras-chave: cultivares, pró-vitamina A, milho, Brasil.

ABSTRACT - The Brazilian pro-VA maize breeding program started in 2006. Six agronomic (AG) traits elite inbred lines with higher total pro-VA content were used to develop BRS 4104, a pro-VA synthetic open pollinated variety (OPV). BRS 4104 is being improved for AG and pro-VA traits with three cycles of selection. This cultivar shows grain yield performance competitive with some others OPVs in Brazil. The total pro-VA content of this cultivar is below that observed in CIMMYT hybrids. A set of these hybrids was evaluated in Sete Lagoas, in the 2014/2015 growing season. These pro-VA hybrids were not grain yield competitive with BRS 1055, a no Biofortified single cross. The parents of the best hybrids can be used as pro-VA sources to improve Brazilian inbred lines that may generate biofortified versions of commercial hybrids.

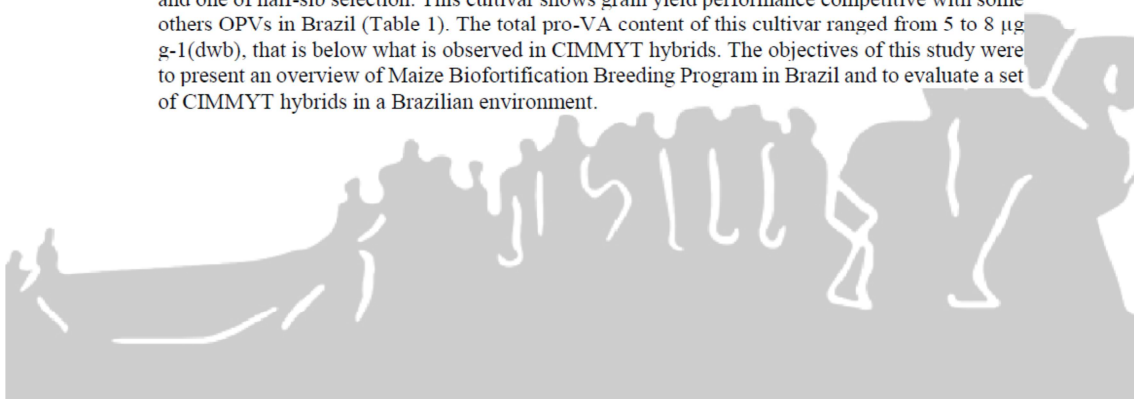
Keywords: cultivars, pro-vitamin A, maize, Brazil.

INTRODUCTION

The Brazilian pro-VA maize breeding program started in 2006. Two hundred forty-six maize samples were screened for carotenoids profile. From this group, six AG traits elite inbred lines were selected for presenting higher total pro-VA content, ranged from 6.2 to 9.1 $\mu\text{g g}^{-1}$ and averaged 7.2 $\mu\text{g g}^{-1}$ (dwb).

These selected lines were used to develop BRS 4104, a pro-VA synthetic OPV. They were crossed to generate all hybrids combinations. These parental hybrids were crossed and the seeds bulked.

BRS 4104 is being improved for AG and pro-VA traits with two cycles of mass selection and one of half-sib selection. This cultivar shows grain yield performance competitive with some others OPVs in Brazil (Table 1). The total pro-VA content of this cultivar ranged from 5 to 8 $\mu\text{g g}^{-1}$ (dwb), that is below what is observed in CIMMYT hybrids. The objectives of this study were to present an overview of Maize Biofortification Breeding Program in Brazil and to evaluate a set of CIMMYT hybrids in a Brazilian environment.



METHOD

A randomized block experiment CIMMYT trial (CHTSPROA), with 23 pro-VA hybrids and two checks (BRS 1055 – no pro-VA hybrid, and BRS 4104 – a pro-VA OPV) was evaluated for AG traits in 2014/2015 Sete Lagoas growing season.

RESULTS AND DISCUSSION

Data from agronomic traits were obtained from this CIMMYT PRO-VA hybrid trial (Table 2). The grain yield from CIMMYT Pro-VA hybrids ranged from 3.4 to 9.6 t/ha, while the yield for BRS 1055 (no pro-VA SC check) and BRS 4104 (pro-VA OPV check) were, respectively, 11.3 and 7.7 t/ha. Grain samples from these materials will be analyzed for carotenoids profile.

Since these pro-VA hybrids were not grain yield competitive with BRS 1055, they showed low potential to be released to the Brazilian maize seed market. However, the parents of the best hybrids can be used as pro-VA sources in a backcrossing breeding program to improve this trait in commercial Brazilian inbred lines. These improved inbred lines can be used to generate biofortified versions of commercial hybrids.

Table 1 - Grain yield (t/ha) of BRS 4104 and three OPVs checks evaluated in the Brazilian OPV Trial. Four growing seasons - 96 environments.

	Season			
	2008/09	2009/10	2010/2011	2011/12
BRS 4104	4.9	5.5	5.6	5.6
BR 106	5.1	5.4	5.9	5.9
Sol da Manhã	4.3	4.6	4.9	5.0
BRS 4103	5.8	5.6	6.2	5.3
Environments	27	15	25	29

Table 2 - Grain yield and other agronomic traits of pro-VA hybrids - CIMMYT trial CHTSPROA, Sete Lagoas, 2014/2015 growing season.

Entry	Grain Yield	Stalk + Root lodging	Plant Height	Ear Height	Female flowering	Grain Moisture
	t/ha	%	cm	cm	d	%
BRS1055 (no Pro-VA SC)	11.26	9	273	165	63	15.4
CML297/CML300//CLHP00306	9.58	9	245	145	62	14.4
CLHP0049/CML297//CLHP00306	8.39	50	253	143	61	14.9
CLHP0049/CML297//CLHP00478	8.35	3	265	163	62	15.3
CLHP0003/CLHP0005//CLHP00434	8.13	19	255	143	58	14.1
CLHP0049/CML297//CLHP00294	8.01	22	245	145	61	15.8
CML297/CML300//CLHP00340	7.79	19	240	150	64	15.5
CML297/CML300//CLHP0353	7.72	31	265	163	62	14.8
BRS4104 (Pro-VA OPV)	7.70	19	248	153	63	15.4
CML297/CML300//CLHP0221	7.66	16	250	155	63	15.2
CLHP0049/CML297//CLHP0342	7.54	16	253	158	63	15.4
CLHP0049/CML297//CLHP0310	7.47	13	248	143	62	14.8
CLHP0046/CLHP0020//CLHP0213	7.45	6	230	138	58	13.9
CLHP0003/CLHP0005//CLHP0364	7.13	25	238	133	60	13.8
CLHP0046/CLHP0020//CLHP0331	6.87	3	218	120	56	14.2
CLHP0003/CLHP0005//CML304-B	6.67	31	263	153	59	13.7
CLHP0046/CLHP0020//CLHP0333	6.50	22	198	105	56	15.5
CLHP0003/CLHP0005//CLHP0316	5.95	22	225	125	57	13.9
CLHP0003/CLHP0005//CLHP00308	5.77	19	243	130	59	13.9
CLHP0049/CML297//CLHP00432	4.81	3	253	135	59	14.4
CLHP0049/CML297//CLHP0350	4.73	13	243	135	61	15.2
CLHP0068/CLHP0020//CLHP0299	3.95	9	205	123	59	14.7
CLHP0068/CLHP0020//CLHP0301	3.94	6	225	130	58	15.2
CLHP0068/CLHP0020//CLHP0289	3.81	25	198	113	57	15.2
CLHP0046/CLHP0020//CLHP0293	3.43	19	213	120	58	15.2
LSD 0.05	3.20					

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