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CULTIVAR RELEASE

UENF 14: a new popcorn cultivar

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Abstract – *The aim of this work is to present the features of the popcorn cultivar UENF 14, developed from five cycles of recurrent selection of the population UNB-2U, to the scientific community. The cultivar produces yields of 3047.58 kg ha^{-1} and has popping expansion of 35.69 mL g^{-1}.*

Key words: Zea mays *L., plant breeding, yield, popping expansion.*

INTRODUCTION

Popcorn (*Zea mays* var. *everta*) is a popular snack food in Brazil. Although there are no reliable statistics and systematic production data, several studies of the Ministry of Agriculture, Livestock and Food (MAPA) have shown that production still falls far short of the market potential of the crop (Arnhold et al. 2009, Mendes de Paula et al. 2010).

However, the limited number of cultivars with both satisfactory agronomic characteristics and a high popping expansion rate is considered to be the main barrier to expansion of the popcorn crop in Brazil (Freitas Júnior et al. 2009, Rangel et al. 2011, Moterle et al. 2012). According to the National Registry of Cultivars of MAPA, 46 cultivar entries are registered, but most belong to packaging companies that restrict their use to partner producers. This fact was confirmed by a survey conducted by Cruz et al. (2012) in which it was found that only the cultivars RS 20, UFVM2 Barão de Viçosa and IAC 125 were available for sale in the 2011/2012 season.

Thus, breeding programs for the development of varieties and/or hybrids with high agronomic potential are key factor to stimulate the agribusiness sub-sector of popcorn cultivation. With this objective, the Universidade Estadual do Norte Fluminense (North Fluminense State University) (UENF) has been working since 1998 with recurrent selection of the population UNB-2U for a greater frequency of favorable alleles (Pereira and Amaral Júnior 2001). In the repeated selection cycles, one variety (UENF 14) stood out, which was subsequently evaluated for release in VCU (value for cultivation and use) and DHE (distinctness, homogeneity and stability) tests in the 2009/2010 and 2010/2011 growing seasons in the north and northwest of the state of Rio de Janeiro. In this context, the purpose of this study is to inform the scientific community about the features of this new cultivar.

GENETIC ORIGIN AND DEVELOPMENT

The cultivar UENF 14 was developed in five cycles of recurrent selection of the UNB-2U population. This population was derived from UNB-2 after two mass selection cycles in Campos dos Goytacazes, Rio de Janeiro, Brazil. For its part, UNB-2 was derived from selection of an 'indigenous composite breed', which the Escola Superior de Agricultura "Luiz de Queiroz" (ESALQ/USP) had donated to the Universidade de Brasilia (UNB). From this base, the UNB-1 population was generated, which was crossed with a maize variety named American popcorn, with high pop-

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ping expansion. The selected progenies were crossed with a variety named high-yielding yellow Popcorn, with yellow grain and resistance to northern leaf blight (*Exserohilum turcicum*). After two cycles of mass selection, we obtained a population consisting of resistant plants with yellow grain. This population was backcrossed three times with the American variety, resulting in the UNB-2 population.

In the 2009/2010 and 2010/2011 growing seasons, the UENF 14 variety was compared with the open-pollinated cultivars 'BRS Angela' and 'UFVM2-Barão de Viçosa' for VCU and DHE tests, as required by MAPA. The experiments were conducted in Campos dos Goytacazes, Cambuci and Itaocara, corresponding to the north and northwest of the state of Rio de Janeiro.

PERFORMANCE TRAITS

In the VCU and DHE tests, coefficients of variation (CVe) from 6.12 to 9.15% were observed for grain yield, and from 4.87 to 7.29% for popping expansion, indicating good experimental precision for the two most important popcorn traits. The mean values of these two traits were highest for the UENF 14 cultivar, with an average grain yield of 3047.58 kg ha^{-1}, while the yields of the controls BRS Angela and UFVM2 Barão de Viçosa were 2192.11 and 2314.50 kg ha^{-1}, respectively (Table 1). For popping expansion, the mean values were 35.69 mL g^{-1} for the UENF 14 cultivar, and 34.52 and 33.33 mL g $^{-1}$, respectively, for the controls BRS Angela and UFVM2 Barão de Viçosa.

For growing this variety, the best planting conditions should be described. For this purpose, in the 2011/2011 growing season (second season) and 2011/2012 growing season (first season), experiments were carried out to determine the growing conditions to maximize the performance of the new variety. A split plot experimental design was used where the plots represented the planting seasons (first and second season), the sub-plots represented between-row spacing (0.45, 0.60 and 0.90 m), and the sub-subplots represented the population density (60,000, 75,000 and 90,000 plants ha^{-1}).

