



## BRS Cipotânea and BRS Diamantina: maize varieties

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**ABSTRACT** - *The maize cultivars BRS Cipotânea and BRS Diamantina were developed from accessions of the Maize Germplasm Bank of Embrapa Maize and Sorghum. The evaluation was participative, performed by scientists and end-users. The varieties were developed to provide farmers with maize varieties suitable for corn-husk crafts.*

**Key words:** *handicraft; husk; Zea mays; participatory breeding; family farming.*

### INTRODUCTION

New high-yielding maize cultivars are made available to farmers by several breeding programs every year. The wide range of maize cultivars on the market is extremely favorable for Brazilian agriculture, because it leads to constant improvements in yield and quality (Ramalho et al. 2009). The main maize breeding goals focus on yield and yield-related factors, such as uniformity, stability and adaptability (Pacheco et al. 2002). Subsequently, breeding became a major driving force of the high increase of maize yield in Brazil. According to a survey released by the National Supply Company (CONAB 2010), the national maize yield of the first and second harvests together reached 54.14 million tons, representing a gain of 6.1 % or 3.13 million tons, compared to the last period. Parallel to this promising scenario, the needs of some corn producers are not met by the cultivars available.

Farmers and artisans working with corn-husk handicraft need cultivars with long husks, in varying color

and texture, according to the specific craft techniques. These producers, in general family farmers, claim that the cultivars available on the market do not adequately meet the requirements of corn husk craft (Teixeira et al. 2005). To fill this gap in the range of cultivars available to Brazilian farmers, a participatory selection program was developed with accessions of the maize germplasm bank maintained by EMBRAPA that led to the indication of the maize varieties BRS Cipotânea and BRS Diamantina that have husk suited for crafting. The aim of this study was to inform the scientific community about aspects related to these cultivars.

### BREEDING METHODS

#### Plant material

BRS Cipotânea and BRS Diamantina were used directly from the *ex situ* maize germplasm bank (information on the parents of these accessions in Table 1). These cultivars are open-pollinated varieties, which had to be

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**Table 1.** Information on the accessions of the maize germplasm bank used as parents of the varieties BRS Cipotânea and BRS Diamantina

Information on accessions	BRS Cipotânea	BRS Diamantina
BRA code	052680	064572
Germplasm bank code	MG 075	MG 053
Collection name	Milho Palha Roxa	Palha Roxa
Collection site	Barroso-MG	Carmo de Minas-MG
Collection date	08/26/1985	11/30/1988
Collector	Ronaldo Feldman	Ronaldo Feldman

replanted twice in the field, together with the other accessions tested, to obtain enough seeds for the evaluations. Generally, accessions from a germplasm bank, created to preserve the genetic variability, are not exposed to selection (Teixeira et al. 2005). However, in this study the seeds were multiplied with a view to breeding, justifying the use of intrapopulation selection to eliminate tall plants and/or with high ear insertion and late and broken or lodged plants.

### Participatory selection

The selection process for the indication of the varieties BRS Cipotânea and BRS Diamantina began with the evaluation of file data of the Maize Germplasm bank accessions. Firstly, the users of corn straw were visited to compile the properties of husk suited for handicraft. Based on this information, the file cards of the accession collection were read and 50 accessions from the states of Minas Gerais, Bahia, Paraná, Mato Grosso do Sul, and Santa Catarina selected, with properties such as “purple husk” or “soft husk”.

After the initial selection, the seeds were multiplied for identification tests of accessions from the Maize Germplasm bank with husk suited for craft. Additionally, traits related to yield and agronomic performance were assessed. Assessments were conducted in an experimental area of Embrapa Maize and Sorghum and in the community of Planalto de Minas in Diamantina and Cipotânea, both in Minas Gerais. The traits were evaluated by extension staff of the Company of Technical Assistance and Rural Extension of Minas Gerais (Emater-MG) and artisans who work with corn husk. The possible forms of participatory breeding and contributions of the farmers and researchers can vary widely (Morris and Bellon 2004). In this study, the participation of the end user, the artisans, was focused on the stages of testing and evaluating the husk quality. The intrapopulation selection, for agronomic traits only, was

however not participatory. It is worth mentioning that the evaluation of husk quality is subjective and should therefore be performed by someone familiar with husk properties. It should also be emphasized that the identification of BRS Cipotânea and BRS Diamantina aimed to detect suitable accessions for corn husk craft in the maize germplasm bank, rather than alter the allele frequency of these populations by intrapopulation selection.

The results of the evaluation of the Maize Germplasm bank accessions for corn husk craft were presented by Teixeira et al. (2007).

### PERFORMANCE CHARACTERISTICS

After identifying the best-suited cultivars for corn husk craft, experiments of Value for Cultivation and Use (VCU) were conducted to evaluate the performance of these varieties and for subsequent inclusion in the National Registry of Cultivars of the Ministry of Agriculture, Livestock and Supply.

