

CULTIVAR RELEASE

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UEL 175: a novel lipoxygenase-free soybean cultivar with kunitz trypsin inhibitor absence

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Abstract – UEL 175 is lipoxygenase-free soybean cultivar and has absence of the antinutritional factors kunitz trypsin inhibitor (SKTI). UEL 175 presents high yield potential and good adaptation under no-tillage. It is resistant to soybean stem canker, brown stem rot, frogeye leaf spot, and bacterial pustule.

Key words: Glycine max, kunitz trypsin inhibitor absence, lipoxygenase-free seed, plant breeding.

INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] is considered as a high quality source of oil and protein for food and feed. However, lipoxygenases develops undesirable grassy and beany flavors in foods containing soybean due to oxidation of polyunsaturated fatty acids. Thus, soy products made of soybeans with lipoxygenases-free seeds have shown improved flavor characteristics (Hajika et al. 1991, Hajika et al. 1992, Carrão-Panizzi and Kitamura 1995). Moreover, raw soybean cannot be used for monogastric animal feeding due to the presence of factors that decrease its nutritional value. Among the antinutritional factors present in soybean seeds, the main one is the protease inhibitors kunitz trypsin inhibitor (SKTI), which is usually inactivated by heat treatment. However, heat treatment does not completely eliminate SKTI, and it may considerably decrease protein solubility. Eliminating this antinutritional factor, and obtaining lipoxygenase-free soybean varieties are of great importance and are desirable for the feed and food industry.

The soybean breeding program currently in progress at the Agronomy Department of Londrina State University, Londrina – PR has focused not only on yield, but also on quality improvement of soy-derived products used for feed and food.

Pursuing these objectives, UEL 04-6 x UEL 04-5 cross-
ing was carried out.

PEDIGREE AND BREEDING METHODS

UEL 175 originated from a single plant selection in the F₂ population derived from the crossing between UEL 04-6 and UEL 04-5, which was carried out during the 2003/04 season, at UEL, Londrina, PR. Parentage of UEL 04-5 is UEL 04/PI 157440/ BRS 155. PI 157440 and BRS 155, used as parents, are lines lacking the kunitz trypsin inhibitor, and the parent BRS 213 cultivar shows low lipoxygenases activity (Orf and Hymowitz 1979, Hymowitz 1986, MAPA 2014). Parentage of UEL 04-6 is UEL 04/BRS 213 (MAPA, 2014). F₁ plants were grown in the greenhouse.

The individual 293 of the F₂ generation was analyzed genotypically with polymorphic SSR molecular markers for null alleles for *lox1*, *lox2* and *lox3* enzymes (Lenis et al. 2010, Mandal et al. 2013). The F₂ generation lacking SKTI was analyzed with specific PCR primers for selecting seeds which lacked the SKTI protein. The primer sequences are as follows: forward: 5' -CTTTTGTGCCTTCACCACCT-3'; reverse: 5'-GAATTCATCATCAGAACTCTA-3' (Moraes et al., 2006). The F₂ generation was also analyzed by SDS-PAGE in order to confirm the genotypes of the F₂ selected seeds: The F₂ generation was phenotyped by SDS-PAGE, which are colorimetric assays for seed lipoxygenase and SKTI status, confirming the genotypes of the F₂ selected. The F₂ generation was cultivated in the field, and the harvest was carried out by single seed descent method (SSD).

The F₃ generation plants were harvested in bulk, and

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Table 1. Performance of UEL 175, BRS 232 and BRS 284 soybean cultivars in three environments seasons 2009/10, 2010/11 and 2011/12 in Londrina, Ponta Grossa, and Guarapuava, Brazil

Cultivar	Days to maturity	Plant height (cm)	Mass of 100 seeds (g)	Seed yield (kg ha ⁻¹)	Relative yield (%)
UEL 175	128	80	16.42	3.294	100.91
BRS 232	129	80	19.81	3.264	100.00
BRS 284	123	96	16.95	4.635	142.00

were designated UEL 04-175. During the 2006/2007 season, in F₃, plants were grown at UEL, using the bulk method to advance the generation. During the 2007/2008 season, in F₄, the individual plant was selected, and was evaluated as a progeny in the 2009/2010 season (in F₆) with the name of UEL 175. From F₇ generation on, UEL 175 cultivar was included in several regional trials carried out in Paraná (PR), and was released in 2013.

PERFORMANCE

UEL 175 cultivar had an average yield of 3.294 kg/ha in 3 experiments carried out in the 2009/1, 2010/11 and 2011/12 agricultural years in Londrina, Ponta Grossa, and Guarapuava. UEL 175's yield performance was inferior to BRS 284, which has indetermined growth, but it was 0.91 % higher than BRS 232, which presents determined growth and was used as control (Table 1). The potential of UEL 175 is being lipoxigenase-free and lacking the antinutritional factors kunitz trypsin inhibitor (SKTI). This seed line works as parents to develop elite breeding populations for breeding programs aiming at quality improvement of soy-derived products used for feed and food. Results of preliminary feeding trials, with chicks and young pigs, revealed that gain/feed was significantly higher when using lines lacking the kunitz trypsin inhibitor than when using cultivars

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containing the inhibitor (Hymowitz 1986).

OTHER CHARACTERISTICS

UEL175 has determined growth, plant height exceeding 82 cm, and high resistance to lodging pod dehiscence. It flowers at 58 days on average, and reaches harvest maturity at 120 days after emergence; it belongs to maturity group 6.7, and 100 seeds weight is 16.42 g. The oil and protein percentual contents are 21.63% and 38.54%, respectively. UEL 175 cultivar has white colored flowers, gray pubescence and pod, and bright and yellow seed coat.

UEL 175 is resistant to soybean stem canker, caused by *Diaporthe phaseolorum* f. sp. *Meridionalis*, to brown stem rot and frogeye leaf spot, caused by *Cercospora sojina*, and to bacterial pustule, caused by *Xanthomonas axonopodis* pv. *glycines*.

MAINTENANCE AND DISTRIBUTION

Breeder seed of UEL175 is maintained by the State University of Londrina. Small amount of seeds are available for research purposes at the Universidade Estadual de Londrina, Departamento de Agronomia, Campus Universitario, Londrina-PR, Rodovia Celso Garcia Cid, PR 445, km 380, Box 6001, 86.051-990, Londrina, PR, Brazil.