The results showed an insignificant difference between the sowing dates for grain yield, demonstrating that this cultivar can be grown in both seasons in the above-cited regions, without reducing yields (Table 2).

In terms of population density, it was found that the best arrangement for the UENF 14 cultivar was a spacing of 0.60 m between rows and 0.18 m between plants, resulting in a density of approximately 90,000 plants ha^{-1}. In the VCU and DHE tests, rows were spaced at 0.90 m and plants 0.20 m apart, resulting in an average yield of 3047.58 kg ha^{-1} (2608.02 - 3530.09 kg ha^{-1}), while at a density of 0.60 x 0.18 m, the average yield was 4023.30 kg ha^{-1}.

OTHER TRAITS

The UENF 14 cultivar was characterized based on agronomic and morphological traits proposed by the National Cultivar Protection Service (SNPC) of MAPA. The agro-

Table 2. Grain yield of UENF 14 in different growing seasons, row spacing and plant density per hectare

Growing season	Grain yield (kg ha^{-1})
Second season/2011	3470.7 a
First season/2011-2012	3850.8 a
Spacing between plant rows (m)	
0.45	3748.2 a
0.60	3975.2 a
0.90	3258.9 b
Plant density (plants ha^{-1})	
60.000	3284.1 b
75.000	3593.9 ab
90.000	4104.3 a

Table 1. Mean grain yield (kg ha^{-1}) and popping expansion (kg ha^{-1}) of the cultivar UENF 14 and controls, in the 2009/2010 and 2010/2011 growing seasons in three municipalities of the state of Rio de Janeiro

Locations (E)[1]	Agronomic traits					
	Grain yield			Popping expansion		
	UENF 14	BRS Angela	UFVM2	UENF 14	BRS Angela	UFVM2
E1	2577.33	2075.67	1658.67	34.33	34.33	33.00
E2	3163.67	2500.00	2770.00	35.67	34.00	33.00
E3	3530.09	2363.27	2494.29	36.00	33.78	33.22
E4	3358.80	2171.30	2602.47	36.89	37.33	35.22
E5	2608.02	1850.31	2047.07	35.56	33.17	32.11
Mean	3047.58	2192.11	2314.50	35.69	34.52	33.31

E1: Cambuci (2009/2010); E2: Campos dos Goytacazes (2009/2010); E3: Cambuci (2010/2011); E4: Campos dos Goytacazes (2010/2011) and E5: Itaocara (2010/2011).

nomic characteristics used as key descriptors of the UENF 14 cultivar are listed in Table 3. The morphological traits were differentiated according to the stage of crop development, measured from the seedling to post-harvest stage.

In the seedling stage, the degree of plumule pigmentation by anthocyanin of the UENF 14 cultivar was average. At the maturity stage of the plant reproductive organs, designated as the beginning of anthesis, the angle between the leaf blade and stem was defined as small, i.e., a narrow angle between stem and leaf blades. At mid-anthesis, the anthers of the variety were weakly anthocyanin pigmented, however, with a stronger staining of the stigmas by this natural pigment.

In the grain milk stage, beginning from 12 to 15 days after pollination, strong anthocyanin pigmentation of the aerial roots of this variety was observed. At harvest, some descriptors particularly characterize UENF 14, e.g., the conical-cylindrical ears. The husks on the ears of this variety were characterized by an intermediate degree of loose husks.

In post-harvest, the descriptors related to grain color were most characteristic of the variety. The pericarp was colorless. The crown color of UENF 14 is yellow-orange, as well as the endosperm, which are important descriptors in terms of visual consumer acceptance.

Table 3. Mean values for the agronomic traits of cultivar UENF 14 measured in the VCU and DHE tests

Agronomic traits	UENF 14
Number of days to flowering	59 days
Plant height	1.82 m
Ear height	1.03 m
Number of ears per plant	1.88 ears
Ear length	15.55 cm
Ear diameter	30.72 mm
Number of grain rows (highest frequency)	12 rows
1000-seed weight	118.65 g
Test weight	826.67 g

SEED PRODUCTION

Seed production began in 2012, in compliance with the regulations of MAPA. For seed storage and marketing, partnerships will be established with packaging companies that will be responsible for distribution to interested farmers.

UENF 14: nova cultivar de milho-pipoca

Resumo – *O presente trabalho tem como objetivo informar a comunidade científica os aspectos relacionados à cultivar de milho-pipoca UENF 14, desenvolvida a partir de cinco ciclos de seleção recorrente da população UNB-2U. A cultivar obteve produtividade de 3047.58 kg ha^{-1} e capacidade de expansão de 35.69 mL g^{-1}.*

Palavras-chave: Zea mays *L., melhoramento de plantas, produtividade, capacidade de expansão.*

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