Nine VCU experiments were carried out, using maize varieties BRS473 and BR106 as controls (see Table 2 for soil and climatic regions, locations and years of VCU tests). The average coefficient of variation for grain yield in the VCU trials was high (27.36 %), although this point had no influence on the trait studied.

**Table 2.** Soil-climatic regions, locations and years of VCU evaluations

Experiment	Soil climatic regions	County-State	Growing season
E1	Zona da Mata	Cipotânea-MG	2005
E2	Vale do Jequitinhonha	Diamantina-MG	2005
E3	Cerrado	Sete Lagoas-MG	2005
E4	Cerrado	Dourados-MS	2005
E5	Zona da Mata	Cipotânea-MG	2006
E6	Vale do Jequitinhonha	Diamantina-MG	2006
E7	Cerrado	Sete Lagoas-MG	2006
E8	Semi-árido	Janaúba-MG	2006
E9	Cerrado	Dourados-MS	2006

The mean data for agronomic and husk-related traits are presented in Table 3. The results show that the cultivars are late and have tall plants with high ear insertion, but have long ears, large diameter and are totally husked. The husk color varies among the plants of both varieties. The incidence of ears with pink, purple and mixed husk in BRS

**Table 3.** Mean values for agronomic and corn husk traits of the varieties BRS Cipotânea and BRS Diamantina in the VCU tests

Trait	BRS Cipotânea	BRS Diamantina
Number of days until male flowering	77.5	76.9
Number of days until female flowering	80.9	80.4
Plant height (m)	2.93	2.87
Ear height (m)	1.90	1.77
Mean length of husked ears (cm)	25.94	25.62
Mean diameter of husked ears (mm)	43.70	39.15
Number of grain rows (greatest frequency)	14	14
Grain texture	Flint	Flint
Grain color	Orange	Orange
Husk cover of the ear	Complete	Complete
1000 seed weight (g)	316.50	270.86
Hectoliter weight (g)	746.31	799.04
Husk color*	pink purple and mixed	purple and mixed
Disadvantage of the cultivar	High percentage of lodged or broken plants	High percentage of lodged or broken plants

\* high incidence of ears with husk in the above colors.

Cipotânea and of ears with purple and mixed husk in BRS Diamantina was high. A comparison of the two varieties showed that the husk of BRS Diamantina is more pigmented than of BRS Cipotânea. The greatest drawback of both varieties is possibly the high percentage of lodged and/or broken plants.

The results of evaluations of the varieties BRS Cipotânea and BRS Diamantina in relation to productivity are presented in Table 4. Interestingly in most trials, the controls were more productive than the varieties suited for corn husk craft. The percentage reductions in grain yield ranged from 2.91 % for BRS Diamantina E5 to 69.96 % for BRS Diamantina in E3 in comparison with the best-performing control, indicating a highly variable yield performance of these cultivars. It must be remembered that traits of husk quality and not of grain yield in weight or volume were evaluated here, and that the latter is possibly correlated with ear yield.

The development of the varieties BRS Cipotânea and BRS Diamantina could amplify the genetic base of plants suitable for cultivation and the exploitation of the *Ex situ* Maize Germplasm bank.

### BASIC SEED PRODUCTION

The genetic and basic seed of BRS Cipotânea and BRS Diamantina was produced on isolated plots of Embrapa Maize and Sorghum. Small samples of these seeds will be distributed free of charge to small farmers and communities that need husk for crafts. The varieties were

**Table 4.** Mean grain yield (in kg ha<sup>-1</sup>) of the varieties BRS Cipotânea and BRS Diamantina and of the controls in the VCU tests

Trial	BRS Cipotânea	BRS Diamantina	BR106	BRS473
E1	5281	5134	6320	6089
E2	6456	5123	5858	4790
E3	3371	1591	5298	4790
E4	2668	2937	3925	3566
E5	2657	2968	3057	810
E6	1877	1097	2209	1577
E7	4375	4110	7043	5110
E8	718	582	1370	966
E9	1187	1176	2328	2406

tested and can be recommended in the valley of Jequitinhonha and in the Cerrado. Contact address of the Consumer Service Center of Embrapa Maize and Sorghum: sac@cnpms.embrapa.br.

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## BRS Cipotânea e BRS Diamantina: variedades de milho

**RESUMO** - As cultivares de milho BRS Cipotânea e BRS Diamantina foram desenvolvidas pela Embrapa Milho e Sorgo a partir de acessos do Banco de Germoplasma de Milho. A avaliação foi participativa. Essas variedades foram desenvolvidas visando disponibilizar aos agricultores variedades de milho com palha apropriada para o uso artesanal.

**Palavras-chave:** artesanato, palha, Zea mays, melhoramento participativo, agricultura familiar.

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